

**THE CORNER TREASURY OF ARCANE AND NEGLECTED PHILOSOPHICAL GEMS
(OF MY OWN MAKING)**

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Gem #3: THE NEUROLOGICAL BASIS OF SELF-CONSCIOUSNESS: PHENOMENOLOGICAL
PRINCIPLES AND PHYSIOLOGICAL CONSTRAINTS.

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Attempts to 'explain' consciousness in terms of brain activity invariably founder on a reluctance or inability (perhaps inherent in the very nature of the phenomenon) to confront the essential difficulty uniquely involved in this particular question: how can any physical process whatsoever give rise to an internal conscious experience? Either such experience is an emergent property of complex material organization - in which case, how can its sudden appearance ever be deduced from knowledge about simpler molecular or cellular systems? - or else it reflects some sort of 'cosmic' awareness which is a fundamental aspect of each quantum of energy in the universe. If such an inherently *speculative* consciousness were actually to exist, however, how is it possible to conceptualize what it really means - or 'feels' like - for a simple physico-chemical system to be conscious, and at the same time account for the emergence (made possible in ontogeny and phylogeny by the attainment of some critical degree of neurological complexity) of a qualitatively distinct form of subjectivity - *experiential* consciousness - every time we wake up?

Although a causal explanation in terms of underlying 'mechanisms' appears to be inherently unattainable, a compelling case can be made for the emergence of consciousness - in evolution, development, and from day to day - within neural networks meeting highly specific requirements for the generation of electrochemical fields having distinctive spatio-temporal properties. As a starting point for further studies of mind/brain relationships, I will now list those propositions which may plausibly be supposed to be true in the light of present-day knowledge of how the brain works, . In particular, I wish to call attention to the possibility of deriving an elementary neurophysiological model as a first approximation - a 'Perfect Gas Law', as it were - for the experience of being a subjective SELF as distinct from the 'outside world', based on measurable 'brain-wave' characteristics.

1) Most of the contents of consciousness - viz., those appearing to reflect an 'outside (non-self) world' - make little sense unless thought of as an 'inner aspect' of brain activity (I propose the metaphor of a mirror, reflecting 'virtual' as opposed to 'real' images). It is only our consciousness of (being) a perceptibly distinct SELF that leads to any conceptual basis for a monist/dualist controversy. Realizing that sensory perceptions are never '*der Ding an sich*', as Prof. Kant of Koenigsburg was wont to put it, what can possibly be gained by supposing socially evoked conscious imagery to have any kind of separate, immaterial existence?

2) 'Brain wave' correlates of consciousness, during, both wakefulness and dream sleep, demonstrate its dependence upon a critical level of largely 'desynchronized' electrical brain activity: too little (as in coma) or too strongly synchronous neuronal firing (deep

sleep, epilepsy) leads to a loss of consciousness as we normally understand it. Upon this 'permissive' physiological background, sensory stimuli evoke unique patterns of bio-electric activity which, within certain appropriately organized networks (see below), are associated with privately experienced multi-modal 'images'.

3) The existence of myriad brain functions occurring outside our conscious awareness, the loss of consciousness from anatomically detached 'lower' structures such as retina and spinal cord, and our ability to identify short-lasting or simultaneous 'events' with reasonable precision despite the temporal 'smearing' of sensory messages as they move sequentially from one level of the nervous system to another, all argue for a high degree of localization of consciousness to specific regions. Most of the 'neural correlates of consciousness', as a given sensory message travels from receptor to spinal cord or brainstem, and then on to higher centers and, eventually, to motor centers must therefore be presumed to be devoid of conscious experience.

4) Its internal organization (as a thinly laminated, essentially two-dimensional sheet of richly interconnected neurons) and its extrinsic connectivity (as the ultimate receiving station for the ascending projection of sensory information), along with the selective losses associated with localized lesions and the highly specific sensations evoked by focal stimulation, implicate the cerebral (neo-)cortex as the most likely putative neurological substrate directly subserving conscious experience. In Sherrington's beautiful imagery (in his famous book, *Man on His Nature*) the brain 'lights up' only when ascending information reaches this level.

5) The generally unified ('bonded') nature of the conscious 'field' and, as pointed out above, the evidently non-computational character of most of its ongoing content – in addition to abundant evidence for the existence of problem-solving activity going on at subconscious levels - suggest that conscious experience is primarily associated with the *display* of information rather than with its actual manipulation. The analogy here would be with the monitoring system of a computer, with its highly selective display of incoming information and ongoing computational steps, thus enabling judicious intervention in the (invisible) processing of the data.

6) The importance, for survival and reproduction, of a quantitatively accurate representation of figure: ground relationships in the '*umwelt*' has led to the evolution of an instinctive 'Newtonian' mode of internal representation at the conscious, i.e., neocortical level. Thus, stable 'objects and other things' appear to exist, for the most part, within an otherwise 'empty space'. Certain altered (e.g., 'mystical') states of consciousness, on the other hand, entail a switch to a qualitatively more realistic

'Einsteinian' mode of perception, viz., oscillatory concentrations of energy within a dynamically permeated spatial field.

7) Such altered states characteristically include a radically different perception of one's SELF from the usual one: there can be either a '*detached*' observation of one's body and mental activity, as if they have become part of the outside world, or an '*oceanic*' state in which one feels oneself actually dissolving into the Umwelt. The former state – described in the Tibetan *Book of the Dead* and many other yogic meditation reports – involves attentional invasion of previously 'limited access' zones of consciousness (Corner 1976), whereas the latter – as reported, for instance, in Wm. James' *Varieties of Religious Experience* – involves deep relaxation of body sensations and mental activities. In addition, there is a third type of 'altered state' (usually described as 'ecstatic') where the Self appears to *expand* so as to include aspects of consciousness previously experienced as belonging to the 'outside world'.

8) Breaks in consciousness, as occur in (slow-wave) sleep and 'spike-and-wave' (petit mal) epilepsy, constitute a serious challenge to any conception of such a 'self as having a distinct existence in its own right. Were self/soul/spirit really a separate 'thing', namely, rather than a functional state subject to interruptions, we would expect there to be some sort of continuity of subjective experience even when all itemizable contents of consciousness ('qualia') are absent. Without such permanent self-awareness, independent of the physical state of 'its bodily abode', a dualistic world view appears to make no sense.

9) Focussed attention entails a highly selective localized reduction in the brain's slow-wave activity, accompanied by intensified high-frequency oscillations: i.e., a relatively *high-pass* functional state as measured by the cortical electro-encephalogram (EEG). Since the bodily (and mental) sensations which one normally experiences as being 'me/I' represent components of consciousness from which the flitting 'spotlight' of attention is for the most part excluded, the '*detached*' type of altered self-perception (see above: point 7) presumably involves high-pass activity patterns invading the 'limited access' areas of the cerebral cortex which constitute the substrate for bodily sensations.

10) Consciousness of an outside world which is not currently being attended to must be associated, in turn, with a relatively '*low-pass*' mode of cerebral cortex function: i.e., enhanced slow-wave and reduced high-frequency activity in the waking EEG. Since deep bodily and/or mental relaxation lead towards a sense of oneself 'melting' non-attentively into the outside world, it would now be the low-pass activity pattern which invades the normally 'limited access' areas of the cortex where consciousness of the Self, as normally experienced, is generated.

11) Since both high- and low-pass modes of waking cortical neuronal activity are associated with the conscious perception of an outside world, the conscious experience of 'self' cannot be associated with either of these functional modes but, rather, with a '*band-pass*' mode of activity in which abundant low and high frequency neuronal oscillations are simultaneously present. In this way, self-consciousness can be transformed into *non-Self* simply by sufficiently reducing either the high or the low end of the waking EEG power spectrum. Ecstatic trance states, on the other hand, with their characteristic sense of 'mystical union' of the Self with its surroundings, would entail an expansion of this putative zone of broad-band neuronal firing into cortical projection areas normally subserving consciousness of an 'outside world'.

12) The cortical projection fields for proprio- and interoceptive impulses from within the body constitute, during normal waking consciousness, the putative primary location for the postulated special conjunction of functional parameters, i.e., intense activity across an unusually wide range of neuronal firing frequencies. After years of ignorance on this score, neuro-anatomical research has recently succeeded in tracing these ascending projections as far as the *insular* region of the cerebral cortex (e.g., Damasio 2003), an area which is invisible to surface recording electrodes. Magneto-EEG recordings and functional tomography focussed on specific underlying portions of the neocortex, especially in the dominant half of the cerebral hemispheres, would thus appear to be the approach of choice in testing the prediction of an anatomically and physiologically specific EEG signature linked to the conscious experience of Self.

13) The 'passive' experience of self, with its quality of affective tone (i.e., 'pleasure' or 'pain') associated with perceived sensory stimuli, is presumably a reflection of information reaching the cerebral cortex regarding the operation of subcortical circuits involved in, respectively, positive and negative reinforcement of ongoing behavior. The 'active' sense of self, on the other hand, as experienced in the making of voluntary decisions about how to act or think (i.e., *free will*: see part 1 of this essay), implicates the cerebral cortex as possessing a higher order 'command' or 'gating' function for overruling (or fine-tuning) subcortical behavioral regulatory systems, the activity of which we experience consciously as 'involuntary' motor or mental actions.

14) Activity patterns associated with consciousness have a *chaotic* character (thus being inherently unpredictable without being random) and tend to fall sequentially into one or another quasi-stable 'attractor'. Not only is the daily alternation between sleep and wakefulness, as well as the intermittent occurrence of dreaming during the former state, an example of a switch from one self-perpetuating activity pattern to another, but the

triggered stereotyped 'emotional' states associated with basic instincts such as lust, rage and fear involve a transient 'descent' into a new basin of attraction.

15) Certain of the human brain's latent 'strange attractors' subserve stubbornly persistent psycho-pathological states such as epilepsy, depression, and one or another form of schizophrenia. The 'spiritual' disciplines practised in many cultures are evidently attempts to coax (or force!) cortical neuronal activity into yet another strange attractor, one which is characterized by a breakdown of ego/world boundaries. In practise, however, the `homeostatic' restorative tendencies of one's habitual personality act powerfully to thwart such efforts. Here is clearly an area of psychological praxis which would benefit greatly from a proper scientific analysis of underlying mechanisms and potentialities.

16) Both the initial establishment of 'set-points' associated with neuro-physiological basins of attraction, and their potential subsequent modification with experience and training, must be supposed to follow developmental principles similar to those which hold for other multi-cellular biological systems. In particular, the existence of 'critical' periods for establishing stable responses to specific stimuli may be important for the origin and maturation of self-consciousness as well - if not for the phenomenon itself, at least for the way it manifests itself to the organism possessing it.

Clearing away conceptual debris obscuring what can and needs to be done may well be a necessary step for making progress in this field. A number of counter-productive metaphors, for instance, are still current in the neuro-philosophical literature: besides the mercifully *passé* models of the nervous system as telephone central or digital computer, my own favorite *bête noire* is the one inspired by Herman Hesse's *Steppenwolf*, viz., that of a *theater* (in which consciousness is obviously represented by the lighted stage). In addition to its implicit overemphasis on the actors at the expense of the overall decor, this model is too self-contained to bear any useful resemblance to what a real nervous system is doing most of the time. The moving-picture *screen* as a metaphor for conscious experience suffers from a similar presumption of already stored images deriving, as it were, from a sub-cortical film projector. At best, this might serve as a model for *dreaming* during (for the most part) REM sleep! The proper analogy, then, for what Sherrington so evocatively called the "enchanted loom", is with the display terminals - 'intelligent' ones, in this case, equipped with extensive cross-connections among their active elements - of a multi-media closed-circuit monitoring system, on which sensorially selected aspects of the organism's immediate environment and its '*milieu interior*' are, at least during wakefulness, continuously being scanned in real-time.

Curiously, an intractable conundrum has repeatedly been constructed by philosophers concerning the problematic nature of 'the observer' of such a monitoring system. It is all too often maintained, namely, that in all versions of the 'screening terminal' metaphor not only does consciousness necessarily imply the existence of an observational 'homunculus', but that s/he/it (...whatever) must itself be under observation, and so on and on. This infinite regress is then, by way of a *reductio ad absurdum*, supposed to entirely negate the validity of the analogy, with the regrettable effect of discouraging pursuit of its more interesting implications. The fatal mistake here (having been deceived by our natural habitual failure to pay full attention to what's going on in our own minds: see above, especially point #7) lies in regarding such an 'observing Self', i.e. homunculus, as itself being present *within consciousness* rather than completely out of sight 'in the shadows'.

The *subconscious* nature of any such 'Self' which is busy observing the conscious display of information can be appreciated, at least with respect to the visual component of consciousness, by imagining our metaphorical monitoring screen to be completely covered by a layer of photo-sensors. Activated phosphors - the 'imagery' is thus still present, though *optically* inaccessible - would continuously project, via anatomical connections, their excited state onwards to some sort of central-processing-unit (but note: not of a high speed digital but, rather, of a slow multi-channel *analog* computer). This 'cpu', in turn, would determine not only which bits of incoming sensory information are to be allowed to pass upwards to the cerebral cortex, but also what course of action the 'robot' (in which the whole thing would be embedded, and whose internal sensors complement the information provided by its exteroceptive sensory organs) can best take under the given circumstances. Neurologically speaking, then, the direct 'observer' of the complex multi-media conscious display is nothing less than *the sum total of subcortical centers to which the cerebral cortex projects mono-synaptically*. The subsequent poly-synaptic 'regress' to ever more distant sets of receiving stations is neither infinite nor philosophically problematical!

All that needs to be added now in order to make this 'model of the mind' complete in broad outline is the superposition of that ethereal spectrum of sensory imagery that we experience as thoughts, 'feelings', fantasies and memories. I like to think of there being a multi-media data bank or recording device somewhere in the brain, in which all sorts of selected life experiences are stored. These are triggered in diverse combinations and associations by ongoing external and internal events, including conscious (i.e., neocortical) activity itself, and then projected upwards to be viewed on the cerebral 'monitoring panels' as an ongoing integrated whole. Confusion between what is happening in real-time and what is merely being remembered or imagined is achieved -

as was realized by David Hume already in the 18th century - by means of a discrepancy between the intensity of these two types of perceptual information. This reality safeguard thus breaks down only with either very weak outside stimuli - "did I hear/see/feel ... (whatever), or was it only a figment of my imagination?" - or very strong internal stimuli: "am I going crazy, or are those (angels, ghosts, pink elephants ...) really out there?"

In closing this essay, it may be pointed out that the question of **why it should be** (or, equivalently, **how can it be?**) that different types of conscious experience – focussed attention, peripheral perception, self-awareness, etc. – are caused by specific patterns of neuronal activity within the cerebral cortex (see above) is no more amenable to physiological explanation or derivation than is Chalmers's celebrated "hard question" itself, viz., how the appearance of consciousness in any material/energetic system can be accounted for in the first place, i.e., deduced from an analysis of underlying physical mechanisms. After years of feigned optimism about the power of brain research to ultimately solve the 'mind/brain problem', there still is not the faintest theoretical guideline as to how this "explanatory gap" could ever be bridged (see above; also Corner 1976). Is the exact *nature of the material* of which a brain is composed crucial (could, for instance, a man-made intelligent robot or a non-carboniferous 'monster from outer space' actually be conscious)? Does it matter what the precise *anatomical disposition* is of the neurons carrying out a given operation (is a bird, fish, invertebrate - or a whale for that matter – really capable of consciousness)? Is the intensity of *electrical fields* generated by activated neurons a decisive factor (could a lowly amphibian or fetal cerebral cortex, or even a low-density cortical tissue culture, be conscious)? Does the *absolute size* of the cellular network matter (how conscious, in fact, are mammals smaller than ourselves when they are behaviorally awake or in REM sleep)? Or even (don't laugh!), might not the externally perceptible images on an activated terminal be associated with some sort of private *internal* 'experience'?

It is pointless, really, to speculate at this time about the answers to such questions, for there appears to be no conceivable way that any of them can be tested. Equally beyond all possibility of verification, it would seem, is the question of *what sort of consciousness* (if any) arises when, for instance, a bat or whale's sonar or a snake's infra-red cortical receiving centers become activated: would there really be a *visual* 'picture', such as we are familiar with on the basis of photographic realizations and *National Geographic* video reconstructions? All recent claims of great progress towards "explaining consciousness" (most outrageously in Dennett's *Consciousness Explained*) can therefore be regarded as mere variations on that delightful joke about the two mathematicians poring over a proof: "here, in this step, a **miracle** occurs". The same verdict applies equally when the phenomenon of consciousness is transformed conceptually from something requiring

explanation into an explanatory principle in its own right – an *intervening variable* in 'the brain equation' - as when "mere (sic) physical mechanisms" are held *a priori* to be inadequate to account for human mentation (as, famously, in Popper and Eccles' *The Self and its Brain*) or for several 'higher' forms of animal behavior (e.g., Allen and Bekoff's *Species of Mind: the Philosophy and Biology of Cognitive Ethology*, reviewed by me in the *Journal of Consciousness Studies*: vol. 7, pp.91-92).

It begins to look, therefore, as if we will have to learn to be satisfied with an asymptotic acquisition of ever more complete *empirical* knowledge of the exact neural *substrates* (not mere 'correlates'!) for the multifarious 'qualia' of which consciousness is comprised, and for the highly selective identification with some of them which constitutes the sense of being distinctly me, my-Self (Corner 1976). A start might be made, for instance, in mapping out the between columns generating, for example, *visual* perception when excited from those sub-serving either some kind of *body* sensation or a different modality of exteroceptive sensory experience. Even within a given cortical area, moreover, subtle morpho -physiological differences ought to be demonstrable between, for instance, modules producing a sensation of *redness* when stimulated and those generating *green-* or *blueness*. Analyses of 'phantom' bodily sensations (see Ramachandran's fascinating volume, *Phantoms in the Brain*) have further convincingly demonstrated that it is the specific cortical area that is activated, rather than the source or nature of the incoming message, that determines what a given stimulus will 'feel' like subjectively. Introspection tells us that there must be literally thousands of such 'quantal substrates' for the bits and pieces constituting an integrated field of conscious experience.

In conclusion, then, rather than continuing individualistically – as profiled in Taylor's *The Race for Consciousness* - to launch broad 'space-shots' at untestable answers to the ultimate questions concerning the human mind (e.g., Corner 1976), future philosophical analysis might be more profitably devoted to the relatively humble task of high-lighting those aspects of mental life which, besides being vitally important or merely highly interesting, are (with proper intellectual guidance, to be sure) *capable* within the limits of human intelligence of cumulatively being made comprehensible through the application of scientific reasoning and techniques.