

# WUNDT'S THEORY OF IMAGELESS THOUGHT AS A POSSIBLE KEY TO THE ROLE OF SLOW-WAVE SLEEP IN DEPRESSIVE RUMINATIONS

Ullin T. Place

[Paper presented at the Sixth Annual Meeting of the European Society for Philosophy and Psychology (ESPP), Padova, 28th August 1997]

## *1. The Functions of Consciousness and the Subconscious Automatic Pilot*

In a joint paper with Kathleen Taylor presented at the ESPP meeting in Oxford in 1995, I proposed an interpretation of the behavioral effects of lesions of the striate cortex in monkeys and humans (Humphrey 1974; Weiskrantz 1986; Cowey & Stoerig 1995) in which there are two parallel input-output transformation systems:

- I. *Consciousness* whose functions are
  - (a) to categorize *problematic inputs* in terms of the kind of object, event or state of affairs with which they represent an encounter,
  - (b) to select or devise a *behavioral strategy* appropriate to encounter with an object, event or state of affairs of that kind and to the organism's motivational concerns with respect to it, and
  - (c) to monitor the *execution* of the selected response so as to ensure the achievement of the desired outcome.
- II. the *subconscious automatic pilot* or, as I am now calling it (Place 1997), "the *zombie-within*" whose functions are
  - (a) to scan the total current input so as to alert consciousness to any inputs which are problematic either because they are *unexpected* or because they are significant relative to the organism's current or perennial *motivational concerns*,
  - (b) to protect consciousness (Broadbent's, 1958, "limited capacity channel") from overload by either ignoring unproblematic inputs or, where a response is so well learned as to be completed without the intervention of consciousness, by simply transforming an input into an output.

## *2. Conscious Experience*

A sub-system within consciousness is *conscious experience* in which the human subject is responding when he or she describes *what it is like* to encounter or undergo this or that. Its function we propose is to provide what Broadbent (1971) calls the "evidence" on which categorization of the input is based. Without conscious experience the individual is unable to categorize an input. Moreover, although as the blindsight phenomenon shows, he or she may be able to make some remarkably accurate sensory discriminations, in the absence of conscious experience there is no way of checking the response against the "evidence" on which it is based. Such responses, however accurate, are simply "blind guesses".

Although it is almost certainly generated further "downstream", the evidence from the blindsight phenomenon shows that the raw material from which *visual* conscious experience is constructed comes from the striate cortex (V1) with the result that it is abolished by lesions in that area. Presumably the corresponding sensory projection areas play a similar role in the other sensory modalities.

Conscious experience, we suppose, contributes to the categorization of inputs which have been identified by the subconscious automatic pilot as problematic by modifying the *figure-ground relations* within the central representation of the problematic input until a satisfactory categorization is achieved. In the case of a *mental image* the externally determined figure-ground structure is so weak that the figure-ground organization in the "evidence" is determined by categorization rather than *vice-versa*, as in the case of sense perception.

## *3. The Function of Dream Imagery and REM Sleep*

The hypothesis which I developed at last year's ESPP meeting in Barcelona was that the function of the *dream imagery* which is characteristic of rapid eye-movement (REM) sleep is to "stamp in" those new associations formed within consciousness during the preceding period of waking which are motivationally significant to the organism at the expense of those that are motivationally neutral. This, we suggested in the 1995 paper, is achieved by switching on conscious experience under conditions where it is effectively decoupled from sensory input with the result that the "evidence" takes a form determined by such principles as wish-fulfilment (Freud 1900/1913) and fear-fulfilment (Freud 1920/1922) rather than by the structure of the current input, as it is when the individual is awake.

#### ***4. The Anti-Depressant Effect of Suppressing REM Sleep***

In last year's paper I explored the implications of this hypothesis for the suggestion that anti-depressant drugs produce their anti-depressant effect by suppressing REM sleep, thereby weakening the power of current environmental stimuli to evoke the melancholy and guilt-stricken thoughts that pre-occupy the depressed patient.

A review of the evidence for the hypothesis showed that while it is supported by the success of therapies, such as cognitive therapy, which aim specifically at reducing the incidence of these depressive ruminations, the evidence that their effect in suppressing REM sleep is what gives *anti-depressant drugs* their anti-depressant effect is more ambiguous.

#### ***5. Evidence of a Role for Slow-Wave Sleep in Depressive Ruminations***

What I want to discuss in this paper are two pieces of evidence, one of which appeared in the review of the anti-depressant effect of various forms of sleep deprivation, while the other was drawn to my attention by Tony Marcel in the discussion after my presentation at Barcelona. The effect of both is to point to the possible involvement of *slow-wave sleep* in promoting depressive ruminations. The first piece of evidence comes from a comparison between the relatively modest anti-depressant effect reported by Vogel, Vogel, McAbee & Thurmond (1980) from a study in which depressed patients were woken as soon as they began to go into the REM phase of sleep as indicated by the EEG and the much larger effect produced by total sleep deprivation (Wu & Bunney 1990), suggesting that both phases of sleep, slow-wave as well as REM, are implicated in maintaining depressive ruminations. The second piece of evidence which was drawn to my attention by Tony Marcel is the fact that the gloomy thoughts which appear to be instrumental in maintaining the depression resemble the vague imageless thoughts reported [by] subjects woken from slow wave sleep much more than they resemble the dream imagery characteristic of REM. By itself, as I pointed out at the time, this does not count against the original hypothesis that the effect of REM is to sensitize the associative connection between current environmental stimuli and memories of past failures and misdemeanours; but taken together with the other evidence, it compels us to take seriously the possibility of a link between slow-wave sleep and depressive ruminations and to wonder what sense can be made of such a connection.

#### ***6. The Imageless Thought Controversy***

To anyone who is familiar with the history of psychology, the contrast between the vivid imagery reported by subjects who are wakened during or immediately after periods of REM sleep and vague imageless thoughts reported by those woken from slow-wave sleep cannot fail to evoke echoes of the famous "imageless thought" controversy which convulsed the infant science during the first decade of the century that is now drawing to its close. The controversy arose from a series of introspective experimental studies of the thought process carried out by a group of psychologists at the University of Würzburg under the leadership of Oswald Külpe. A typical example of the results obtained in these studies is quoted by Humphrey (1951 p. 58) from his own translation of Bühler (1907, p 318):

Is this correct: "The future is just as much a condition of the present as of the past?" Answer: "No." (10 secs.) "First I thought: that sounds like something correct (without words). Then I made the attempt to represent it to myself. The thought came to me: Men are determined by thoughts of the future. Then, however, immediately the thought: *that the thought of the future should not be confounded with the future itself; that such confusions, however, constitute a frequent dodge in philosophical thought. (Of words and images there was throughout no trace.) Thereupon the answer: No.* (Bühler's italics)

### 7. *Wundt's Theory of Imageless Thought*

The consternation which reports such as this aroused at the time is not difficult to appreciate. For if thoughts with such an elaborate content can occur without their being expressed in any word or image at the time, it not only makes the process of thought infinitely mysterious, it raises questions about the function in thought of words and images when they *do* occur. Needless to say, the initial effect of drawing attention to the similarity between these imageless thoughts and those described both by subjects woken from slow-wave sleep and by depressed patients is simply to pile mystery on mystery. Fortunately, the situation is not quite as bad as that would suggest. For we *do* have a rational explanation of the phenomenon of imageless thought which locates it firmly within linguistic theory, even if its links with the theory of consciousness and cognition generally remain obscure. The theory is presented towards the end of a long and tedious critique of the work of the Würzburg group published by the founding father of experimental psychology, Wilhelm Wundt, in *Psychologische Studien* for 1907. No complete English translation of this paper has been published. What we do have is a summary of its contents in George Humphrey's (1951) book *Thinking: An Introduction to its Experimental Psychology* (pp. 107-112). Humphrey's account of Wundt's theory reads as follows:

One of the most important methods [for the study of thinking] is to be found in the psychology of speech. By his own observations Wundt has made it clear that "a thought is not first formed while one speaks the sentence, but that it already stands as a whole in our consciousness before we begin to fit words to it. With this whole there is, nevertheless, present at the focus of consciousness none of the verbal or other representations which form during the development and the linguistic expression of the thought; but only at the moment when we develop the thoughts are their separate parts successively lifted to clear consciousness" [Wundt 1907, p. 351] . . . .

For Wundt thought is, then, a logical total presentation which appears as a totality in consciousness. "As such it is constituted of the same nexus of single presentations as that into which discursive thought articulates it afterwards in successive apperception of the single elements. But it is, with all these parts, dimly apprehended; and only because this is so can it be given at all as a simultaneous whole, which enters the forms of consciousness in discrete presentational elements by means of the total feeling peculiar to it. This also not seldom happens when the process of thought-articulation is inhibited. The real development, or, as we could better call it here, unfolding of the thought, is constituted in the successive grasping of the separate constituent elements of the total presentation standing in the background of consciousness. [Wundt *op.cit.* p. 356] [Humphrey 1951, pp. 110-111]

### 8. *Dispositions, Novel Sentences and the Relay Energisation Theory of Thought Occurrence*

In order to make contemporary sense of this theory of Wundt's, it needs to be read in the light of two subsequent developments

- (a) the notion of a disposition as developed by Ryle (1949), but doubtless inspired by Wittgenstein's (1958 pp. 100-1) "language game" in the *Brown Book* in which dispositional predicates are replaced by descriptions of test results,
- (b) Chomsky's (1957, etc.) repeated emphasis on the fact that sentences are seldom repeated word-for-word; but are typically constructed anew on each occasion of utterance.

Viewed in the light of these developments, Wundt's theory proposes that a thought is a disposition which every speaker must have before uttering a sentence to construct *a range of semantically equivalent sentences* of which the sentence she in fact ends up constructing and uttering is only one. We can think of the *occurrence* of a thought, on this theory, on the analogy of the energising of an electro-magnetic relay. The effect of such energisation is that certain switches that were previously open are now closed while other switches which were previously closed are now open. Assuming that none of the circuits in which those switches lie are complete nothing *else* need happen. Nevertheless, as soon as some other switch in those circuits is closed, the change that has come about as a consequence of the opening and closing of switches by the relay becomes manifest. Circuits which would otherwise have remained incomplete are completed. Circuits which would otherwise have been completed remain incomplete.

This is a perfect analogy for the occurrence of the kind of imageless thoughts described in the Würzburg experiments. The occurrence of the thought without the occurrence of any words or images at

the time is the energisation of the relay which opens some switches and closes others without either completing a circuit or breaking one that was previously complete. But when the observer is asked to explain the content of his thought, this has the effect of closing a switch controlling the verbal output with the result that all those things which the observer was, as it were, "primed" to say by the opening and closing of the relay switches, when the relay was energised, now come pouring out.

### ***9. The Problem of Imageless Thought in Animals***

But while this gives us an excellent account of what is happening in the Würzburg experiments, it leaves us with a serious problem in accounting both for the imageless nature of the thoughts that are characteristic of slow-wave sleep and for the putative role of slow-wave sleep in the ruminations of the depressive. The problem is this. Unless you believe, and I don't, in Fodor's (1975) "language of thought", language is an exclusively human phenomenon. It follows that, on a theory such as Wundt's in which thought is tied to the process of sentence-construction, animals cannot have thoughts in this sense. Yet we know that, the alternation between periods of REM and periods of slow-wave sleep is found in all species of mammal. There can also be little doubt that dream imagery is as much the distinguishing feature of REM sleep in other species as it is in humans. How do we explain the massive inhibition of the skeletal musculature during this phase of sleep, if not as a way of preventing the massive somnambulism that would otherwise occur in response to those images? But if so, not only do animals have dream imagery; if such elaborate precautions are needed to prevent its otherwise maladaptive consequences, to have evolved as a feature of every mammalian brain, it must have some important biological function. The hypothesis developed in my 1995 ESPP presentation whose consequences I explored further in last year's presentation was an attempt to explain what that function might be. That hypothesis, however, suggests a function only for dream imagery. It has no obvious application to the problem of the biological function of the imageless thoughts reported in slow-wave sleep. Yet if, as its apparent role in maintaining depressive rumination suggests it must have, slow-wave sleep must also have an important biological function. Moreover, if, as we have proposed, it is the dream imagery involved in it that gives REM its biological function, it is natural to assume that the biological function of slow-wave sleep derives from its characteristic imageless thoughts. That assumes that just as all mammals have dream imagery, so they also have imageless thoughts. But what is it for an animal to have an imageless thought?

### ***10. Horgan & Tienson to the Rescue***

To answer that question we can perhaps borrow an idea from a recent book by Terry Horgan and John Tienson (1996) entitled *Connectionism and the Philosophy of Psychology*. The basic idea behind this book is the analogy between the process whereby words are put together to form an infinite variety of sentences and the process whereby in a game of skill, such as the game of netball which is their principal example, movements are put together to form an infinite variety of ways to meet the demands of the task. In both cases, success depends on following unverballed and in many cases unverballed rules which can be described in both cases as "rules of syntax", syntax in its original sense of an orderly arrangement of parts.

Despite their allegiance to connectionism and their consequent repudiation of the notion that the brain operates as an "algorithm-governed" symbol manipulator, Horgan and Tienson take this analogy as evidence both for a language of thought (whose syntax controls skilled movements as well as the sentences of natural language) and for the role of propositional attitudes in the control of the non-linguistic as well as the linguistic aspects of behaviour. The conclusion they should have drawn, in my view, is that the syntax in the linguistic sense grows out of the syntax of skilled movement rather than *vice-versa*. That this is so can be seen very clearly in the organisation of the brain. The area in the non-dominant (usually right) lobe of the cerebral cortex which corresponds to an area in the dominant hemisphere (Broca's area) where lesions result in aphasia of the syntactic variety is an area specialised for the control of the execution of complex motor skills.

In the light of this link between the syntax of sentence construction and the syntax of complex motor skills, we may suppose that, just as on Wundt's theory the occurrence of an imageless thought consists in the pre-selection of a range of different, but semantically equivalent sentences, so on what we may think of as the Horgan-Tienson version of that theory the occurrence of an imageless thought would consist in the pre-

selection of a response strategy consistent with a range of different tactical executions. Just as in the sentence construction case the precise form taken by the sentence remains open (and hence 'imageless') until determined by the particular context of utterance when the time comes; so in the case of a motor skill the precise tactics of the movement remain open ('imageless') until determined by the context prevailing at the moment when the response is called for.

### ***11. Kant's Concept of the Schema***

The Horgan-Tienson version of Wundt's theory (surprisingly in view of Horgan and Tienson's endorsement of the "language of thought") shows us how 'imageless' thoughts could be a feature of the slow-wave sleep of organisms that have no language. But in order to explain what function such thoughts might be supposed to have we need to draw on three other ideas from the past history of psychology and its philosophical antecedents. The first of these is the concept of the "*schema*" first proposed by Kant (1781/1787/1929) in his *Kritik der reinen Vernunft* and developed experimentally by Sir Frederick Bartlett (1932) in his book *Remembering*. Kant introduces the concept of the "schema" in Chapter I of the 'Transcendental Doctrine of Judgment' in an attempt to explain how particular "intuitions" by which he means particular sensory experiences are "subsumed" under "pure" concepts. How, in other words, are we able to ignore all those features which differentiate one instance of a kind from another and respond only to that feature or those features that all such instances have in common? Kant emphasises that the schema that enables us to do this is to be distinguished from an image. For an image is always of a particular case, even if only an imaginary one. It is this intrinsic generality and open-endedness which links the schema to Wundt's dispositional theory of imageless thought.

### ***12. The Negative Feedback Theory of Voluntary Movement***

To tie the concept of a schema into what we are calling the Horgan-Tienson version of Wundt's theory we need to go back only a little more than fifty years to Rosenblueth, Wiener & Bigelow's (1943) seminal paper 'Behaviour, Purpose and Teleology' in which they propose a "negative feedback" theory of voluntary movement. This demands a pre-conceived schema of how the movement is to develop so that variations that deviate from that preconceived pattern are recognised and can thus trigger the corrections that the negative feedback principle requires.<sup>1</sup>

### ***13. The Zeigarnik Effect and the Function of Slow-Wave Sleep***

The final piece of the jig-saw is provided by the so-called "Zeigarnik effect" which takes its name from the Russian psychologist of that name who showed in a classic experiment (Zeigarnik 1927) that subjects remember tasks which they were prevented from completing much better than otherwise similar tasks which they are allowed to complete. This result undoubtedly reflects an adaptive psychological principle whereby uncompleted tasks and unsolved problems continue to preoccupy the organism's thoughts for some time thereafter, a principle which appears to extend into the slow-wave phase of sleep where, in the absence of distracting sensory input, a solution can often be found. Hence the old adage "If you've got a problem, sleep on it." This is an adaptive response so long as pondering unresolved problems in this way can yield a solution. It becomes maladaptive when it extends to unresolved problems, including some from the sleeper's remote past, which it is too late to remedy, particularly when such ruminations spill over and intrude into the individual's waking life. That way lies depression, a condition which afflicts human beings to a degree that appears to have no real counterpart in animals. Why that should be, if they too have imageless ruminations during their slow-wave sleep, is not altogether clear; but it may have something to do with the fact that, having acquired language and a culture and social order based upon it, despite a much more efficient problem-solving apparatus, human beings are left with many more problems unresolved. Added to this is the undoubted fact that the Zeigarnik effect does not decay as a function of time. At the age of 72 I am still haunted by thoughts of stupid mistakes I made more than fifty years ago. Nor am I unique in this respect. I heard on the radio a few weeks back a recording of an interview with an old lady of 102 who said that she

---

<sup>1</sup> A similar schema is needed in order to obey the instruction "Imagine you were looking at/listening to \_\_\_\_". This brings out more clearly than anything Kant's point that "the schema has to be distinguished from the image."

was still haunted by an indiscretion she had committed when she was a little girl some ninety years ago. Such things cannot be mended now. If anyone was hurt or offended by them at the time, they are probably long dead. Yet the Zeigarnik effect lives on.

#### **14. Conclusion**

To summarise, what I am suggesting is that sleep contributes in two ways to the aetiology of clinical depression. The dream imagery of REM sleep stamps in associations between current environmental events and other emotionally charged incidents in the past, only some of which are depressive in nature. The imageless ruminations of slow-wave sleep have a more specific depressive effect in that they keep alive, often indefinitely, problems for which no solution is to be found. What implications that analysis has for the treatment of clinical depression is not clear to me. Evidently abolishing sleep altogether is not an option. Even if it were, since on this view the respective contributions of REM and slow-wave sleep are by-products of important adaptive functions, we would expect their abolition to have serious psychological side-effects, quite apart from the physiological ones. All I can say is that, if these speculations turn out to be even half-correct, our understanding of the phenomenon of clinical depression will have been significantly enhanced, and that can't be bad.

#### **References**

- Broadbent, D. E. (1958) *Perception and Communication*. Oxford: Pergamon.
- Broadbent, D. E. (1971) *Decision and Stress*. London: Academic Press.
- Bühler, K. (1907) Tatsachen und Probleme zu einer Psychologie der Denkvorgänge. I. Über Gedanken. *Archiv für die gesamte Psychologie* 9: 297-365.
- Chomsky, N. (1957) *Syntactic Structures*. 's Gravenhage: Mouton.
- Cowey, A. and Stoerig, P. (1995) Blindsight in monkeys. *Nature* 373, 6511: 247-9.
- Fodor, J. (1975). *The Language of Thought*, New York: Crowell.
- Freud, S. (1900/1913) *Die Traumdeutung*. Franz Deuticke. English translation as *The Interpretation of Dreams* by A. A. Brill. London: George Allen & Co.
- Freud, S. (1920/1922) *Jenseits des Lustprinzips*. Internationaler Psycho-analytischer Verlag. English translation as *Beyond the Pleasure Principle* by C. J. M. Hubback. London: International Psycho-Analytical Press.
- Horgan, T. and Tienson, J. (1996) *Connectionism and the Philosophy of Psychology*. Cambridge, MA: M.I.T. Press.
- Humphrey, G. (1951) *Thinking: An Introduction to its Experimental Psychology*. London: Methuen.
- Humphrey, N.K. (1974) Vision in a monkey without striate cortex: a case study. *Perception* 3: 241-255.
- Kant, I. (1781/1787/1929). *Kritik der reinen Vernunft*. First and Second Editions, Riga: Hartknoch. English translation by N. Kemp Smith as *Immanuel Kant's Critique of Pure Reason*, London: Macmillan.
- Place, U. T. and Taylor, K. E. (1995) '[The functions of consciousness and its constituent parts](#).' Paper presented to the Annual Meeting of the European Society for Philosophy and Psychology, St. Catherine's College, Oxford, 31st August 1995.
- Place, U. T. (1996) '[On the anti-depressant effect of suppressing REM sleep](#).' Paper presented to the Annual Meeting of the European Society for Philosophy and Psychology, University of Barcelona, Collegi Major Penyaforç, 15th-21st July 1996
- Place, U. T. (1997) '[Consciousness and the Zombie-within](#)'. Paper presented at the Inaugural Conference of the Association for the Scientific Study of Consciousness, Claremont, CA, June 15th 1997.
- Rosenblueth, A., Wiener, N. and Bigelow, J. (1943) Behavior, Purpose and Teleology. *Philosophy of Science*, 10.
- Ryle, G. (1949) *The Concept of Mind*. London: Hutchinson.
- Vogel, G. W., Vogel, F., McAbee, R. S. and Thurmond, A. J. (1980) Improvement of depression by REM sleep deprivation. *Archives of General Psychiatry* 37: 247-253.
- Weiskrantz, L. (1986) *Blindsight*. Oxford: Clarendon Press.
- Wittgenstein, L. (1958). *The Blue and Brown Books*. Oxford: Blackwell.

- Wu, J. C. and Bunney, W. E. (1990) The biological basis of an anti-depressant response to sleep deprivation and relapse: Review and hypothesis. *American Journal of Psychiatry* 147:15-21.
- Wundt, W. (1907) Über Ausfrageexperimente und über die Methoden zur Psychologie des Denkens. *Psychologische Studien*, 3, 301-360.
- Zeigarnik, B. (1927/1938) Über das Behalten von erledigten und unerledigten Handlungen. *Psychologisches Forschung*, 1-85. English translation as 'On finished and unfinished tasks'. In W. D. Ellis (Ed.) *A Source Book of Gestalt Psychology*. London: Routledge, pp. 300-314.