Alfred Korzybski Memorial Lecture, 1985

THE POTENTIALS OF NEUROSEMANTICS FOR MODERN NEUROPSYCHOLOGY*

by

Russell Meyers, M.D.

INTRODUCTION by Stuart Mayper: The list of Alfred Korzybski Memorial Lecturers contains many illustrious names -- forty-two from 1952 to this date. Of these, only two people have appeared more than once; only two have been invited back, or perhaps I should say, have accepted a second invitation. One of them is Robert R. Blake, who is in the audience. The other is our 1985 Lecturer, who was also our 1958 Lecturer.[26h]

Since the Barbizon-Plaza is closing in two days, I won't give you the full history of this remarkable man. He originated in Brooklyn in 1904, and fifty years ago was becoming a neurosurgeon. But not only a neurosurgeon; his academic positions have been in Embryology, Histology, Psychology, Speech Pathology, Neurology, Neurophysiology, and Neurosurgery. He served in World War II as Chief Neurosurgeon at four Army Hospitals, and after seventeen years at Iowa University became Chief of the Appalachian Regional Hospital in West Virginia. He has published 140 papers and monographs in the fields mentioned, and his honors and awards have been multitudinous. He retired from practice in 1975, but don't think that meant a period of inactivity. He says he remains a student: he's attending and contributing to weekly and biweekly medical conferences, he's taking a course in symbolic logic, and he is getting his long-awaited book into shape: "Orientation for Neurology, Psychology and Psychiatry". The orientation it describes is general semantics. He has been President of the International Society for General Semantics and President of the Board of Trustees of the Institute.

Let me just mention his first A.K. Lecture: "Potentials of General Semantics in the Age of Space." It contains a thorough synopsis of the anxious attitude that pervaded this country just after the Russians had put Sputnik into orbit. It's well worth reading in the light of our present drive to improve our educational methods, to restore literacy and introduce Critical Thinking. He contrasts the competitive reaction of the military and the politicians to the attitude of scientists; he outlines a scientific ethic of time-binding. Well, read that first lecture, but now listen to and let your nervous systems be expanded by his second Korzybski Lecture: "The Potentials of Neurosemantics for Modern Neuropsychology".

Dr. Russell Meyers!

* Presented at the Barbizon-Plaza Hotel, New York, NY, on December 13, 1985.

President Exton, Dr. Mayper, Trustees and members and guests of The Institute of General Semantics: greetings. In designating me as your essayist for this, the thirty-fourth annual commemoration of the late Alfred Korzybski, you have bestowed upon me an honor which I shall cherish to the end of my days. For that I wish to express my deep appreciation.

At this early moment I would like to pay earnest tribute to the merits of Korzybski's endeavors with which I became deeply impressed upon first encountering them in 1938. That was the year in which I opened my office for the practice of neurology and neurosurgery. The Great Depression was still in process, wars were rife in Europe and Asia and the second World War was imminent. The dearth of patients capable of paying for my services was such that I was impelled to "moon-light" at New York University, teaching under-graduate courses in experimental and physiological psychology.

Late one night I had occasion to let myself into the psychology department library and noticed a lone book lying face open on the table, at a page reading, "Part VI: On the Foundation of Psychophysiology." The book was entitled "Science and Sanity" and had been authored by an engineer-mathematician with whose name I was thoroughly unfamiliar. While still afoot I leafed through its nearly 800 pages and then, mainly because its Part VI manifestly pertained to the courses I was teaching, drew up a chair and spent the next three hours reading and making copious notes.

Included among the topics treated were the general and special characteristics of stimuli; the excitability and conductivity of living cells, with special focus on those comprising neuronal and muscular tissues; refractory periods, retroactive inhibition and delayed responses; electrocolloidal gradients as embryogenic determinants of the 'natural order' of neuroaxial developments; adversive and aversive tropisms; somatic and visceral reflexology; prepotencies among reflexes; the functional roles of the supra- and infragranular cortices; conditional responses and their roles in the organismic processes of discriminating, generalizing, abstracting, learning and extinction; and intraorganismal conflicts manifest as minor maladjustments and experimental and clinical neuroses.

Those topics were the stock-in-trade of that period in neuro-physiology and physiological psychology. They were succinctly and lucidly presented and certainly competently integrated; but what engaged me was the fresh illumination brought off by the author's adroit exposition of a to-me new dimension, linguistics -- that modest scientific discipline which, despite its neglect by most scientific craftsmen, carries high potentials for abetting or sabotaging the best intended efforts to acquire, verify, evaluate and transmit knowledge.

On the following day I bought a copy of S & S and spent most of my free time in the next three weeks studying its contents. And a considerable part of my preparation for tonight's lecture consisted in reading from cover to cover for the ninth time that much underlined, marginally annotated and dog-eared copy.

• I regard Korzybski's "Science and Sanity" [22] as the most important book I have thus far read.

• For the second time [26] in the present century I submit the opinion that there appears to be no need to retract or revise any of the key formulations published by Korzybski in 1933.

• With few exceptions, such modest contributions to science as it has been my lot to make during the past 53 years have been mere applications of Korzybski's broadly generalizable non-Aristotelian formulations (v.i.) to the neurological and psychological specialties which have for the most part claimed my professional attention; and

• I regard Alfred Korzybski without reservation as one among the geniuses of the current century.

ISSUES OF CONCERN

The time-frame of the term 'modern neuropsychology' which appears in the title of this essay embraces the quarter-century from, say, 1960 to the present -- a period during which the subspecialty may with fair warrant be said to have come of age.

The interest of the scientific community in neuropsychology was in considerable measure quickened during the decade following the close of World War II by the time-binding coalescence of antecedent technical advances in espionage, cryptology, guided missiles, robotics, servo-mechanisms, transistors, war neuroses, brain-washing, mass propaganda, psychosomatic medicine and the spread of neuronal impulses through nerve nets; and by the concomitant development of cybernetics, information theory and communication science.

One consequence of that coalescence was the fashioning in the late 1940's of Shannon and Weaver's information theory [34], which reflected aspects of Bernoulli's probability mathematics, Boole's symbolic transformation of Aristotle's two-valued logic, the 'all or none' law of neuronal action, and the authors' own linguistic analysis of the redundancy abiding with written English. The earliest beneficient spin-off of the Shannon-Weaver theory was the unanticipated discovery that its mathematical expression is a simulacrum of that of the second law of thermodynamics -- entropy -- the groundwork of which had been laid in the 19th century by Carnot, Joule, Thomson, Clausius and Boltzmann. An even less anticipated beneficence was the demonstration for the first time of the quantifiability of a human emotion, viz., surprise.

The latter triggered a rash of novel investigations by physiologists, mathematical biophysicists, engineers, neurologists, psychologists, psychiatrists, educators and others. Many of them, students of the processes of communication set in motion during the war, perceived in the structure of the human nervous system -- as Korzybski had earlier done -- a model par excellence of those intriguing processes. In consequence, the quality and quantity of contributions to the literature of neuropsychology grew apace.

By the mid-1960's it was no longer considered en avant for a psychologist to profess a serene indifference to the phenomena of what was patronizingly called "the black box" -- meaning the process-events of the neurohumoral apparatus which occur between the impingement of a stimulus (S) upon a given receptor field of an organism and the occurrence of an overt or covert response (R) thereto.

In the main, then, things went well and within the next decade neuropsychology as a sub-subspecialty earned an estimable place in the scientific community.

However, as folk-wisdom admonishes, the course of true love never runs smooth, and it was inevitable that neuropsychologists, like their fellows in all other areas of human endeavor, would encounter thorny and perversely intractable problems. And they did. Alluding to them in a somewhat different context than that of the present essay, neurophysiologist Karl Pribram* [31a] invited attention in 1971 to the paradoxes and puzzles unexpectedly emerging from his own and his colleagues' researches which had defied explanation within the theoretical framework employed by most investigators of that period. On the whole, the situation has not appreciably changed for the better in the 15 years since. In view thereof it would be advantageous to know why.

This brings me to the issues with which my presentation is chiefly concerned:

- Ever-operative but thus far largely unnoticed, the linguistico-semantic factors which have impressed me [26a,g,i] since the late 1940's as contributing to the etiology of the perversities mentioned above, and

- Potentially preventative and therapeutic measures for emending such problems.

In addressing those issues I believe it will save our time and energy for me arbitrarily to adopt one from among the several substantive topics that perturbate modern neuropsychology and allow it to represent the others. Of the two most conspicuous such topics: 1) the so-called revolution-in-process concerning the 'true' definition of intelligence, and 2) the dilemmas posed by disparate and currently irreconcilable results of the so-called split-brain studies of the past twenty years, I will settle on the latter as the one about which I happen to be the more qualified to speak.

In what follows I shall try to hold to a minimum the technologic details of data, research design and modus operandi. In so doing I stand on fairly safe ground for two good reasons: first, because, as well-indoctrinated students of GS, most of you are quite at home with the rudiments of neurology and psychology; and second, because an in-depth knowledge of those subspecialties of science is not indispensable for comprehending the principles of which I shall be speaking. (Some help may be found in the **Glossary** of potentially troublesome terms, beginning on p. 50 .)

Let me at this juncture provide a hint about the effort to resolve some of the recalcitrant perplexities that impede the progress of neuropsychological science. It abides with two pithy quotations:

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* Professor Karl H. Pribram of Stanford University presented the illuminating Alfred Korzybski Memorial Lecture for 1984: "Brain and Meaning" [31b].

"In every science, but in the physiological sciences more than the others, we are in danger of deceiving ourselves about words. We must never forget that our characterization of the phenomena of nature . . . are merely figurative language by which we must not allow ourselves to be duped . . . we must learn that the words we use to express phenomena whose cause we do not know are nothing in themselves; and that the moment we grant them any value in criticism or discussion, we abandon experience and fall into scholasticism. In explaining phenomena we must be very careful never to . . . put a word in place of a fact."
-- Claude Bernard (1874)

"A scientist may be very much up to date in his line of work, let us say in biology; but his physico-mathematical structural knowledge may be somewhere in the 18th or 19th century and his epistemology, metaphysics and structure of language 300 B.C. This classification by years gives a fairly good picture of his semantic status."
-- Alfred Korzybski (1933)

ON 'SPLIT-BRAIN' STUDIES

The historical roots of what are currently called split-brain studies reach back to the 1870's after a landmark neurophysiological breakthrough by Fritsch and Hitzig [8], viz., the identification of the locus of a 'motor cortex' in man and other mammals for movements on the opposite side of the body. A number of physiologists working independently then noted that by applying a relatively strong electrical current to virtually any conveniently accessible locus on the cerebral cortex of one hemisphere, violent jerking movements of the muscles of both sides of the body -- face, neck, trunk, and limbs -- and a transient comatose state were regularly evocable. Such phenomena closely mimicked the well known human affliction called grand mal epilepsy, and aroused widespread interest among physicians as well as physiologists.

Among the many questions raised thereby was that concerning just how the abnormal brain events which subtend such bilateral spasmodic actions spread from the site of the initial electrical excitation of the brain through the central nervous system to reach the peripheral muscles of both sides.

Reliable answers awaited the invention of small-current amplifiers (vacuum tubes and transistors) and arrays of multiple sensors ('pick-up electrodes') capable of being distributed upon, within and deep to the cerebral cortex -- much as the multiple sensors of an electroencephalographic instrument are distributed on and within the scalp. Such 'sophisticated tools' were some 60 years in coming, and when they were brought into the physiological laboratories and hospital operating rooms they made it possible to demonstrate that the abnormal electro-colloidal brain events of an induced epileptiform convulsion are propagated from the cortical site initially stimulated, first, to the neighboring cortex and subjacent cortical white matter ('U'-fibers) and thence rapidly beyond and across the rest of the cortex, roughly like waves spreading peripherally across a pool of water from the initial agitation of a dropped stone (figure 1).

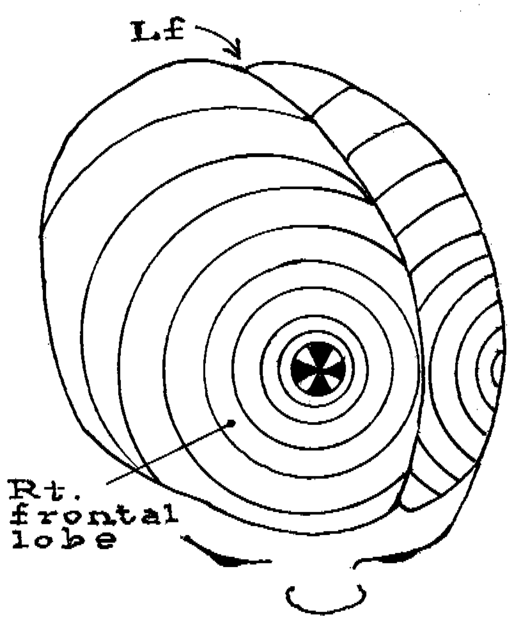

FIGURE 1. Diagram of human cerebral hemispheres seen from a point above and lateral to the right frontal lobe of the subject. Lf: The interhemispheric longitudinal fissure. The cross denotes an 'epileptogenic focus' (scar, tumor, infection, biochemical malfunction, etc.) within or beneath the cortex of the right frontal lobe. When neurons lying within and/or neighboring upon such a focus become unstabile they may trigger a spreading unstability in adjacent and more remotely situated brain tissues in the form of convulsions of focal or generalized severity.

In and of itself that demonstration was highly informative. However while it answered part of the question concerning the mode of propagation of the cortical events, it failed to accommodate earlier data concerning the time sequences of onset of spasmodic muscular actions on both sides of the body. That then raised the question as to whether other routes of propagation might exist.

The latter question was answered in 1940 by T. Erickson [5] who showed the existence in monkeys of a second route which conveys convulsive-inducing electro-colloidal impulses from the cerebral cortex of one side of the brain to that of the opposite side via the corpus callosum. It evoked a highly plausible inference that the comparable structure in other species -- man included -- plays a comparable rôle in the propagation of epileptogenic seizures.

Let us pause long enough to recall that the corpus callosum is the largest and most conspicuous member of a 'family' of some 17 thus-far identified 'commissures' in the brain. The common anatomico-physiological characteristics of commissures are that (a) they consist of aggregates of axonal branches of neurons with cell bodies located on one or the other side of the median longitudinal axis of the central nervous system; (b) as axons, they make synaptic connections with dendritic branches of neurons with cell bodies located on the opposite side of the midline; and (c) they convey neural signals (information) from one side of the central nervous system to the other. In the case of the corpus callosum the structures connected thereby are in the main those regions of the right and left hemispheral cortices -- frontal, parietal, temporal and occipital -- which are anatomical counterparts (homologues) of each other.

The human corpus callosum is estimated as being comprised of some 200 million axonal nerve fibers. The latter are most closely packed at their midportions, whence they fan out vertically, obliquely and horizontally (figures 2a, b, c and d).

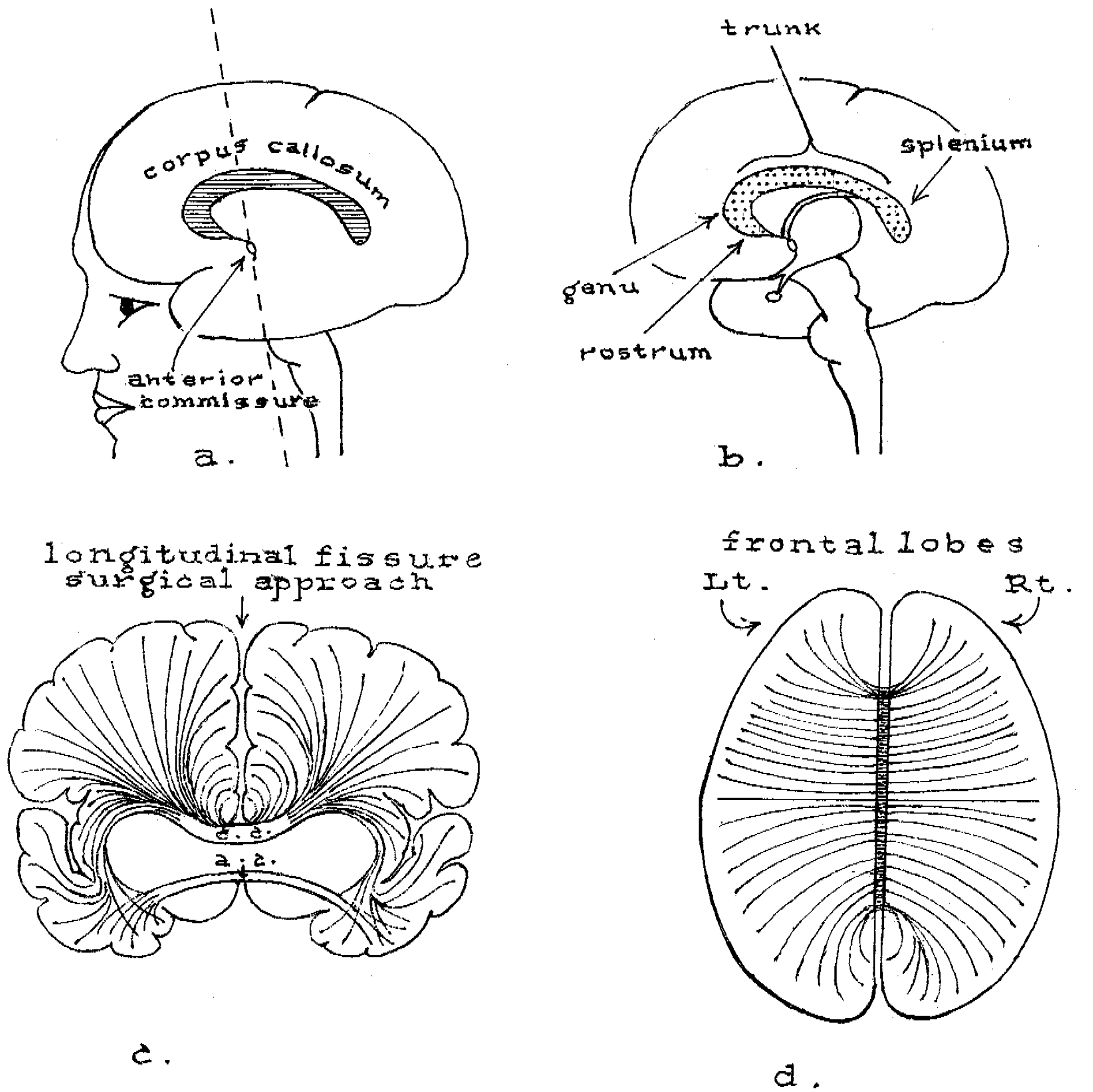

FIGURE **2a:** Relative positions of the callosal and anterior commissures seen as if their midline slices were visible through a transparent left hemisphere. **2b:** The four anatomical components of the corpus callosum -- rostrum, genu, trunk and splenium. (Stipples represent the severed ends of axons which normally transmit nerve impulses from one cerebral hemisphere to its opposite fellow.) **2c:** Cut surfaces of both cerebral hemispheres seen as if sliced through a plane corresponding to the broken line of 2a. Depicted are the distributions of axons of the corpus callosum (**c.c.**) and anterior commissure (**a.c.**). **2d:** Bird's-eye view depicting the distribution of axons comprising the corpus callosum as if visible through transparent hemispheres.

At about the time that Erickson was completing his callosal studies in monkeys, neurosurgeon W. P. Van Wagenen postulated that surgical interruption of all or part of the corpus callosum of a person afflicted by grand mal epilepsy might bestow the clinically desirable effects of limiting the spread of convulsive movements to one side of the victim's body, thereby appreciably reducing the severity of the seizures and the coincidence of traumatic complications and averting the ictal development of coma -- a state which seemed consequent to bilateral, rather than unilateral convulsions.

Van Wagenen [39] worked out the technical details of such an operation and planned its employment in a small series of human cases whereby his hypothesis could be put to test. The aims he envisioned were clearly delineated. The operation, called 'callosal commissurotomy', was to be reserved for the unfortunate ten percent of sufferers from grand mal epilepsy who, despite protracted adherence to the then-standard conservative regimens of treatment (anticonvulsive drugs, ketogenic diets and mild dehydration), failed to obtain appreciable, if any, benefit; and, while he hoped that the severity of their convulsions could be lessened, improving their quality of life appreciably, he had no expectation that they could be rendered seizure-free.

The investigation was predominantly an experimental venture in surgical therapeutics. However, Van Wagenen and a faculty colleague, psychologist A. J. Akelaitis [10], foresaw that it could contribute to the general fund of neurological and psychological information. Accordingly, they set up a research project the protocols of which included appropriate pre- and postoperative assessments of the neurological and psychological states of the patient-participants in the study.

Beginning in 1939 thirty patients underwent one or more operative procedures. However, Van Wagenen modified the procedure from case to case, performing complete callosal commissurotomies in some and incomplete variations thereof in others. In some instances he also severed the anterior commissure; in others, one or both limbs of the fornico-hippocampal commissure; and in still others, both commissures. In addition, the initial intention -- to reserve callosal commissurotomy for cases of grand mal epilepsy -- was not rigorously observed. The exercise of such options of course introduced iatrogenic variables over and above those of the research design of the project (differences in age, sex, IQ, formal education, communicative skills, past medical and psychological histories; the coexistence of general medical, neurological and/or psychological illnesses with grand mal epilepsy; and the sites, extents and pathologic characteristics of brain lesions -- scars, cysts, tumors, genetic and vascular degenerations etc.)*

A synopsis of the most salient results of the double-aspect Van Wagenen-Akelaitis study follows:

Surgical therapeutics. There were no operative mortalities. With one exception -- a self-limited intracerebral hemorrhage which necessitated surgical evacuation -- postoperative complications were relatively few in number and their clinically discernible morbid effects largely transitory. Periodic follow-up studies were capably implemented and continued.

Both subjective and clinically determinable benefits such as unilaterally delimited convulsions and the preservation of consciousness during

* So many variables in a series of 30 cases perforce exclude definitive statistical analysis.

seizures ranged from nil to slight to moderate. But no end-result was considered optimal. As expected, the better therapeutic end-results followed complete callosal commissurotomies. It was not clear whether or not cutting the anterior and fornico-hippocampal commissures appreciably enhanced the outcomes.

Contemplating the disappointing results, Van Wagenen [39] thought that when epileptogenic foci exist in both cerebral hemispheres callosal commissurotomy cannot be expected to help much. And there was no device for preoperatively identifying all such 'firing points'. (Electroencephalography was not then and is not now up to that task.)

The surgical series was accordingly discontinued.

Neuropsychological findings. By far the most arresting and, for our purposes, significant disclosure of the study abided with Van Wagenen's [39] early announcement, "Section of the commissural pathways contained in the corpus callosum may be carried out without any untoward effect on the patient." His assertion was backed up by detailed case reports pertaining to general health and neurological, psychological, psychometric and psychiatric assessments as prepared by the surgeons and special consultants [30a,b] and attested by patients and their families.

Such reports were tacitly taken to be the experimentally established 'facts' of the period. The possibility that they might have been iatrogenic artifacts imputable to the limitations of the testing instruments then employed apparently did not occur to either the investigators or their professional contemporaries who equated words with 'things' (process-events).

Although the corpus callosum continued to engage the attention of 'basic' neuroscientists during the next 20-odd years, the employment of callosal commissurotomy in behalf of patients with severe epilepsy was all but completely foregone. For the most part its use was limited to the relatively few cases wherein the medical work-up indicated that any epileptogenic foci found were all in the same hemisphere.

As late as 1972 Minckler [27] reported, "The function of the corpus callosum remains obscure insofar as specific neurological deficits occur from lesions within it. The structure can be absent by agenesis with the defect imperceptible." However, by that time a novel approach to the examination of callosally commissurotomized human subjects had been adopted by neuropsychologist Roger Sperry and his collaborators, and rewarding reports thereof had revivified the literature of the topic. Minckler briefly alluded to it, saying, " ... but so-called split-brain preparations* have a profound effect on learning and retention. The commissure is undoubtedly related during the period of growth and learning to transferring of engrams, particularly of the higher integrative type from one side to the other."

The novel approach (v.s.) was to fashion a new instrument for examining commissurotomized humans, viz.:

* The expression 'split-brain preparation' is a nick-name for any callosally commissurotomized organism, human or subhuman. It is, of course, a flagrant misnomer, for, literally to split the brain would be summarily to kill its owner. Minckler quite properly used the modifier "so-called". When it is omitted -- as most commonly it is -- it should be assumed.

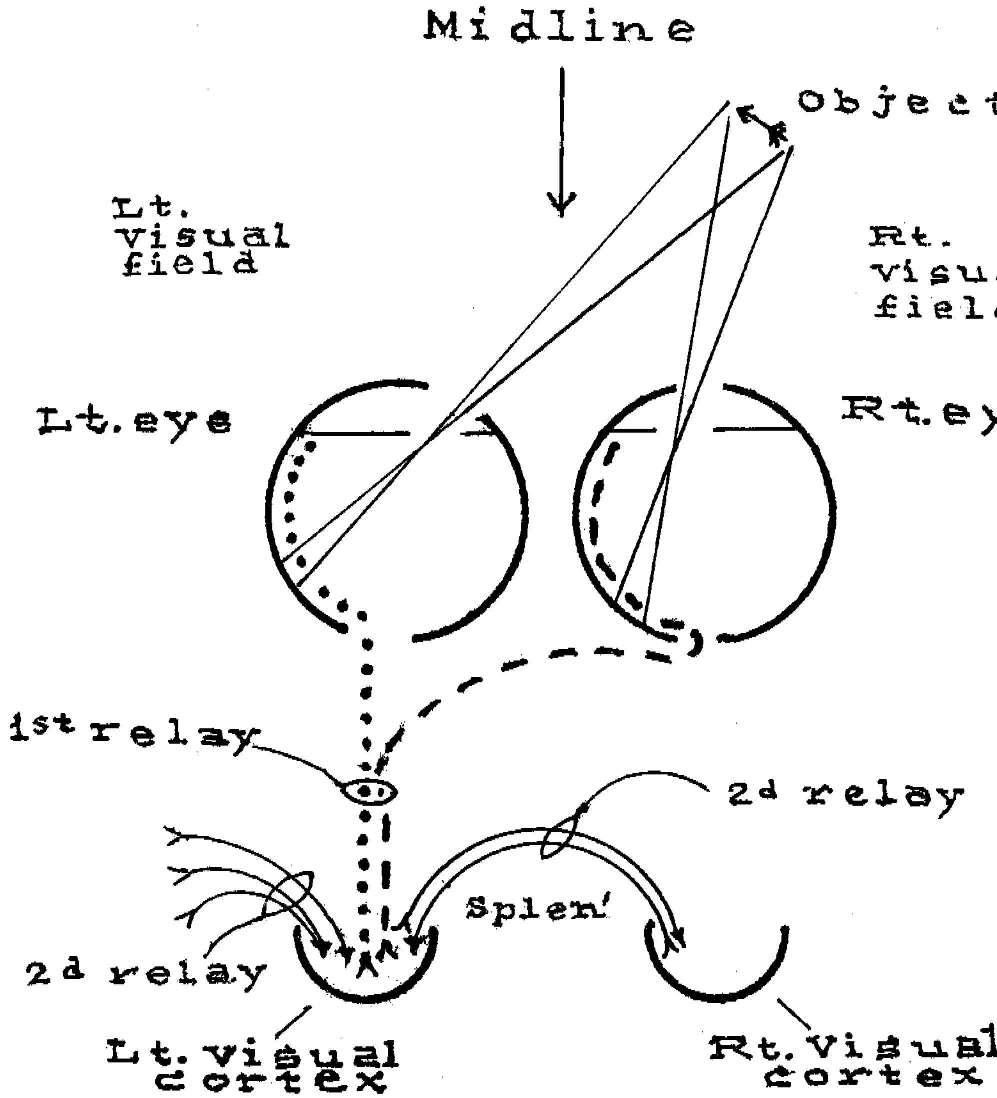

FIGURE 3. Bird's-eye diagram illustrating how normally light beams reflected from an object (arrow) located in the observer's right visual field provoke neuronal activity in and beyond the visual cortices of the left and right hemispheres. Dotted lines symbolize the light-sensitive retinal cells of the left eye and the course taken thence by neural impulses which reach the left visual cortex via the "first relay"; and broken lines similarly symbolize the retinal cells of the right eye and the course of neural impulses to the left visual cortex via the corresponding "first relay". In the left visual cortex two sets of "second relays" are activated: one distributes impulses widely to the cerebral cortices of the left cerebral hemisphere, and the other to the right visual cortex via the splenium (splen'). On the right side a "third relay" (not depicted) departs the right visual cortex. Its axons are analogous in their distribution to those of the "second relay" which departs the left visual cortex.

It had been known [33] since 1888 that, in entering the eyes, light beams reflected from objects located in, say, the observer's right visual field normally impinge the retinal cells of the left halves of both eyes. The retinal cells then activate a five-synapse relay of neural impulses which play upon an aggregate of neuronal cells -- the left visual cortex -- located in the occipital lobe of the left cerebral hemisphere (figure 3). In short, the left visual cortex typically receives inputs of information from the observer's right visual field.

Beyond the five-synapse relay referred to above, two additional relays had been described, each of which takes off from the left visual cortex (figure 3). One conveys neural impulses therefrom to most of the rest of the cortex of the left hemisphere and the other, to the visual cortex of the right hemisphere via the most posterior prominence of the corpus callosum -- its splenium (figure 2b). Consequently, objects located in the right visual field normally instigate a train of neural impulses which, among other things, play upon both the left and right cerebral hemispheres via (a) the splenium and (b) the respective visual cortices of those hemispheres. (Like the eyes themselves -- which are in fact outpouchings of the brain -- that neural pattern is paired. Excitation of the retinal cells of the right halves of the eyes (by light from the left visual fields) activates neural impulses which play upon both the right and left cerebral hemispheres similarly. Thus, the splenium serves as a two-way conduit whereby the right and left visual cortices are anatomically and functionally related to one another.)

It had likewise long been known by embryologists, geneticists, teratologists and others that, thanks to the inbuilt presence of 'organizers' and to attributes variously called 'plasticity', 'equipotentiality' and 'adaptability' inherent with developing tissues and rudimentary structures of the nervous system, opportunity exists during the pre- and postnatal period of maturations and organization of brain patterns (engrams) to recruit neurohumoral elements that ordinarily would not be exploited for the acquisition of a given functional pattern -- thereby 'making up', within limits, for a deficit imputable to genetic and/or other intrinsic and extrinsic noxious agents. In line with our present interest, such a deficit is exemplified by agenesis of the corpus callosum.

Readily at hand in the 1960's was a considerable number of relatively valid, reliable and quantifiable neurological and psychological (cognitive, aptitudinal and projective) tests.

Similarly available were sophisticated audio-visual instruments for presenting stimuli during controlled conditions to persons under examination. Among them was the tachistoscope, whereby visual stimuli can be flashed on a viewing screen for a predetermined period of time, e.g., 0.06 second, within which the normal examinee is able to perceive a relatively simple visual presentation but does not have time to scan it the better to perceive it.

R. E. Myers and R. W. Sperry continued into the 1950's the study of the functions of the corpus callosum. Having first corroborated in cats the paucity of biobehavioral aberrations following commissurotomies, they speculated that such negative findings might be due more to the irrelevance of the testing procedures employed than to the corpus callosum itself. They opted to supplement the conventional methods of assessing the pre- and postoperative capabilities of their cats with special training procedures in which the cats had to acquire new neural patterns [28], rather than merely exercise already well established ones. That change in tactics paid large dividends: the post-commissurotomized cats exhibited conspicuous deficits in perceptual responses, learning, and memory compared to their pre-operative capacities. These findings were corroborated by colleagues around the globe. A breakthrough had at long last been made.

The question that next arose was whether special supplementary tests in human subjects, analogous to those introduced in the cat series, would shed comparable light on the functional rôles of the corpus callosum in man.

Encouraged by the positive results of the cat studies, Sperry designed and implemented a research project whereby the question might be definitively answered. With the cooperation of neurosurgeons J. E. Bogen and P. J. Vogel [2] twenty-four epileptic patients scheduled for complete callosal, anterior and fornico-hippocampal commissurotomies were recruited for Sperry's study. Like the patients in the Van Wagenen-Akelaitis series, they had serious bilateral convulsions not helped by conventional therapies. But they differed in important respects: 1) they were accepted only if their clinical workups showed that their epileptogenic foci were limited to one hemisphere; 2) all patients underwent the same surgical operations (v.s.); and 3) they were subjected pre- and postoperatively to special supplementary neuropsychological tests in addition to the conventional ones.

The first-mentioned tactic -- that of excluding patients with evidence of bilateral epileptogenic foci -- pertained solely to the therapeutic aspect of the study and as such need not detain us here. As anticipated, it yielded decidedly more beneficial results than those earlier reported by Van Wagenen.

The tactic of employing essentially the same surgical procedure for each patient gave the study the statistical advantage of reducing the number of variables.

The third tactic merits some elaboration, for it was that whereby Sperry's illuminating 'split-brain' data were disclosed. We should recall that severing the axons which constitute the splenium anatomically interrupts -- permanently -- the two-way conduit whereby the left and right visual cortices are directly connected (figure 3). Functionally, however, the deficiency imputable to that interruption typically goes unnoticed by both the patient and his examiners (as it very obviously did in the Van Wagenen-Akelaitis studies) owing to the unwitting acquisition by the patient of a compensatory habit of scanning his gross visual field by making barely discernible movements of his eyeballs and head.*

* Such habits frequently ensue when, e.g., due to a 'stroke', tumor, infection, multiple sclerotic lesion etc., the visual cortex of one hemisphere and/or the nerve pathways leading to it are deranged. The consequence of such derangement is loss of vision in the opposite visual field or part thereof, called respectively homonymous hemi- or quadrantanopia. Many persons so afflicted remain oblivious to such deficiencies due to their having unwittingly acquired the habit of scanning their visual fields.

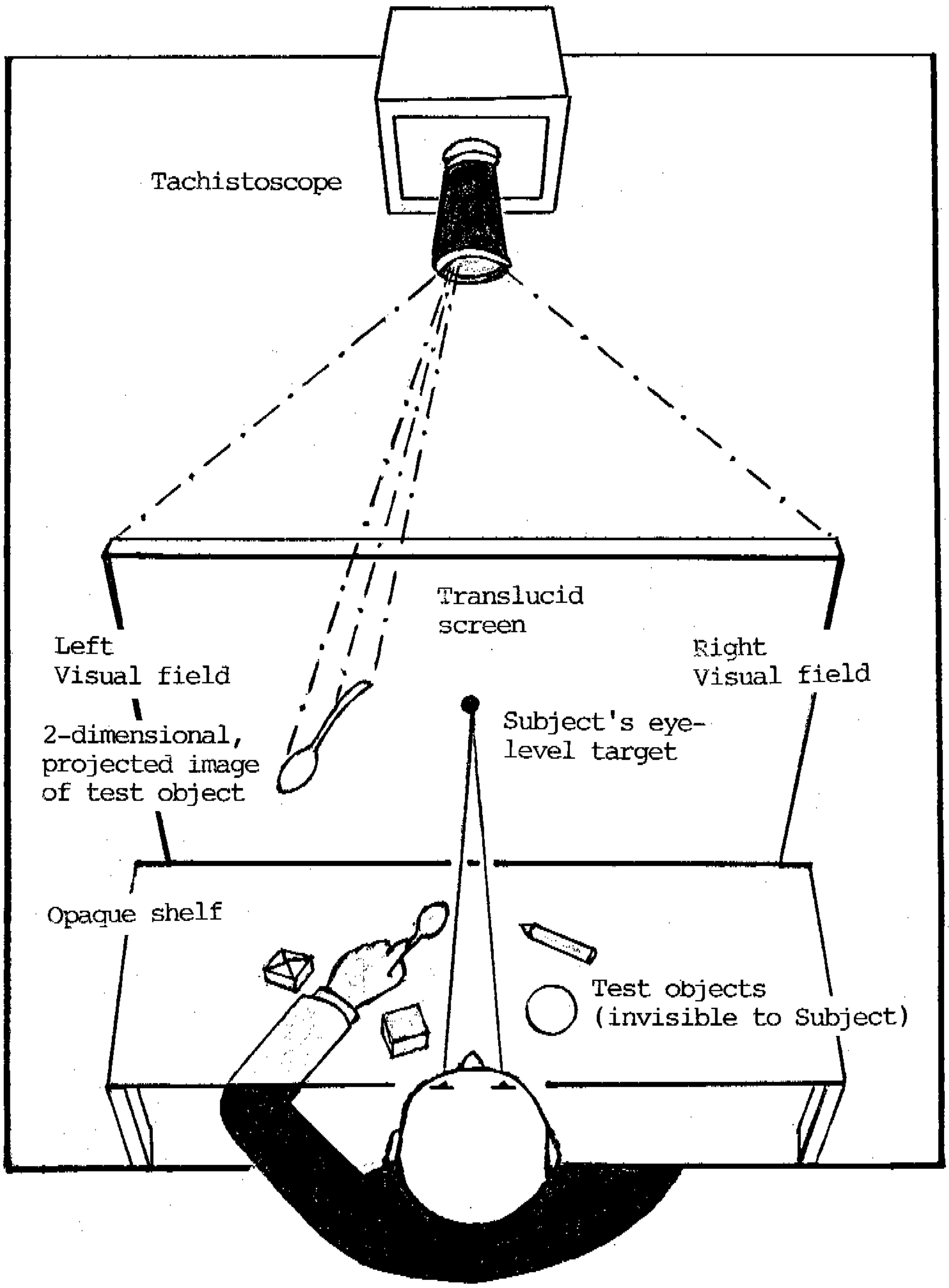

FIGURE 4. The basic testing arrangement used pre- and postoperatively by Sperry et al. to lateralize visual and tactile inputs of information, and observe tactile non-verbal responses. The subject directly faces a screen illuminable from behind by a tachistoscope whereby 2-dimensional images of 3-dimensional test-objects can be singly projected in either visual field. The test-objects disposed on the table are hidden from the subject's view but can be tactilely examined by him/her. Upon being alerted the subject visually fixates the target at the center of the screen. An image then appears briefly in his/her right or left visual field. The subject is asked to select unimanually the corresponding test-object. Overt responses are recorded by an observer.

Thus, only when such adventitious movements are deliberately excluded by the use of accessory apparatus (e.g. tachistoscopy, monitored inputs of visual stimuli from a single visual field, properly placed screens etc.), as they were in Sperry's human studies, do the covert functional deficiencies become overt.

Failure to employ such precautions in previous experimental perceptual-learning situations permitted masking of not only visual but other, more general deficits properly imputable to commissurotomy. That in turn seriously compromised assessment of abilities and disabilities and, as we can now appreciate, led to the false negative results of the earlier subhuman and human studies.

One such accessory test set-up is depicted in Figure 4.

As in the cat studies of Myers and Sperry, the modus operandi in Sperry's human studies led to a harvest of positive findings which in their turn, necessitated revisions of the then-prevailing concepts regarding conscious experience, perception, learning, memory, the cerebral loci of various 'functions' and the meanings of the terms 'cerebral asymmetry', 'laterality', 'dominance' and 'subordination'.

In 1981 the Nobel Prize in Physiology or Medicine was deservedly awarded to Professor Sperry.

As earlier announced, tonight's essay focuses upon 1) the persistence in certain neuropsychological areas, among which 'split-brain' studies constitute only one, of as-yet unresolved dilemmas which seem to me needlessly to impede research, and 2) the potentials inhering with multi- and infinite-valued, non-Aristotelian GS formulations for resolving dilemmas which may stem more from unsuspected and unrecognized iatrogenic semantic factors than from the phenomena regarded by many otherwise highly competent investigators as their 'true' objects of inquiry. Frequently, the unwitting use of Aristotelian [38b] two-valued formulations in the effort to resolve such dilemmas, is as inapplicable as it is ineffectual.

Needed at this point is a specific illustration, and because it is often easier to identify and evaluate flaws in the thinking-and-doing of persons in subcultures which differ in some respects from one's own, I shall here recount a scenario lifted from a 'bull session' that developed one evening in 1981 in my hotel room in Christchurch, New Zealand.

Gathered there were eight cronies -- all of us white caucasian American males and all competitors in the 1981 Track and Field Championships of the World Association of Veteran Athletes then in process. (Almost certainly we were typical of the majority of 300 male athletes in the USA contingent, and as such comprised a sub-subculture of sorts.)

Quite without plan the conversation got around to a seldom-bared topic: the latent discomfiture, the mild-to-moderate chagrin felt by many American 'Whites' -- spectators as well as athletes -- over the circumstance that for a number of recent years 'Black' athletes -- women and men -- had largely dominated the open regional, national and international meets in the sprinting, hurdling and horizontal jumping events. Among other dilemmas generated thereby was that of understanding how the genre of 'Blacks', which at that time reportedly comprised less than 13 percent of the general population of the USA, 'managed' to produce enough world-class speedsters to outshine their 'White' counterparts, whose racial fellows comprised well over 70 percent of the general population.

During the ensuing discussion three causally monofactorial hypotheses -- one genetic, another anthropologic and a third motivational -- were in turn proposed, explored and, upon being shown to harbor serious internal contradictions, relinquished. At that juncture I offered a causally multifactorial hypothesis which, while using some components of each of the earlier proposals, introduced a fourth factor -- the pervasive and often occult effects of humanly-contrived categories (classes) and the evaluative neurosemantic reactions thereby evoked upon efforts to resolve the dilemma.

I began by inviting attention to the circumstances that (a) miscegenation among members of the negroid, mongoloid and caucasoid races and their subclasses [13], including 'Whites', has been rife for so many centuries that attempts to label the ancestral lines of persons, families, clans, tribes and regional communities as 'pure' in respect of any one or a combination of physiognomonic traits are insupportable; (b) each year in the USA an indeterminate, yet substantial number of individuals previously classified as 'Black' succeed not only in "passing the line", that is, surreptitiously gaining acceptance as 'Whites' among 'Whites', but in maintaining that status enduringly; (c) the color of the skin of 'Black' persons, perforce including that of 'Black' athletes, is not de facto black, but brown, the degrees of saturation of which are distributed along a continuum from very dark to such a pallid tan as to merge insensibly with the tan and pinkish-tan complexions of persons regarded by their associates as 'Whites'; and (d) continua analogous to the continuum of skin color obtain in respect of all the physiognomonic traits stereotypically alleged to characterize 'Blacks' -- kinky or wooly hair, 'black' or dark brown irises, thick lips, flat noses with wide alae nasi etc.

Thence I proceeded to assess critically the arbitrary and well-entrenched convention of labelling mulattoes, quadroons, octoroons and others* with the same generic class-name -- Blacks -- as that used in legal, reportorial and social frameworks for allegedly 'pure-blooded' Negroes. Among other things I indicated that, in the effort to solve empirical problems involving unknown as well as known variables (which by far most cases have) the inadvertent use of two-valued, as distinct from multi- and infinite-valued paradigms, not only courts failure but exposes the user to unanticipated and sometimes gravely sobering repercussions. Thus, from the logical, mathematical and biogenetic points of view, the warrant (if any at all) for labelling and therefore classifying mulattoes "White" is at least equal to that for labelling them "Black"; and by like token, that for labelling quadroons,

* In 1970 the following became a public law in Louisiana: "In signifying race, a person having one-thirty-second or less of Negro blood shall not be deemed, described or designated by any public official in the state of Louisiana as 'colored', a 'mulatto', a 'black', a 'negro', a 'griffe', a 'mestizo', a 'colored person' or a 'person of color.'" By inverse implication, the use of those labels to designate persons having one-sixteenth or more of Negro blood remained legal and thereby Act 46 kept largely intact a long-observed but unwritten law under which the self-same labels had been legally applicable to persons having one-thirty-second of Negro blood. The law was repealed in 1983.

octoroons and others "White" preponderantly outweighs the warrant for labelling them "Black." (Such a repercussion is obviously antithetic to that intended by the designers of the labelling practice.)

An animated dialectic followed, in the course of which the initial dilemma was re-examined. The material 'objects of interest' comprising it of course remained unchanged. However, it soon became apparent that the examiners themselves had undergone some salutary changes.

For one, they now appeared to 'savvy' what until then they had been semantically unable to comprehend, namely, that the 'silent level' biogenetic constitutions of the mulattoid, quadroonoid and octroonoid athletes whose performances generally topped those of both their "pure White" and "pure Black" counterparts, manifestly included both "White" and "Black" components, in the miscegenation of which the "White", by definition, appreciably outweighed the "Black" components. Pigmentary endowments aside, one inference gratuitously deducible therefrom was that the "White" bio-genetic components are integral to and possibly the necessary and sufficient determinants of top-quality, 'fast-twitch' neuromuscular performances. That perceptual transformation, valid or not, appeared to confer a tranquilizing therapeutic effect on my guests, one of whom felt moved to assert, "Say, I can live with that!"

For another, those present appeared to have gained a fair measure of insight regarding the circumstances that (a) the class-name "Black", like all other multiordinal terms, conveys a quite different meaning when used on one level of abstraction, e.g., census-taking, than it does on another, e.g., the biological level; and (b) failure on the part of users of the term to recognize and accommodate that difference results in confusing levels of abstraction and thereby inadvertently setting up vexatious dilemmas.

A third such change was identified by a clinical psychologist in our midst who postulated that the dilemma with which those present were engaged stemmed in considerable part from their own value systems -- particularly from the threat to their self-esteem which they as "Whites" had allowed themselves to perceive in the athletic performance of their 'colored' counterparts. In addition he interpreted the discomfiture, chagrin and other negative feelings experienced by his friends as surrogates of the deeper, darker, irrational and unacknowledgeable emotion of fear triggered by the threat to what J. Baldwin had earlier called "the myth of white supremacy."

The rest of the dialogue was brief. Four of those present voiced full assent with the sobering disclosures of the evening and none dissented. Shortly thereafter the 'bull session' ran down and drew to a close. Although no one formally remarked the circumstance as we genially bade one another good night, our dilemma had evidently vanished.

The mundane scenario abstracted above exemplifies a few of the many semantic etio-pathogenic factors which, unrecognized as such, all too frequently generate dilemmas that waste the time, energies, materials and resources of individuals, institutions, subcultures and cultures, viz.:

- Deficient linguistic forms and contents of the questions raised,

- False-to-fact categories and class terms,

- Confusion of levels of abstraction related to 'allness', 'identity', 'elementalism' and similar semantic reactions,

- Differences in the meanings of 'multiordinal terms' when used on different levels of abstraction,

- The self-reflexive propensities of one's value-systems, and

- The incapacity of two-valued and over-simplified multi-valued paradigms to accommodate the data of infinite-valued continua.

The half-dozen semantically-rooted etiopathological factors listed above* happen to inhere with one of the oldest, most obdurate and as yet incompletely resolved neuropsychological dilemmas on record -- that of the relationship between handedness and the hemispheral lateralization of the human speech function. Inasmuch as that issue has from its beginning been part-and-parcel of the 'split-brain' studies with which we are now engaged it merits our critical notice.

The relationship was addressed in the early 1860's by the French surgeon Paul Broca [3a,b,c] who correlated clinical and anatomico-pathological data derived from patients with aphasia and concluded that the seat of the faculty of articulate speech is located in the posterior portion of the inferior frontal gyrus of the left hemisphere (Figure 5).

In 1864 Broca ventured the generalization that in dominantly right-handed persons the speech faculty is located at the site above designated in the left, and in dominantly left-handed persons at the corresponding site in the right hemisphere. The aphorism -- concise, informative, definitive, readily memorizable and known as Broca's Rule -- was confidently used by many diagnosticians, anthropologists, educators and other professionals well into the 20th century -- long after its empirical reliability had been vitiated.

* In all, some fifteen such semantic etiopathological factors have thus far been identified. Others will no doubt be added as experience grows.

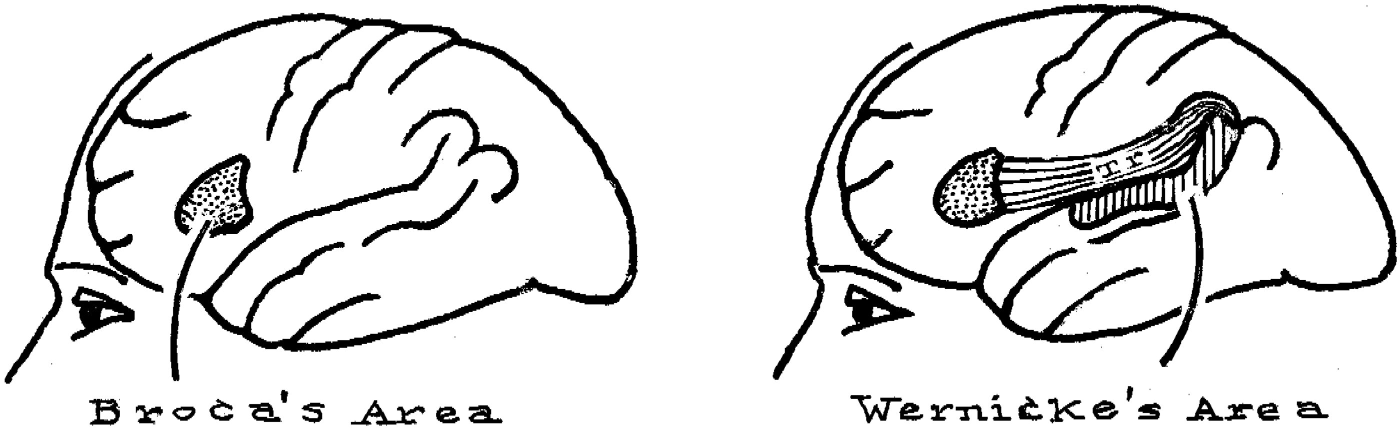

FIGURE 5. Schematic lateral views of left cerebral hemisphere. On reader's left: approximate locus of the cortex of Broca's area (stippled). On the right: approximate locus of Wernicke's area (vertical lines). Tr: transcortical/subcortical neuronal two-way connecting fibers between Broca's and Wernicke's areas.

Reports of exceptions to Broca's Rule began to appear almost as soon as autopsy data from prestigious clinics in Europe and America were collatable. Relatively early consensus revealed that among right-handed aphasics the responsible lesion (stroke, trauma, abscess, tumor, degeneratio etc.) was found in the left hemisphere in well under 100 percent of cases, and in the right hemisphere in the remainder. Obversely, among lefthanded aphasics the exceptions to the rule were yet more disconcerting in that the lesion was found in the left hemisphere in some 50 to 60 percent of cases, and in the right in the remainder.

Of no less interest was the frequency of autopsy reports indicating that the site of the responsible lesion was by no means always at, within, encroaching upon or encompassing Broca's area, but posterior to it. In fact, a second speech center, located in the temporo-parietal area some four to seven cm 'behind' Broca's area, was reported by C. Wernicke [41] of Breslau in 1874 (figure 5). The clinical characteristics of lesions in Wernicke's area were interpreted as essentially 'sensory' ('receptive') and thereby distinguishable from those of aphasias due to lesions in Broca's area, which were considered essentially 'motor' ('emissive') in type.

Also reported as capable of producing aphasia were lesions so situated as to compromise the two-way 'transcortical' neuronal connections between Wernicke's and Broca's areas.

For the above reasons the status of Broca's Rule fell from that of an 'axiomatic truth' to one of a statistical guide -- helpful in the latter context, but regrettably inapplicable to individual cases.

Broca's Rule clearly constituted what today we would call a neuropsychological formulation, comparable, e.g., to the familiar Weber-Fechner principle. That being so, a comprehension of the semantically iatropathogenic factors that occultly contributed to its degradation appear to carry a potential for illuminating at least some dilemmas of modern neuropsychology, including those discernible in 'split-brain' studies. In dredging for such factors we must make general allowance for the circumstance that Broca was, as most of us are, a product of Western Civilization which for many centuries has been steeped in Aristotle's three laws of rational thought (v.i.,p.31).

In formulating his rule Broca appears to have unwittingly employed something like the following unvoiced premises:

- As a clinical entity, 'aphasia' (Broca's 'aphèmie') is unitypical, i.e., of one type or class.

- The cerebral locus of the 'faculty of speech' is unilateral, i.e., it lies in either the left or right hemisphere, not in both.

- Human beings are dominantly either right- or lefthanded, not both.

- Concerning dominant handedness, the 'say-so' of a subject or his associates is a clinically acceptable criterion.

- The anatomical locus of a brain lesion which causes aphasia indicates the locus of the 'faculty of speech' in the healthy state.

To be sure, the above premises were nowhere spelled out as such in Broca's papers. They constitute present inferences drawn therefrom which, if inductively cogent, suggest some aspects of Broca's cultural heritage, his 'semantic profile' and the rationale leading to his ill-fated rule. That recognized, it can be readily seen that the first premise reflects Aristotle's Law of Identity -- A is A; that each of the second and third premises reflects Aristotle's Laws of (non) Contradiction, i.e., an entity cannot be both A and not-A; and Excluded Middle, i.e., an entity is either A or not-A; that the fourth premise reflects the ubiquitous propensity of humans to equate words about process-events with the events themselves; and the fifth reflects a failure of Broca to recognize that merely to demonstrate a site in the brain which when damaged results in derangement or loss of a function in no sense demonstrates 'the' locus of that function [15].

Underlying the unvoiced premises mentioned above was -- and for many investigators continues to be -- the tacit and semantically naive presupposition that the humanly-contrived classes (abstractions of abstractions) of human experiences at the 'silent (object) level' are, like the 'real', 'objective' and 'universal Forms' envisioned by Plato [38a], 'real classes existing in nature' -- allegedly separate and separable from human abstractors of phenomenal experiences.

During the last quarter of the 19th and the first of the 20th century it was realized that if the relations between dominant handedness and speech-dominant brainedness were ever to be understood, the phylogenetic and ontogenetic incidences, determinants, characteristics, modifications and criteria for defining dominant handedness would have to be intensively studied. In due course such studies were widely implemented and soon revealed that even such apparently simple 'nose-counting' researches as determining the numbers of right- and left-handers in a given population are much more complicated than they appear to be upon initial address. Thus, between 1877 and 1916 seven separate studies of the incidence of left-handedness were implemented in which seven different single-item tests for dominant handedness (dynamometric, tremographic, ergometric, tapping, tracing etc.) were employed. A comparison of results disclosed a range of from two to 20 percent.

Contemplating those disparate results in 1923, B. S. Parson [29] lamented, "The wide variety of the tests and the divergent ideas embodied in them indicate the confusion of thought that prevails on the subject ... the tests invariably fail at the very moment that some decisive pronouncement is urgently called for. ... the alleged great preponderance of dextrals over sinistrals is very much overstated ... classifications rely too much on the more or less untrustworthy statements of the persons themselves."

In a valiant effort to circumvent the difficulties of testing for dominant handedness Parson resorted to testing for native ('original') dominant eyedness -- a phenomenon considered equally 'normal' to that of dominant handedness, but much less susceptible than the latter to being 'switched' because of later-acquired dysfunctions of eye or limb and/or educational, occupational and other psychosocial pressures.

An embryologist, Parson theorized that native dominant eyedness is ontogenetically induced by contralateral speech-dominant brainedness, and that the eyedness in turn ontogenetically induces ipsilateral native dominant handedness. Those conditions entertained pro tem, he held that the laterality of eyedness reliably indicates the laterality of both handedness and the cerebral speech apparatus, except in the relatively few cases in which eye switches had been made.

To identify a person's dominant eye Parson had him/her peer through a freely movable optoscope, locate and hold in focus a previously designated object. That task accomplished, the examiner was able by opening and closing shutters inside the optoscope to decide which eye the person used to maintain a line-of-sight on a target.

In order to approach the 'native' status as closely as possible Parson optoscopically identified the dominant eyedness of 877 children aged six to 14 years and compared each such datum with the child's statement regarding his/her dominant handedness. His major findings were as follows:

- Six hundred and eight children, (slightly under 70 percent) were considered dominantly righteyed.

- Two hundred and fifty-seven (just under 30 percent) were considered dominantly lefteyed.

- Twelve (1.37 percent) were considered "impartially eyed" (the only ones considered by Parson to be 'native', i.e., 'true' ambidexters, and as such distinguishable from the much more numerous and varied 'pseudo-ambidexters' whose optoscopic tests showed them to have conventional unilateral dominant eyedness.)

- Among the 608 children whose optoscopic tests showed them to be righteyed, 604 (99 percent) called themselves righthanded and four (1 percent) lefthanded. Parson classified the latter as righteyed sinistrals. (In private interviews two of them reported defective vision in the left eye.)

- Among the 257 children whose optoscopic tests showed them to be lefteyed, only 32 (12.4 percent) called themselves lefthanded. The other 225 called themselves righthanders, ambidexters or 'mixed'. (In private interviews 21 acknowledged that they "used to be" lefthanded; 20, that they were "partly" lefthanded; four, that their right eyes were defective; and two that both eyes were "bad". Parson classified these 47 children as lefteyed dextrals.)

In short, as data relative to handedness accumulated it became increasingly evident that they could no longer be forced into the simplistic, two-valued, right-left mold inadvertently adopted by Broca and other early students.

We have seen that Parson needed four categories to subsume his data on handedness, and five on eyedness in grade school children. In so doing he moved to a multi-valued classification and foresaw that aftercoming investigators studying the relationships between handedness and eyedness in older children and adults would have to make increasing allowances for switching. (He could not have known what later investigators would establish about the plasticity of the brains of preschool children in virtue of which the native laterality of the cerebral speech apparatus itself may, when morbidly compromised, switch in considerable measure if not completely, and with or without the help of speech pathologists, to the contralateral healthy hemisphere.)

Since that period most investigators have continued to make use of various multi-valued classifications of handedness. And while some (v.i.) continue to rely upon the verbal say-so's of their subjects (or surrogates) to furnish data concerning their dominant handedness, others employ smaller or larger batteries of unimanual and bimanual tasks to decide these issues.

In 1949 J. Wada [40] introduced a valuable neuropsychological procedure to identify the laterality(-ies) of a patient's cerebral speech apparatus without need to investigate his/her dominant handedness, eyedness and past medical and psychosocial histories. The procedure temporarily obtunds the neuropsychological functions normally mediated by a given hemisphere, e.g., the left, while sparing those of the opposite hemisphere. This can be induced by running a mildly sedative drug (sodium amytal) into the main blood supply of the left hemisphere. Should the patient promptly develop the clinical manifestations of aphasia the inference would be warranted that at least a part, if not all, of his cerebral speech apparatus resides therein; conversely, should he not, the inference that no part resides there would be warranted. Whatever the result, a similar procedure is routinely carried out within a few days on the right hemisphere. In most cases no signs of aphasia ensue. However, in a relatively small but important percentage, signs of aphasia do ensue -- usually in lefthanders or ambidexters -- indicating that speech lateralization can be bilateral (v.s.).

A more recent assessment of the relations between dominant handedness and the lateralization of the cerebral speech apparatus as determined by the Wada test was reported in 1977 by T. Rasmussen and B. Milner [32]. Their findings indicated that among 140 righthanders speech was located in the left hemisphere in 96 percent and in the right hemisphere in four percent of the cases. In marked contrast thereto, among 122 lefthanders speech was located in the left hemisphere in 70 percent, in the right hemisphere alone in 15 percent, and in both hemispheres in 15 percent. Thus, among the 262 patients comprising the series seven (2.6 percent) were considered to be bona fide instances of right hemispheral laterality of speech. A like number appeared to have speech apparatus in both hemispheres.

However basic, indispensable and valuable such numerical data are to empirical scientists, they do not per se furnish scientific explanation(s) of their being. On the contrary, the data constitute a part of that which needs explanation. In that connection numerous hypotheses purporting to explain dominant handedness and related topics anteceded and followed the advent of the Wada procedure. Parson [29] had synopsized nine such in 1924 and B. Kolb and I. Whishaw [20] seven in 1985. Regrettably, the net result has been less than rewarding.

In such frustrating circumstances a search for theretofore unsuspected iatrogenic semantic impediments is clearly indicated. One such is, as previously noted, man's ingenuous (and usually unvoiced) assumption that humanly-contrived and labelled classfications are 'facts of Nature herself' and as such quite as 'objective', 'real' and 'true' as other phenomenal 'facts'. Another is the failure of many otherwise competent investigators to appreciate that not only classes of phenomenal 'facts' but the latter themselves are, ultimately and unmitigably, humanly-contrived, doctrinal abstractions, hence, error-prone.*

Both of these impediments (and many others) are discernible in the literature on handedness and related phenomena. As pithily concluded by

* Recall that until relatively recently in mankind's history whales, porpoises and dolphins -- all considered to be natural phenomenal 'facts' -- were confidently classified as fish.

Grinker and Sahs [12] "more precise definitions of handedness are required for an understanding of this problem."

Having digressed from the topic of 'split-brain' studies to survey the dilemmas of (a) my erstwhile track and field cronies and (b) contemporary colleagues engaged with problems of the lateralities of handedness and brainedness, we must now return to unfinished business. To that purpose I submit here a work-sheet compilation of the classes of 'higher level neuropsychological functions' imputed during the past 25 years, by various investigators and adventitious commentators, to the human cerebral hemispheres.

HIGHER LEVEL 'FUNCTIONS' ASSERTEDLY PROCESSED

by the

MAJOR HEMISPHERE (Left, in ca. 95 percent; right in ca. 2.5 percent)	MINOR HEMISPHERE
Language* verbal, mathematic	
Digital*	Analogic*
Analytic*	Synthetic, holistic*
Temporal* seqential	Visuo-spatial* simultaneous
Cognitive intelligent, logical, abstract, factual, discrete, scientific	Feeling-Emotive instinctive, intuitive, concrete, imaginative, metaphoric, artistic, creative
Musical rhythmic, lyric	Musical pitch, intensity, timbre, melody, harmony
Historic	Timeless
Western thought	Eastern thought
Occupations e.g., lawyer	Occupations e.g., architect

* Empirically supported; not necessarily correct.

For present purposes the classes of neuropsychological 'functions' above adequately exemplify, but do not exhaust, all items proposed to date by the many professional and lay writers interested in 'split-brain' phenomena and the far-flung inferences deduced therefrom.* The list is, as indicat4ed, a compilation and as such is not the product of any particular investigator(s). By no means do all contributors subscribe to all items spelled out, much less to all combinations thereof.

Linguists, lexicographers, GSers and others practiced in critical thinking will at once notice the vagueness, equivocation, multiordinal meanings and proclivities toward 'dichotomania' that characterize many of the referents of the terms. Consider for instance the use of 'abstract' and 'concrete'. In both lexical and everyday uses they imply mutually exclusive and antithetic qualities of the categorical 'entities' to which they refer. However, owing to the radical transformations inevitably imposed by human neurohumoural equipment upon the gravely limited inputs of energy changes in the environment which physiologists call 'stimuli', there appears to be no way for the human organism to experience, perceive, engrammize, label, store, retrieve, talk about, 'know' or 'understand' anything which is not an abstraction, i.e., an evaluative semantic reaction to a part-as-if-to-the-'whole' of a presenting situation. In view thereof the referents of the terms 'abstract' and 'concrete' are as false-to-fact as our digitalized geographic time zones are to the analogic spin of the earth and the consequent apparent movement of the sun from east to west.

* Interested readers will find an extensive survey of this and related subjects in a triad of papers published in 1985 by N. Geschwind and A. Galaburda [11].

Organismic circumstances being what they are, that which is by long linguistic habit labelled 'a concrete datum', e.g., a chair or, more specifically, a kitchen chair; and that which is by like habit labelled 'an abstraction', e.g., a piece of furniture or, more generally, something to sit on; are akin in the sense that, qualitatively, both constitute cerebral engrams,* i.e., patterned and stored abstractions of antecedent organismic experiences.

Obviously abstractions can and do differ from one another -- a circumstance reflected linguistically by our coarsely quantitative and sometimes metaphoric terms, 'more', 'less', 'degrees', 'higher/lower levels' etc. -- yet remain abstractions. The principle here involved can, of course, be extrapolated to include such loftily generalized abstractions as $E=Mc^2$, 'democracy'

* The term 'engram', meaning a functional cerebral pattern (e.g., that of a stored and retrievable arithmetic rule, a musical melody, a mother's face, a chemical formula, a high jumping technique) was introduced in 1920 by Physiological Psychologist K. S. Lashley. Its referent is a humanly-contrived, hypostasized, heuristic construct and as such an abstraction. It is envisioned as being of a material nature, i.e., electro-colloidal and neurohumoural, not mentalistic. While its anatomical unit is perforce neuronic, its functional unit is predominantly synaptic. It has the advantage over the older, vague expression, 'neurological substrate', of being more definitive. Thus, in its materialism the engram construct bears a relation to the 'higher level functions' of the cerebral hemispheres analogous to that of the reflex arc construct to the 'lower level functions' of the spinal cord and tegmental brain stem.

and 'fidelity'.

At this juncture the circumstance that much, but by no means all engram* activity is unwittingly 'projected' by its host to the latter's extraorganic environment (as when, e. g., he asserts "The grass is green", although in fact all he is qualified to assert is "The grass looks green to me") becomes pertinent. For, considered epistemologically, engrams, whether or not latently stored or now operating and 'projected', seemingly comprise all that human organisms can with confidence be said to 'know' and react to.

As far as currently available information can guide us, engrams serve both hemispheres. Put another way, our neurolinguistic repertoires to the contrary notwithstanding, it appears epistemologically that what we humans deal with from conception to grave are perforce engrams, i.e., abstractions, of our experiences. The label 'concrete' is merely a humanly contrived symbol for a 'null-class' -- a class as devoid of demonstrable members as the class of quadriplegic jockeys who rode winning horses this year at Churchill Downs. Accordingly, to deal wittingly or unwittingly with the referents of the terms 'abstract' and 'concrete' as if they symbolize qualitatively different neuropsychological 'functions' -- the former mediated by the left, and the latter by the right hemisphere -- is iatrogenically to set the stage for a pseudo-dilemma whose later identification and resolution may prove vexatiously difficult.

One of the earliest and best documented dilemmas in the area of 'split-brain' studies materialized at a blue-ribbon symposium in 1964. In his essay there Sperry [35a] reported "Everything we have seen so far indicates that the surgery has left these people with two separate minds, ... two separate spheres of consciousness. What is experienced in the right hemisphere seems to be entirely outside the awareness of the left hemisphere. This mental division has been demonstrated in regard to perception, cognition, volition, learning and memory. One of the hemispheres, the left, dominant or major hemisphere, has speech and is normally talkative and conversant. The other, the minor hemisphere, however, is mute or dumb, being able to express itself only through nonverbal reactions. ... When we deliberately induce different activities in the right and left hemispheres by means of various testing procedures ... it then becomes evident that each hemisphere is oblivious to the cognitive experience of the other."

In discussing Sperry's presentation Professor D. Mac Kay [24] dissented, saying, "What I am asking is whether this evidence justifies us in saying that there are really two minds here. Aren't we all conscious of executing minor automatisms ... when our mind is concentrating on something else? ... Why shouldn't we say rather that ... because of the [severed] corpus callosum, they [commissurotomized patients] are capable in a way we are not ... of attending to part of their hemispheric activity at a time? ... I don't think it makes sense to attribute consciousness to cerebral hemispheres."

Sperry [35b] reaffirmed his 1964 formulations a decade later and was supported therein by several other investigators including J. LeDoux et al.[10,23]. However, as of the present date the 'split-brain' dilemma which emerged at the symposium on "Brain and Conscious Experience" in 1964 has not yet been resolved. That cirucmstance comes as no surprise to those familiar with the history of philosophy and science, for it is

* See preceding footnote.

apparent from the use of the terms 'mind', 'consciousness', 'hemispheres' etc. by Sperry and Mac Kay that the dilemma is but a particular case of the more general and culture-pervading mind-and-body problem which has thwarted the efforts of Western philosophers, theologians, psychologists and physiologists to resolve it for at least 24 centuries.

As I survey the situation, the crucial and insidious etiological factor of the mind-and-body dilemma and its countless variants is predominantly iatrogenic, viz., a self-reflexive semantic consequence of well-intentioned, but thus far futile attempts on the part of past and present investigators to force their hard-won, empirically-acquired data into a verbally hypostatized mold -- the mind-and-body dichotomy cast by their forebears -- into which much of their data can not be made to fit.

A pertinent historic instance of what is here alluded to confronted European astronomers in the latter half of the 16th century. Culturally imbued as those worthies were with the doctrines that (a) the circle is the perfect geometrical figure and (b) in creating the universe, God, being Himself perfect, must surely have contrived circular orbits for the planets, they inevitably encountered serious discrepancies between the data of their own empirical observations and those expected to materialize from their inferred circular orbits. Several ingenious attempts (e.g., epicycles) were made to force the acquired factual data into the doctrinaire mold without enduring beneficial effect. The dilemma was resolved in 1601 when, armed with irrefutable trigonometric data, Johannes Kepler rejected the iatrogenic circular myth and installed an elliptical paradigm in its place. Since then his endeavor has proved invaluable to the sciences of astronomy and astrophysics.

To return now to the neuropsychological area: in 1963 I [26i] advocated abrogation by my neurological, psychological and psychiatric colleagues of the mind-and-body dualism and its clinical variants, 'psychogenic' ('functional') and 'organic' diseases. My contention was and remains that their use reflects our professional ignorance at this period in medical history far more than it differentiates the phenomena to which the terms purportedly refer.

In partial support thereof has been the demonstration during the past 50 years of remarkable improvements in diagnostic science due to technical advances in biophysics, biochemistry, molecular and nuclear biology, electrographies, pneumographies, angiographies, electron microscopy, sonographies, the computerized radiologic tomographies, magnetic resonance imagery etc. Morbid conditions, including paralysis agitans, choreoathetosis, Tourette's syndrome, psychomotor seizures, the manic-depressive psychoses, the premenstrual syndrome and others once confidently labeled 'psychogenic' for want of discernible 'lesions', are now considered 'organic'.

Clearly, the mere failure at any period of medical, neurological and psychological history to demonstrate a physico-chemical 'lesion' in no way warrants the conclusion that no lesion is present.

Rejecting out of hand the continued use of the terms 'psychogenic' and 'organic' because of their historically tainted connotations, and recognizing that the morbid states of paraplegia, aphasia, dissociative hysterical neuroses, autism, paranoia, pathological lying, transvestism etc. are manifest exemplars of intra- and/or interpersonal disorders of communication, I recommended replacing the outworn and misleading terms 'psychogenic' and 'organic' with the extensional linguistics of modern information theory and communication science, and rested my case.

Not surprisingly, my proposals have thus far had only trivial impact on the community of neuroscientists -- a circumstance by no means unfamiliar to GSers working in their own bailiwicks.

THE NEUROPSYCHOLOGICAL GENRE AS A SUBCULTURE

The disclosure in the previous section of an occultly operating iatrogenic component in the etiology of the 'split-brain' dilemma which developed at the 1964 symposium (v.s.) is but one of several identifiable at that time and since then remaining unresolved. Owing to the limits of time, your patience and my stamina, that dilemma must be allowed to exemplify the others. Suffice it to say that while citation here of the latter would doubtless reinforce, it would not further illuminate the point I have been trying to make.

In any area of professional endeavor the occurrence among qualified specialists of inordinately protracted controversy over rival interpretations of 'the pertinent facts' suggests that in advocating their respective doctrines the participants may inadvertently and self-reflexively be revealing more about themselves -- their latent presuppositions, premises, attitudinal sets, intuitions, articles of faith, value-systems and like biases -- than about the phenomena soberly presumed to be the objects of their study.

Such circumstance, wherein investigators unwittingly 'get into the fact(s)', is all too frequently instanced in our courtrooms when psychiatrists and psychologists who have independently examined a party-to-the-suit submit unmitigably antithetic diagnostic, etiologic and prognostic conclusions. What is less frequently recognized is that similar circumstances obtain in, and to some greater or lesser degree determine, the outcomes of most of our inquiries from the most trivial to the most momentous. How that cirumstance supervenes is schematized in Figure 6.

To begin with the obvious, a 'fact' to become and be accepted as a 'scientific fact' must first be observed, reported upon and verified by at least one other observer. (Hence, an island in the Pacific Ocean and a starry constellation in outer space awaiting discovery by a human being do not qualify as 'facts'.) There is no way for an observer to address and report upon an object of interest without bringing to his processes of observing and reporting many of his well established and highly organized neurohumoural cerebral engrams and the apperceptive response patterns integral thereto. He simply is not and never can be a tabula rasa.

Such dynamically interacting neural engrams are constructional derivatives (v.s. footnote) of the observer's (a) geno-phenotypical endowments; (b) multifaceted cultural and subcultural formulations -- including the linguistic legacies thereof; and (c) 'off-beat' idiosyncratic experiences that sporadically affect his organism from its conception to its surcease. Many of them constitute relatively pervasive and enduring attitudinal sets. In the aggregate they make it possible, among other things, for the observer to be an observer and evaluator.

Recognized or not by the observer, his engrams constitute potent contributing determiners of not only that which he attends and apperceptively reacts to, but that which he fails to notice or, having noticed, disregards. (T. H. Huxley aptly called the latter process "the exercise of selective ignorance.")

Whether or not the observer relies solely upon his own native sensorimotor equipment or supplements it with tools that extend his 'perceptual reach' (hand lens, spectroscope, Doppler sonographs, etc.) in no way alters the circumstance that, in the very process of observing, his organism imperceptibly (a) substitutes his own neurohumoural energy systems (including those dynamically comprising his unique engrams) in place of the energy changes emanating from the object-and-its-environmental-background;* (b) modifies at least some of his already acquired engrams and their respective response components; and (c) thereby furnishes him with what he all too often labels 'objective' and sometimes 'purely objective' facts and information. From that point of view the absolute, either-orish (as distinct from the relative, infinite-valued) dichotomy of 'objectivity' and 'subjectivity' which pervades our linguistic heritage obtains only on the verbal levels of abstraction. On the 'silent', 'object' levels thereof it is flag-

* I cite here but one of dozens of choosable examples. Upon impinging an observer's retina, photons reflected from the surface of an object and assertedly traveling at more than 186,000 miles per second stimulate retinal cells to discharge the latters' stored neurohumoural energies along their axons, propagating a nerve impulse centralward. The velocity of the fastest nerve impulse is of the order of only 90-120 meters per second, and slows down temporarily at every synaptic junction. Hence, the neural impulse is not in that dimension a simulacrum of the photonic impulses which triggered it. Analogous disparities obtain in all the other familiar dimensions of vision: intensity, extensity, protensity, etc., and in other sense modalities: auditory, tactile, thermal, vestibular, proprioceptive etc.

FIGURE 6. The broken line and arrow denote the direction of a photonic beam reflected from the surface of an object of interest toward the fovea centralis of the observer's retina. The hand lens symbolizes any 'tool' used to extend the 'reach' of the observer's native equipment for apperceptive response to stimuli. See text.

rantly false-to-fact, and as such a potential generator of dilemmas.

Thus, what many naively realistic investigators regard as a 'strictly objective fact', meaning one wholly independent of its observer and uncontaminated by his cognitions, values and tools, turns out on critical analysis to be a resultant of an interaction between (a) the energetic outputs of the environment and (b) his own antecedently established repertoire of engrams and their interrelations.

That situation alone indicates the desirability and advantage of putting single quote marks around the term fact(s). Another good reason for doing so is that yesterday's 'fact' is so often shown to be today's error. E.g., recently Smithsonian Astrophysicist M. Reid reported that our sun is only some 23,000 light-years distant from the center of the Milky Way. For two decades the operationally entertained 'fact' was that the distance is some 33,000 light-years. (Has the locus of the galactic center shifted that much in 20 years? What roles in Reid's findings were played by his own engrams and the tools he used? Are we to consider the latest figure to be the final one?)

Ever-present in the dynamic interaction between the observed 'object' and the observer is the incongruence between Observer A's 'fact' and that of Observer B. The situation is no less precarious when an observer ventures to verbally report his data and interpretations to others -- a process which entails further abstracting at several levels (whose order may vary widely from the steps listed below) wherewith to come up with a verbal 'map' whose structural relations are as isomorphic as possible to those of the 'territory':

- Determining via his own value-systems just which items among those in his study constitute 'relevant' as opposed to 'irrelevant' data.

- Selecting the 'relevant' data and putting them in what he, often arbitrarily, considers to be 'the right order'.

- Leaping from the 'silent, object-level' to the verbal or other symbolic levels which impress him as being most appropriate.

- Exploring higher and lower levels of abstraction in search of verbally expressible relationships which were not apparent to him in the data earlier encountered, and

- Revising the form and content of the report prior to its presentation.

Considering the complexity of the abstracting processes involved in observing, hypothesizing about and reporting on scientific findings (with their large potentials for error) one can understand why dilemmas abound in every area of scientific inquiry. They are intrinsic components of the evolutions and occasional revolutions of science, not 'anomalies'.

To the contrary, they are to be expected and resolved as efficiently and expeditiously as possible. There is where skills in identifying and clearly delineating their multifactorial etiologic components become critically important.

The tacit assumption that whenever A communicates with B, C ... n, each and all of them 'quite naturally' comprehend precisely what A himself comprehends and purposes to convey -- that ingenuous assumption is gravely in error, a virtual guarantor of dilemmas and paradoxes.

That naive attitudinal set must be relinquished in favor of 'gut-level' internalization of the more 'realistic' set -- that in every exercise of inter- and intrapersonal, cognitive-affective communication there are risks of misunderstanding and being misunderstood. Such risks should be actively expected and countervailed as fully as possible by: using extensional devices that have been effectively worked out in GS, group dynamics, philosophy of science etc.; candidly and critically raising the questions "What do I (you) mean and how do I (you) know?" [19] in pursuit of the pertinent postulates; and flexibly employing methodologies and technical means for resolving the particular problems that arise.

By far most of the postulates and other biases that observers inadvertently bring to their observations are the paradigmatic engrams inculcated in them by their cultures in the impressionable years of their growing-up, and in the curricula and compliances to 'Western Civilization' prescribed for qualifying as scientists, biologists, neurologists, psychologists, and most specifically, neuropsychologists.

In connection therewith in 1948 I [26a] listed and critically analyzed some 16 firmly entrenched verbal dichotomies which conspicuously pervade our current scientific jargons, disconcert our semantic reactions, and encumber our research in the neurological and psychological sciences. In later years I [26i,j] added items so that my more recent articles enumerate 28, as follows:

Reality, Unreality*
Concrete, Abstract
Fact, Theory
Objective, Subjective*
Empiric, Mystic
Conscious, Unconscious*
Intellect, Emotion*
Intellect, Intuition
Rational, Irrational
Will, Reflex-Instinct
Speech, Thought*
Heredity, Environment
Idiopathic, Symptomatic*
Right, Left Handedness
Structure, Function*
Physical, Mental
Body-Brain, Mind*
Anatomy, Physiology
Physiology, Psychology
Neurology, Psychiatry
Neurology, Psychology
Organic, Psychogenic*
Cortical, Thalamic-Limbic*
Motor, Sensory Systems
Pyramidal, Extrapyramidal*
Cerebrospinal, Autonomic
Brain Centers, Functions
Static, Dynamic

All the above are multiordinal terms. They go far in shaping the questions that can be raised in, and the kinds of answers that can be accepted by any particular culture and subculture. Implicitly and explicitly, singly or more often in combination, they are readily discernible in the hypostasizations, reifications, constructs, paradigms and other 'maps' which characterize the literature of the current century's 'schools' of psychology, psychiatry and the neurosciences.

A case in point is the term 'reality', which during the first half of that period was frequently employed as a reliable criterion for differentiating the neuroses (psychoneuroses) from the psychoses. Neurotics were said to abide by, and psychotics to escape from, reality [7, 16, 18, 21, 25] -- usually undefined; every reader was presumed to understand the term as the author did. Any definition offered proved so abstrusely vague as to be useless for critical clinical purposes. My

* I have published pertinent articles on those pairs marked by asterisks. See references [26b-f].

reaction [26c] was to abandon the dilemma-invoking question, "What is real?" in favor of the operationally-answerable, "What do we take to be 'real'?" Supported by the data of some simple experiments with infants, my reply was that we take to be real that to which we acquire relatively adaptive moto-glandular response patterns. In effect, that paradigm implies that there are de facto as many 'realities' as there are persons capable of responding.

ABSTRACTIONS HAVE CONSEQUENCES

To better comprehend the sub-subculture of modern neuropsychology in its historical perspective we shall find it helpful at this juncture to imagine ourselves in western Europe of the 19th century, witnessing the phenomenal rise, culmination and degradation of the phrenological movement. Therein is a semantic object-lesson which could and should have been learned and generalized by neurologists, psychologists and psychiatrists of the mid-1950's, but which, alas! was largely, even if not completely, missed. With few exceptions that applies today. I refer to the lack of awareness on the part of many otherwise competent clinicians and investigators that at both work and play they (a) inevitably abstract and engrammize, (b) frequently label and extraorganically project and (c) overtly or covertly react to and deal with their uniquely personal engrammic configurations as if the latter were independent 'factual entities', fully comprehensible by and replicable within all who care to take notice.

Phrenology, so named in the year 1815, was allegedly the first empirical endeavor to relate mental 'faculties' ('functions') to the anatomico-physiological topology of the brain.* Its theory, tenets and diagnostic techniques were conceived and put into practice under the name craniology during the closing years of the 18th century by a reputable Viennese physician and critical thinker who later distinguished himself internationally as a comparative neuroanatomist -- Franz J. Gall [9a,b].

Viewed retrospectively in terms of the genetic scheme depicted in Figure 6, Gall's doctrine reflected his cultural and subcultural legacies conspicuous among which were a monotheism unencumbered by formal religious dogmas; a mind-and-body dualism in the Cartesian tradition; a syllogistic logic in the Aristotelian tradition; and a faculty psychology which, while conforming in principle to that of the 18th century philosopher, Christian Wolff [42], was in its particulars Gall's own version.

Although Gall was often accused of being a materialist and an atheist by his dissentient ecclesiastic and academic contemporaries, he was decidedly not so. To the contrary, he taught that the mental faculties, traits and temperaments of individuals were innately God-given; relatively enduring, though modifiable within narrow limits by use and abuse; and always functionally prepotent over their cerebral counterparts. He regarded the latter as mere mediating instruments in the service of the mentalistic processes -- important mainly because, in virtue of the multifarious somatic manifestations to which the cerebral 'organs' alone could give rise, lay observations and scientific studies of the faculties of men and beasts had become feasible.

* Prior to the advent of phrenology a genre of physiognomists had sought empirically to 'read' mental and personality characteristics via facial and other observable bodily features.

Similarly, the visible, palpable and measurable morphologic characteristics of the skull -- Gall's clinical criteria of the magnitudes, strengths and weaknesses of the individual's various mental endowments -- were not per se regarded as functionally important, but as convenient and generally reliable reflections of their structural determinants, namely, the prenatal and early postnatal growth and differential development of the individual's brain.

Gall's early abstractions of mental phenomena consisted of 27 qualitatively different faculties, among which 19 were considered common to human and subhuman animals and eight uniquely human. However, during the ensuing eight years when Gall and Joseph Spurzheim [36] of Paris further developed and promulgated the phrenological doctrine, the number of faculties varied from 26 to 43 or more [37]. Following the demise of Gall in 1828 the listing below was the one generally favored by Spurzheim, G. Combe [4] and other leaders of the movement in Europe and the Americas.

FEELINGS:

1. Amativeness
2. Philoprogenitiveness
3. Concentrativeness
4. Adhesiveness
5. Combativeness
6. Destructiveness
7. Constructiveness
8. Acquisitiveness
9. Secretiveness

SENTIMENTS:

10. Self-esteem
11. Love of Approbation
12. Cautiousness
13. Benevolence
14. Veneration
15. Hope
16. Ideality and Wonder
17. Conscientiousness
18. Firmness

INTELLECTUAL FACULTIES:

19. Individuality and Eventuality
20. Form
21. Size
22. Weight
23. Coloring
24. Locality
25. Order
26. Time
27. Number
28. Tune
29. Language

REFLECTING FACULTIES:

30. Comparison
31. Causality
32. Wit
33. Imitation

The anatomical counterparts of these mental faculties are depicted in Figure 7 -- a purported factually true 'map' of the cranial sites of the subjacent cerebral 'organs'.

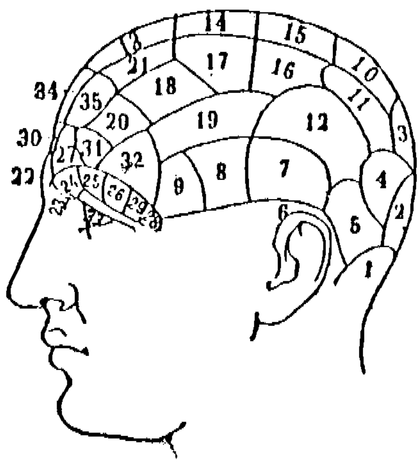

FIGURE 7. J. G. Spurzheim's diagram of the phrenological 'organs' much favored by teachers and practitioners in the early 183Ø's. (Compare with list of mental faculties in text.)

Given this 'map', the question arises as to what modus operandi was employed by its makers in relating it to its 'territory'. Gall had insisted that his doctrine was an empirical science, presumably meaning one based upon 'practical' findings derived from observation and experimentation and for the most part free of such biasing contaminants as reasoning, intuition and a priori theory. Let us see to what degree that claim was warranted.

In a number of cases the results of accidents and disease -- "experiments of Nature" -- were exploited. A case in point was that of a soldier who, consequent to a head-on bayonet thrust into his left orbit, lost his eye and developed a severe derangement of speech. Gall inferred therefrom that the normal locus of "the language faculty" must be in the retrobulbar cerebral tissue, i.e., the pole of the temporal lobe. (See site number 29.) Thenceforth, individuals possessing well-developed retro-orbital cranial structures were expected (and, mirabile dictu, found) to be uncommonly articulate, or at least potentially so; and vice versa.

In most cases, however, linkages between the magnitudes of mental faculties, cerebral organs and cranial structures were established much as narrated by Dr. J. Jastrow [17] in 19Ø2: "That part of the head which seemed well developed in a quarrelsome young man became the place of the organ of 'combativeness'; a portion which Gall believed was prominent in pickpockets was identified as 'acquisitiveness'; the head of a beggar who excused his poverty on account of his pride served to locate 'self-esteem'; a hesitating ecclesiastic and a vacillating councillor with large parietal eminences indicated these parts to be the organ of 'cautiousness'; and so on ..."

See p. 45 for matters pertinent to Galls' culturally determined legacies.

We are indebted to medical historian O. Temkin [37] for a vivid portrayal of the spread of the phrenological movement during the first half of the 19th century. Lecture tours and demonstrations by Gall and Spurzheim in Austria, the German States, France and England captivated a surprising number of distinguished persons in the learned professions, crafts and trades; newspapers and gazettes were replete with feature articles on the new science; and drawing-room conversations of the middle and upper classes were quickened by mere mention of the topic.

This is not to say that opposing views -- individual and institutional -- were inaudible. The French physiologist, Pierre Flourens [6], published a severe criticism of phrenology in 1842, but because his experimental data were drawn from pigeons and other subhuman animals its overall effect was trivial. On the other hand, the results of Broca's human studies in the early 1860's (v.s.) could not be, and were not, ignored.

The disintegration of phrenology was already in process when, a decade later, the electrical excitability of the precentral 'motor' cortex in man and subhuman mammals was demonstrated by Fritsch and Hitzig (v.s.). Thereafter phrenology became moribund and despite a gallant effort by B. Hollander [14] in 1901 to modernize and revive the doctrine, it succumbed with the advent of the Great Depression in the early 1930's.

I wish at this juncture to stress the circumstance that, as far as most interested academic and medical leaders of the end of the 19th century were concerned, the undoing of phrenology stemmed largely from its all too frequent failures in clinical practice to fulfill the diagnostic predictions of its basic formulations. In that pragmatic frame of reference they were, "largely", correct. However, with or without the discoveries of Broca, Wernicke and Fritsch and Hitzig, the clinical deficiency does not -- at least in my opinion -- account fully for the demise of phrenology. For, latent within the doctrine from its incipience (as with many others) was a potentially lethal, culturally-generated epistemological flaw: an ingenuous lack of awareness by its creators, supporters and antagonists of (a) the abstractive character of its formulations and (b) the consequences thereof. Inasmuch as that etiological proposition carries several implications for modern neuropsychology it here calls for specification.

Consider first the abstractive character of Gall's two basic formulations: 'mental faculties' and 'cerebral organs'. Reflected thereby was the already culturally prevalent mind-and-body dualism of René Descartes, the celebrated mathematician and philosopher of the first half of the 17th century who, having (mis)perceived the pineal body as the only unpaired structure of the brain* and teleologically (mis)interpreted its well-padded central location within the skull as a prudent security measure, regarded it as the anatomic "seat" of the "soul" ('psyche', 'mind'). This is one of the best examples of the ubiquitous engrammic nature of human abstracting.

In current epistemological terms, just what is it that Gall can be said to have 'known' about any one of his 30-odd 'mental faculties', e.g., 'acquisitiveness'; its material 'cerebral organ' subjacent to cranial site 8; and the conveniently neat one-to-one relationship envisioned as their common linkage? The reply thereto seems definitive: Gall's own engrams. And inasmuch as engrams appear without exception to be human-contrived abstractions, the answer logically implies that the semantic referents of Gall's terms, 'mental faculties' and 'cerebral organs', were not (as he and his colleagues tacitly supposed) phenomenal 'entities' having existences independent of (albeit discoverable by) observers and reporters, but such abstractions.

* In that era neither Descartes nor his best informed contemporaries could have known of the embryonic epiphysis and paraphysis. That somewhat mitigates and renders comprehensible his erroneous conclusion, without countervailing our point about the engrammic nature of abstraction.

As to the existence of the 'one-on-one' relation between 'faculties' and 'organs' implicit with Figure 7, that formulation may be fairly supposed to have imprinted at least some trainees and practitioners of phrenology with the attitudinal set, "For every mental faculty there is one and only one cerebral organ and vice versa." Once established, such maxims tend to endure long beyond their vitiation.

Let us now consider a few *consequences* of the lack of awareness of one's ongoing abstractive processes.

Conspicuous among them is the propensity of some investigators who, having for a number of *a priori* or *a posteriori* reasons introspectively conceived the existence of a 'faculty' or 'function', not only instigate brain searches for the anatomical locus thereof but on occasion (and in decidedly good faith) report having found it -- only later to be shown dubious or grossly mistaken. As noted above, one such 'faculty' was the 'soul'. Here are some 'functions' of more recent vintage, searches for 'the' loci of which have up to the present been lamentably unrewarding: consciousness, emotion, sleep, voluntary movement, cortical suppression, penile erection, libido, intelligence, learning, retention of information, recall and recognition.

A second consequence is the naive and unvoiced assumption that because an anatomical structure, e.g., the paired nuclei in the tegmentum of the brainstem called the 'locus caeruleus', secretes the hormone noradrenaline, that 'function' is the only one it can and does play in the bodily economy; hence, there exists no need to search for other rôles thereof.

A third consequence is the equally naive (and again unvoiced) assumption that each structure abstracted by the neuroanatomist (e.g., the head of the caudate nucleus and the putamen of the basal ganglia) must fulfill a function uniquely its own.

A fourth consequence -- that earlier (p. 31) indicated by Hughlings Jackson [15] -- is the erroneous assumption that to identify the locus of a brain site, e.g., the occipital pole, that when damaged results in a derangement of a neurological 'function', e.g., vision, is to locate the 'seat' of that 'function'.

Unrecognized and unamended, such consequences are capable of generating many of the dilemmas and paradoxes which engaged us at the outset of this essay.

Together we have come a long way this evening and the time is at hand for us to close shop until the morrow. I leave you with the thought that what I have had to say about the potentials of neurosemantics for abetting the progress of the neuropsychological discipline by helping to resolve its semantically-rooted dilemmas is, in non-Aristotelian principle, due to Alfred Korzybski.

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GLOSSARY

OF TERMS USED IN THE CONTEXT OF THE PRESENT ESSAY

Abstraction (n); **Abstractive** (adj); to **Abstract** (v) < Latin abs (away) + trahere (to pull) >. Consider Fido, a dog in a room with a bowl containing some chicken liver mixed with a few coins, buttons, and thimbles. He responds to environmental stimuli by salivating, approaching the bowl in preference to other 'things' in the room, and eating the liver rather than the other items in the bowl. Responding as determined by his value-systems, he abstracts at non-verbal, 'silent' levels (q.v.), 'pulling away' what appears 'essential' to him. and modifying his internal and external environments. (A herbivore such as a cow would evaluate the 'essential' differently.) Similarly, viruses, bacteria, oysters, weeds, peach trees and humans abstract quite as 'naturally' as they exhibit the attributes of living matter: irritability, conductivity, reaction, metabolism, growth, maturation, reproduction and decline. Most organisms appear limited to abstracting on 'silent' levels. But some animals show some capacity to abstract one, perhaps two, and dubiously three levels above 'silent' by using vocal, gestural, chemical etc. arbitrary symbols. In Korzybski's use of the term, abstracting implies two related operations: (1) the omission or disregarding of some part of the (lower-order) transitory input to the nervous system, and (2) the construction of a 'sensation','response', or 'symbol' as a more stable (higher-order) substitute for or summary of the highly complex input event. Humans surpass all others in their capacity to abstract abstractions ad infinitum through the use of symbols.

Adynamic (adj). Lacking power; weak, ineffective.

Agenesis (n). Defective or zero development of a bodily structure.

All-or-none law of neurons (n). At a given moment a neuron exhibits a 'threshold of excitability', an energy of the surround below which any changes do not serve as stimuli, i.e., do not instigate discharges of bio-chemo-electrical energies stored in the neuron. Once instigated, the energy of a nerve impulse is independent of the intensity of the stimulus which triggered the discharge. The axon conducts the nerve impulse to the neuron's fullest prevailing capacity or not at all. (It is a digitalized, "either-or" response.) (A. Adrian and K. Lucas, 1912; A. Hodgkin and A. Huxley, 1939.)

Ambidexterity (n). The possession of equal or nearly equal manual skills in each hand, some acts being performed more skillfully with one, and some with the other hand.

Aphasia (n); **Aphasic** (adj). Literally, outright loss of one's ability to communicate with language -- spoken, written, gestural, etc. In clinical practice incomplete deficiencies, dysphasias, greatly outnumber instances of (complete) aphasia. They are variously subtyped as 'expressive' verbal and/or graphic dysphasias; 'receptive' word-deafness and/or dyslexia (reading inability); dyscalculias; nominal, grammatic, semantic and mixed dysphasias.

Apperception(s) (n); **Apperceptive, Apperceptual** (adj); to **Apperceive** (v). Inasmuch as no two individuals can bring precisely the same neuropsychological equipment (including their patterned value-systems) to an experience, their response patterns will necessarily differ. Such patterns are called apperceptions, to distinguish them from the related, but 'higher order' abstractive counterparts, perceptions, wherein emphasis is placed on the components presumed to be common among many individuals of a culture.

Aristotle's Laws of Thought (n). The three axiomatic assumptions of the logic systematized by Aristotle in the fourth century B.C.: Identity -- any entity is itself, A is A; (Non)-Contradiction -- an entity cannot be both A and not-A; Excluded Middle -- an entity must be either A or not-A. For an example of their application, see p. 30.

Automatism (n). The performance of other than reflex and 'instinctive' acts without exercise of 'reason', 'intent', 'volition' or 'consciousness'. (This definition is replete with multiordinal terms.)

Awareness (n). See Consciousness.

Axon (n); **Axonal** (adj). The protoplasmic extension of the body of a neuron which transmits nerve impulses away from the neuronal body and toward another neuron or neurons or to muscular or glandular 'effector' cells.

Bimanual task (n). One performed by using both hands, like sweeping with a long-handled broom, or tying shoelaces.

Callosum (n); **Callosal** (adj). The largest commissure of the brain; the arciform mass of axons whose midline dorsal surface lies at the bottom of the longitudinal (interhemispheric) fissure. It consists of transverse neuronic fibers which connect the cerebral hemispheres. See Figure 2.

Coenesthesis (n); **Coenesthetic** (adj). Normal and morbid 'sensations', 'perceptions' and 'feelings' instigated by changes in 'visceral' structures of the organism, e.g., hunger, thirst, orgasm; urges to sneeze, cough, vomit, scratch, get warm, copulate, micturate, defecate, be active, rest and sleep; headache, angina pectoris and menstrual cramps; satiations of the above; and general well-being.

Commissures(s) (n); **Commissural** (adj). See p. 18 of the text and Figure 2.

Commissurotomy (n). Cutting (usually surgically) into or through all or part of a commissure, as in callosal commissurotomy.

Congenital (adj). A normal or pathological condition of an organism or its parts existing at and usually before birth. Etiopathologically, such conditions may be overridingly genic (genetic, genotypic, 'inherited'), as in mongolism (Down's Syndrome); or phenotypically acquired during intrauterine development, as in toxically-induced deformities of the limbs (phocomelia).

Consciousness (n); **Conscious** (adj,n). These multiordinal terms and their synonyms (awareness, subjectivity, introspectiveness etc.) have largely eluded satisfactory lexical definition. In 1852 William Hamilton opined that because the conscious state lies at the root of all knowledge it is itself indefinable. Korzybski, recognizing that all linguistic systems (including mathematics, logic and the empirical sciences) depend on undefined terms, indicated in 1933 that at any date they can allude to, but can not elucidate, vast numbers of 'silent' (unspeakable), submicroscopic, microscopic and macroscopic happenings. (See Silent Levels.) For the present, then, 'consciousness' remains an intraorganismal multiordinal term, denoting a relationship without content. Korzybski proposed [22, Chap. XXVI] supplying the content "of abstracting" to make it a more nearly complete symbol.

Corpus Callosum (n). See Callosum.

Cortex, cortices (n); **Cortical** (adj). The outermost parenchymatous (q.v.) mantle of the cerebral hemispheres. It is described as ashen gray in color and, in postpubertal humans, approximately one fourth of an inch thick. It is largely composed of layers of neuronic cell bodies, dendrites, axons and synapses.

Craniology (n). The empirical study of the skull.

Dendrite(s) (n); **Dendritic** (adj). Multibranched, tree-like branches of a neuronic cell body which conduct neural impulses toward the cell body.

Dextral (adj). Predominately righthanded.

Electroencephalography (n). The recording of the electric currents of the brain by means of 'pick-up' electrodes (sensors) applied to the scalp or mucous membranes of the nasopharynx, or the surface or inside of the brain and its neurons.

Empirical data (n). In epistemology, information and knowledge acquired via prior experience with 'actual facts', as distinct from those acquired 'normatively', i.e. via ethical, aesthetic, political and similar value-systems which prescribe allegedly ideal conditions and rules for behavior.

Engram (n); **Engrammic, engrammatic** (adj). See footnote, p. 35.

Entropy (n). See Law of Entropy.

Epilepsy, Grand Mal type (n). The patterned manifestation of an underlying multifactorial neurological 'instability' of one or more gray matter sites in the cerebral hemispheres, where episodes of inordinate excitation (electro-colloidal depolarization) of neurons develop sporadically. The excitation spreads rapidly to neighboring neurons and provokes a tonic phase of generalized rigidity of somatic muscles (including those which mediate respiration) and coma; a clonic phase of resumed respiration and vigorous jerky movements of head, face, trunk and limbs; and a post-convulsive phase of flaccid relaxation, deep sleep, stupor, confusion and recovery. Amnesia for the episode is permanent.

Epileptogenic focus, foci (n); also **Epileptogenic 'firing point'.** A voluminal anatomical site of the brain with a bioelectric instability whence recurrent convulsive phenomena are sporadically instigated. Such sites usually exhibit hyperexcitability to electrical and chemical stimulation.

Epistemology (n); **Epistemologic(al)** (adj). That branch of philosophy which addresses questions concerning how we know what we assert we know.

Etiology (n). The science or doctrine of causes, especially the investigation of the causes of a disease. (The latter also **etiopathology.**)

Extensional orientation (n). The habit of a nervous system such that, when it confronts difficulties in understanding, it seeks to resolve them by considering specific examples, denotations of terms, beginning from lower orders of abstraction, etc. (Cf. with Intensional orientation.)

Extensity (n). That dimensional characteristic of sensori-perceptive experience related to the spatial distribution of e.g., a small coin versus the side of a barn. (Cf. with Intensity and Protensity.)

Faculty (n). Any normal biological power or capability: e.g., hearing, running, remembering, intuiting, reasoning, sympathizing and enjoying. Often used synonymously with the term 'function'.

Function (n); **Functional** (adj). The special normal capability and activity of any and all tissues, organs or systems of the organism. Often used synonymously with 'faculty'.

Genetic (adj). Of or pertaining to genes as indispensable, yet not the sole determinants of the phenotypic(al) characteristics and traits exhibited by and/or discernible in an organism.

Genotype (n); **Genotypic(al)** (adj). The rudimentary hereditary assortment of genic 'templates' which, together with the conditions of the extra- and intra-organismal environments of the developing organism, determine the phenotype whereby its characteristics become manifest. See Phenotype.

Genu (n). A knee-like 'bend' in an anatomical structure.

Gyrus (n). A tortuous grossly anatomical elevation (convolution) of the surface of the brain due to enfolding of the embryonically growing cerebral and cerebellar cortices within the spatial compartments of the skull and its inner membranes. Neighboring gyri are separated by fissures (sulci) of varying depths.

Iatrogenic (adj). Denoting a medical disorder or problem imputable to the treatment intended to alleviate a previous disorder. (No longer limited to physicians.)

Ictus (n); **Ictal** (adj). A convulsion ('fit', 'seizure', 'attack', 'spell').

Information Theory of Shannon and Weaver, 1949 (n). Probabilistic relation, in a given communicative exercise, between what is said and what might have been said. E.g., in predicting the outcome of the head-tail toss of a coin, the ratio of the probability of an incorrect call to a correct one is as 1:1; of a throw of a die, as 5:1; and of drawing a card from a conventional deck, as 51:1. As defined, less information inheres with the coin situation than with that of the die or the card.

Integration (n). Unification. The correlation of sensory inputs and coordination of motor and glandular outputs such that they constitute a pattern serving a common end, e.g. hammering a nail.

Intensional orientation (n). The habit of a nervous system such that, when it confronts difficulties in understanding, it seeks to resolve them by considering generalizations, the connotations of terms, beginning from higher order abstractions, etc. (Cf. with Extensional orientation.)

Intensity (n). That dimensional characteristic of sensori-perceptive experience related to the relative strength, power, energy, tension and activity evoked by a stimulus (e.g. brightness, loudness, heaviness and painfulness). (Cf. with Extensity and Protensity.)

Knowledge, Knowing (n); to **Know** (v). Possession by an organism of a fund of intraorganismally stored and retrievable paradigms of information (including their corresponding moto-glandular responses) pertaining to foci of the organism's concern. The criterion of the degree of scientific (as distinct from logical) 'truth' inhering with a particular paradigm ultimately consists in assessing the degree of correspondence between the implicit and/or explicit predictive content of the paradigm and its empirical 'materialization'.

Law of Entropy (The Second Law of Thermodynamics) (n). Stated in its most generalized form, order in all irreversible mechanical systems tends to decay, changing to a less organized state with less energy available for doing work. The measure of the decay or disorder is called entropy. The Law states that this measure tends to increase in any spontaneous process in an isolated system; the total amount of energy stays the same, but less of it is available for work, more of it becoming the disordered form 'heat'. (The antithetic quantity, the measure of increasing order--such as that which, in the give-and-take of anabolistic and catabolistic processes, predominates, at least pro tem, in living organisms -- is called negentropy.)

Linguistics (n); formerly Philology. The science of languages; the comparative study of speech sounds, language structures (including grammar), the historical etymology of languages, their speech forms and meanings.

Modus operandi (n). Method of working or proceeding to work. Hence, by implication, the design of a research project.

Morphology (n); **Morphologic(al)** (adj). The science of the macro-, micro- and submicroscopic forms and structures of organisms.

Multiordinality; Multiordinal term (n). As identified by Korzybski ([22] pp.14, 433) the main characteristic of many of the most important terms in our vocabularies (e.g. 'yes', 'no', 'true', 'false', 'fact', 'reality', 'cause', 'effect', 'proposition', 'number', 'relation', 'order', 'structure', 'abstraction', 'love', 'hate', 'doubt', etc.) "consists in the fact that on different levels or orders of abstraction they may have different meanings. As a result they have no general meaning; their meanings are determined solely by the given context ...." (See the discussion of 'Blacks' on pp. 26-28 of the present essay.)

Neurolinguistics (n). The neurological aspects of the science of linguistics. (The term was introduced by Korzybski during the period 1925-30.)

Neuron (n); **Neuronal** (adj). The embryonic, anatomic, trophic and parenchymatous functional unit of the nervous system. It comprises a cell body; dendritic branches, a set of tree-like extensions of the cell body which, when stimulated, instigate the release of electrochemical energies stored in the neuron, which then conduct the nerve impulse toward the cell body; and an axon, a long extension with collateral branches, which conducts the nerve impulse away from the cell body to synaptic contacts with the dendritic branches of other neurons or muscular or glandular cells.

Neuropsychology (n). The neurological aspects of the science of psychology. (The term was introduced by D. Hebb in the late 1940's. Until then such aspects were subsumed by the more general terms, physiological psychology and psycho-physiology.)

Neurosemantics (n). The neurological aspects of the science of semantics; or, a study relating behavior, 'thinking', 'emotion' to neural functioning: 'general semantics'. (The term was introduced by Korzybski during the period 1925-30.)

Nociceptive (adj). Of or pertaining to neurohumoral receptors excitable by nocuous agents that evoke in an organism overt or covert aversive responses and (per inference on the part of the observer) painful or other unpleasant sensori-perceptual experiences.

Occipital (adj). Belonging to the occiput or back part of the head.

Ontogenesis, Ontogeny (n); **Ontogenetic** (adj). The historical development of the individual organism as distinguished from that of a category of organisms (Phylogeny) such as fauna, vertebrates, mammals, primates, humans, etc.

Paradigm (n); **Paradigmatic** (adj). A pattern, configuration, map, design or model. As used particularly (sometimes) by Thomas Kuhn in The Structure of Scientific Revolutions, a complex structure of: theories, the observations compatible with them, and the culture in which they are imbedded.

Parenchymatous (adj). Belonging to the 'essential' and 'proper' tissue of an organ; thus, when the cortex is described as the outermost parenchymatous mantle of the cerebrum, anything further out is not soft functioning brain tissue, but rather tougher protective material.

Parietal (adj). The right and left parietal lobes of the brain lie approximately beneath their similarly named skull bones. The latter "bony plates" lie between the frontal and occipital, and superior to the temporal, "bony plates" of the skull.

Phenotype (n); **Phenotypic(al)** (adj). The normal and abnormal manifestations of the dynamic interactions between (1) the genotypic hereditary potentials for the development of an organism and its parts, and (2) the organism's extra- and intra-organic environments. No gene can live to exert its influences without an environment. Thus, given 'normal' genotypes for the emergence of a trait, e.g. normal two-eyedness, an indispensable prerequisite is a 'normal' intrauterine (extraorganic) environment. Correspondingly, an 'abnormal' phenotypic manifestation, e.g. a single cyclopean eye, requires an 'abnormal' uterine environment, such as a toxin which enters the embryo's circulatory system during a critical period of embryonic development. (See Genotype.)

Photon (n); **Photonic** (adj). A quantum particle of the continuum of electromagnetic radiation, ranging from radio waves to gamma rays. A narrow band of these wavelengths between $4 \cdot 10^{-7}$ and $7 \cdot 10^{-7}$ meters can stimulate 'light receptors' in organisms therewith equipped.

Phrenology (n); **Phrenologic(al)** (adj). The quasi-empirical theory and practice of reading the psycho-social characteristics of a person from the idiosyncratic structural features of his/her cranium.

Play upon (v). To electro-colloidally transmit neural impulses from one neuron or set of neurons to another via synapses, or to muscular or glandular cells via end-plates of their synaptic simulacra.

Postulate (n). A verbalized or unverbalized assumption, axiom, belief, hypothesis, theory, precondition, premise, supposition or principle; (v) to formulate these.

Premise (n). A proposition, statement or assertion, or (pl.) sets thereof, whence an inference or conclusion is or may be drawn.

Proprioception, Proprioceptor (n); **Proprioceptive** (adj). Inputs of information to the central nervous system from special receptors (proprioceptors) stimulatable by contractions and relaxations of muscles, degrees of tensions of tendons and ligaments, and the glidings of synovial joint surfaces across one another. Among the functions in part mediated thereby are the maintenance of muscular tonicity, bodily equilibrium, and the execution of skilled acts.

Protensity (n). That dimensional characteristic of sensori-perceptive experience related to duration, e.g. a second, minute, hour. (Cf. with extensity and intensity.)

Q.v. (phr). Abbreviation of Latin quod vide (= which see).

Retinal cells (n). The aggregate of the photo-sensitive neuronic cells called 'rods' and 'cones', and their sets of accessory cells distributed in microscopically discernible layers over the inner posterior portions of the eyeballs. The rods appear to mediate experiences of achromatic, and the cones of chromatic, vision. Together, they comprise the ninth and next-to-deepest layer of the retina.

Rostrum (n). A beak-shaped anatomical structure.

Self-reflexiveness (n); **self-reflexive** (adj). (From Korzybski's paper, A Non-Aristotelian System and its Necessity for Rigour in Mathematics and Physics, [22, Supp. III, p.748]) "An ideal map would contain the map of the map, the map of the map of the map ., endlessly. This characteristic was first discovered by Royce. We may call it **self-reflexiveness. ...**

"Language also has self-reflexive characteristics. We use language to speak about language, which fact introduces serious verbal and semantic difficulties, solved by the theory of multiordinality. [q.v.] ...

"... it follows that statements about statements represent results of new neurological processes, that their content varies, and that we must discriminate and not identify these different meanings."

To which we can add that any human observing his or her own abstractions necessarily involves a bevy of culturally and idiosyncratically acquired cognitive-emotive-evaluative previous abstractions, which make it impossible to remain 'strictly objective' and 'factual'; one inadvertently 'gets into the act' and so into the 'fact'. Therefore it is not surprising that any five observers, exposed to a given scenario, can come up with five honest, significantly disparate reports. (Cf. Abstracting.)

Semantics (conventional) (n). The scientific study of signs and symbols, including words as denotative units of communication, their interrelationships and meanings, the evolutionary developments thereof and their impacts on social groups. Also in Logic, the study of the relationships "between the expressions of a language and the objects and states of affairs referred to by these expressions." (A. Tarski) (Cf. with Neuro-semantics (= General Semantics).)

'Silent' ('Unspeakable') orders or levels of abstraction (n). Every living organism is immersed in extra- and intra-organic environments, of ever-changing process-events. Because of the 'intrusion' of its own sensori-perceptual equipment, the organism cannot react directly to these events, but only to its own intraorganismic abstractions of them. Moreover, its reactions can never be to the 'whole' of the events of its environment, but at most to a part or parts thereof, clearly an example of abstracting. In Korzybski's depiction of "the natural order of abstraction" the lowest order -- the 'event-level' -- encompasses all the envisaged process-events of any parts of the environment; the next-lowest -- the 'object-level' -- encompasses all the envisaged impacts of the process-events of the environments upon those of the organism. Events and their impacts occur without regard to whether or not verbal or other arbitrary symbols are appended to them. Korzybski called them 'Silent' ('Unspeakable') levels of abstraction, distinguishing them from levels which entail the use of visible, audible, etc. symbols.

Simulacrum (n). Something having merely the form or appearance of some other thing. (Pl.) **Simulacra.**

Sinistral (adj). Predominately left-handed.

Splenium (n). A feature resembling the shape of the spleen: the posterior protruberance of the corpus callosum as seen, e.g. on a midline longitudinal slice through the primate brain. (See Figure 2a and b.)

'Split-brain' (n, adj). See text pp. 21 and footnote, and Figures 2a,b,c,d.

Sulcus (n). An anatomically visible and palpable crease, groove or furrow on the surface of the brain, e.g. on the cortical surface of the cerebral hemispheres, where neighboring gyri are demarcated by such furrows.

Surgical interruption (n). Severance (by sharp or blunt instrument, electro-cautery, ultrasound, cryo- (cold) cautery or laser beam) of a neural pathway, e.g. the corpus callosum, anterior commissure etc.

Synapse (n); **Synaptic** (adj). The region of protoplasmic contiguity (as distinct from continuity) between the endbrush of the axon of one neuron and the dendritic branches or cell body of a second neuron. At such juncture an orderly sequence of bio-electro-chemical excitatory, inhibitory and rest-restoring events, monitored by cholinergic and adrenergic enzymes, effects the transition of a neural impulse from one neuron to another.

Tegmentum (n); **Tegmental** (adj). The grayish dorsal 'plate' of the brain stem which contains, among other neural structures, the primitive somatic and visceral sensory and motor nuclei of the paired cranial nerves II through XII; certain paired integrative nuclei (ruber, nigra, subthalamic etc.); and the anterior ('alerting') and posterior ('suppressing') components of the reticular formation.

Teratology; Teratologist (n). That subspecialty of the sciences of genetics, embryology and pathology which deals with the descriptive, etiologic, demographic and preventive aspects of prenatal malformations; one who practices it.

U-fibers (n). Relatively short neurons whose dendrites and cell bodies reside in the cortical gray matter of a given gyrus and whose axons take U-shaped courses through the white matter subjacent to the cortex at the bottom of the sulcus to make synaptic connections with the dendrites and cell bodies of neurons in the cortices of adjacent and neighboring gyri.

Unilateral (adj). One-sided.

Unimanual task (n). One ordinarily performable by using one hand, e.g. throwing a ball.

'Unspeakable' levels of abstraction (n). See 'Silent' Levels.

V.i. (phr). Abbreviation of Latin vide infra (= see below).

Visual cortex (cortices) (n). (Also called the **calcarine cortex** and the **area striata.**) Those portions of the cerebral cortices of the occipital lobes of the brain which receive the axons of neurons that constitute the fifth 'leg' of a neuronal relay of which the first 'leg' is the layer of retinal rods and cones in the retina. (See Retinal Cells.) The relay does not terminate in the visual cortices. However, their complete destruction in humans results in permanent blindness.

Visual Field (n). That portion of an individual's surroundings which can be seen when the eyes are focused on a 'target'. Given such circumstance, the right visual field subsumes that 'half' of the total visual field which stimulates the left halves of the retinae of both eyes. (The left visual field is a mirror-image counterpart of the right visual field.) The right and left 'halves' of the retinae are demarcated by vertical planes generated by the imaginary lines which connect the macula lutea (retinal site of greatest visual acuity in each eye) with the target.

Viz. (adv). Medieval Latin abbreviation for Videlicet (= namely).

V.s. (phr). Abbreviation of Latin vide supra (= see above).

ERRATA

As we reviewed Dr. Meyers' first (1958) Alfred Korzybski Memorial Lecture, GSB # 22/23, pp. 3-12, we were delighted to find an error. True, it is a most trivial error, but at least it demonstrates that the great man can be, like all the rest of us, humanly fallible. Also it permits us to pursue our futile hope of rooting out 'all' errors from the Bulletin, even those that have persisted unnoticed a quarter of a century.

(GSB #22/23, p.11) It now became possible to note that the blood of certain mentally deficient children contained the 12-carbon sugar, galactose, a substance not found in normal subjects. This