Reading, Writing: Radix

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In this exploratory essay the authors treat of three hypotheses of the radical intersection ("radix") of composing and reading. The emerging context is seen as controlling element in themes of composing and interpreting. Is the interrelation of author, reader, subject/topic and situational context the connecting point worthy of further study? The second hypothesis is that the more specific, concrete act of discovering questions may be the radix; a model used to teach writers how to discover topics (invention) and readers what avenues of questions may be helpful in reading and understanding a literary work is presented. The third is the "physical" hypothesis -- that the radix of composing and interpreting is actually neurophysiological -- based in recent knowledge of the hypothalamic switching center, parallel nerve circuits and cortical distribution of memory.

I

There exists a reciprocal control of part and whole in the act of reading and the act of writing. In the hermeneutic circle the reader either brings to or creates even from the first word, first sentence, a texture for the text ("context," *with* the *text*). This context allows better comprehension of the elements of the text and is in turn adjusted by the reader as each element of the text is processed. In writing, the same pattern can be seen -- the writer increasingly controlled by the already presented elements in the text (that, the context).

I. A. Richards wrote, "In almost all learning, the control of part by whole and of whole by part is, or should be, reciprocal."[1] Drawing on Peirce,[2] Richards goes on to present a discussion of "type" and "token," the crux of which can be stated: As token reinforces or modifies the understanding of type, mediation is lessened. Continuous consideration of tokens within types leads eventually to immediate cognition/recognition. These processes parallel the reader's processes in reading (assuming a fluent reader). Essentially, this is the lowest identifiable level of the hermeneutic circle.[3]

As readers and writers become more familiar with the language, they generate an hierarchically controlled set of rules or axioms, which develop

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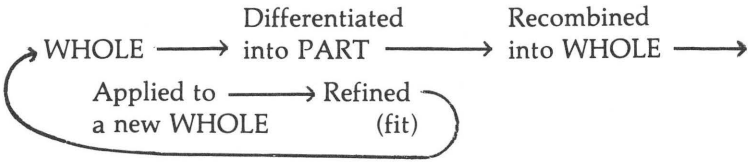
in remarkably parallel ways across cultures. We know that people in learning language move (at different rates in idiosyncratic patterns which are generally describable through series of generalizing stages. For example, consider the past morphene {-ed}. A normal child hears and begins to imitate {-ed}. The child soon uses {-ed}, but she (typically) overgeneralizes, deriving, e.g., "see+ed" and "go+ed," at which time (utilizing feedback in the communication system) she begins to form a scheme for differentiating the forms in the expanded generalization.[4]The correction to fit (differentiation) occurs as the child forms another quasi-axiomatic set, a second-order generalization as it were. The acquisition and use of other morphemes (e.g., plural {-es}) follow the same steps.

Schema expand; occasionally a new schema is formed. Several axiomatic "systems" begin to be related. As a generative principle for their relationship is discovered, a controlling system evolves--in this case a third-order generalization. The symbol using animal quickly (after processing and, maybe, producing thousands of symbolic messages) begins to comprehend the axiomatic system's inability to predict only and wholly the needed patterns. Hence, Gödel's remarkable proof in mathematical logic is paralleded in language.[5]

For example, let us consider a third or fourth-order generalization; we shall use "situational context." At a certain point in the increasingly complex communication system, the instability of the environment is noticed. This unstable environment contains far too much unpredictable flux. While a consideration of situational context allows the language user to decide about factors at the third-order level, situational context is posited and describable only by a higher-order generalization, which is necessarily a non-linear formula-apparatus.

Psycholinguists posit five steps in the acquisition of language, and it seems that these steps are also basic steps in the development of language.[6] The five steps are: imitation, repetition, control of stimuli, expansion, and correction. In terms of part and whole our five step process involves a movement which may be charted thus:



We are now getting very close to reading theory. We have arrived at that point of reciprocity posited by Heidegger and amplified upon by Gadamer, as noted earlier.

II

> An infinity of ever new phenomena belonging to a new dimension... come to light only through consistent penetration into meaning--and validity--implications of what was taken for granted--an infinity, because continued penetration shows that every phenomenon attained through this unfolding of meaning...itself contains meaning--and validity--implications whose exposition leads again to new phenomena, and so on. —Husserl, *Krisis* (trans. Cairns)

Thus, we shall look at several well-established models of reading (while other models may have been chosen, we opted for truly well known theories/models since they have been subjected to close scrutiny and have survived): 1) an information processing model, 2) an hypothesis testing model, and 3) a developmental model. The first is quite similar to the basic machine communication model--say that of Claude Shannon and Warren Weaver--with some elaboration. The hypothesis testing model is familiar through the writings of and about Kenneth Goodman. The purely developmental model is the only causal-comparatively based model we shall entertain.

Information processing model. Those who have based work upon the models of, say, Lasswell or Berlo, Jakobson or Watzlawick would find Gough's "One Second of Reading" model straightforward.[7] Gough's model is designed to relate the operations he assumes must go on within *one second* of reading, as the text "Suppose the eye..." is first noticed, until the vocal system produces the sounds "Suppose the eye." We shall briefly comment on five points in Gough's model.

There is a provision for recognition of basic graphic patterns--a subsystem which works in *tandem* with the scanning system; Gough uses two-way arrows to indicate that the pattern recognition subsystem interacts with the scanning system. Gough believes that an abstract phonemic tape relates the output of the decoder to the "librarian" which in turn works with the lexicon. [Gough cites Chomsky and Halle's *Sound Pattern of English;*[8] in that work, however, they write: "We feel, however, that the existence of such a level has not been demonstrated and that there are strong reasons to doubt its existence."] Gough also postulates a two-way relationship between code book and decoder; similar phenomena are present, according to Gough, between the lexicon and the searcher ("librarian") and between a) the syntactic and semantic rules storage and b) the magical sorting unit (he calls "Merlin").

These components of Gough's model involve the introduction of the reader's experience. That is, the reader's experiences and knowledge about patterns--especially in this model graphemic patterns and abstract

phonemic patterns, lexicon, and rules of syntactic and semantic relationships--exist before reading the text. And obviously these experiences and knowledges are augmented by each successive act of reading, hence learning is continuous.

An information processing model is a *serial* model (each grapheme or set of graphemes studied left to right, top of page to bottom) in which (it is assumed) the reader moves from print to meaning either through a speech loop, through a direct print-meaning jump (See, respectively, Conrad [1972] for the former and Kolers [1970] for the latter), or through a systematic phoneme loop. Gough has decided[9] in favour of the third. Gough's model is designed to produce oral reading, but stopping at "TP-WSGWTAU" is possible--since that mouthful of letters stands for "The Place Where Sentences Go When They Are Understood."

Hypothesis testing model. Goodman's model is an hypothesis testing model.[10]According to Goodman, reading, a "psycholinguistic guessing game," is a process of selective, anticipatory cueing, in which the reader predicts and then reads to confirm the prediction. For those of us who work with relatively fluent readers, at relatively higher levels, this is certainly meaningful. (The reader who cannot anticipate the difference among Joyce's *Ulysses*, Agee's "Carter," and Milton's *Paradise Lost* will certainly have difficulty in reading.)

Goodman believes that three entities exist before (in his drawings of the model, Goodman puts these at the top) the reading: the material to be read, prior predictions (often based, e.g., in knowledges of genre) and the repertoire of language experiences--labelled "long term memory" and placed into the oscilloscopic waveform.

Goodman places medium term memory into the model in four places: a) at prior predicitons, b) at context, actually the *emerging* context c) at prediction and d) at store partial meaning. These are the four crucial points. The model can provide for the emerging context, the partial meaning, and prediction--original and continuous aspect. Meaning, both the principal and ultimate context, is a "long term memory" function; it occurs thrice.

One final comment upon the Goodman and Gough models: the Gough model has fewer components and is more compact but involves more abstract and reified notions. The Goodman model is more involved and apparently more complex, but less mystical.

Developmental models. Developmental models usually are derived by the researcher's looking at the process from the product side of the black box to *produce* that product. No silly *arcana disciplina*, that; but developmental models cannot be used to explain the *process*, which is the goal of the Gough and the Goodman models.

Holmes and Singer[11] can predict 74.6% of the variance in power of reading (a construct) from knowledge of reader's performance in various specific cells, which are interrelated in cell assemblies, in a three-tiered set of sub-systems (hence, the model is called a "substrata" model). That is, given a student score on a "mechanical aptitude" measure, Holmes and Singer could infer 2.99% of the variance of "power of reading." [From inferences of variance, it is statistically straightforward to adduce regression formulae and to predict.]

In level three (the lowest stratum) the largest substrata factors and the percentage of variance which can be inferred from each are phonetic association (5.42), homonymic meaning (5.54) and mechanical aptitude (2.99); in level two range of information and reasoning contribute (21.44%); in level one (the highest stratum) four factors *each* contribute more than 5.00 (vocabulary in isolation, 5.05; vocabulary in context, 5.80; auding, 6.62; and verbal analogy, 6.54).

In a grades 3, 4, 5, and 6 comparison Singer[12] can account for more and more of the variance in power of reading each year. Singer has discovered that this progression continues into the college years, resulting in an ability to apportion 78% of the variance in power of reading at the college level, and *one-half* of that is our language in context variable again! Finally, Singer stresses the importance of "attitudinal factors, verbal flexibility, and mobilizers."

We close this section by proposing a metaphor, which closely represents hermeneutical conceptualizations of reading. We believe that the meaning-making of the act of writing can be visually discovered by making the generator a motor: need to communicate becomes the power and text is produced as output (Figure 1). The metaphor is based on the conceptual relationship between an electric motor and a generator: a motor turns electrical power into force (an electromagnetic field spins the shaft which in turn drives the gears or axle to which the motor is attached) and a generator turns mechanical force into electric power (the shaft rotates the plates within the magnet creating electricity). In our model the power is the text, the force is meaning, and the reader (motor) and the writer (generator) produce, respectively, the meaning and the text.

One interpretive point provides the worthy idea to be got from seeing reading and writing as radically similar: in the Heideggerian concept of *Dasein* is implied, via the thrown-ness of being, *being-with*. In the first place, then, there are *two* hermeneutic progressions: part and whole within text *and* reader with text. That is to say, there are two particular relationships which are 1) text as particle and reader as particle and 2) part as particle and text as whole. Just as the hermeneutic builds intratextually, so

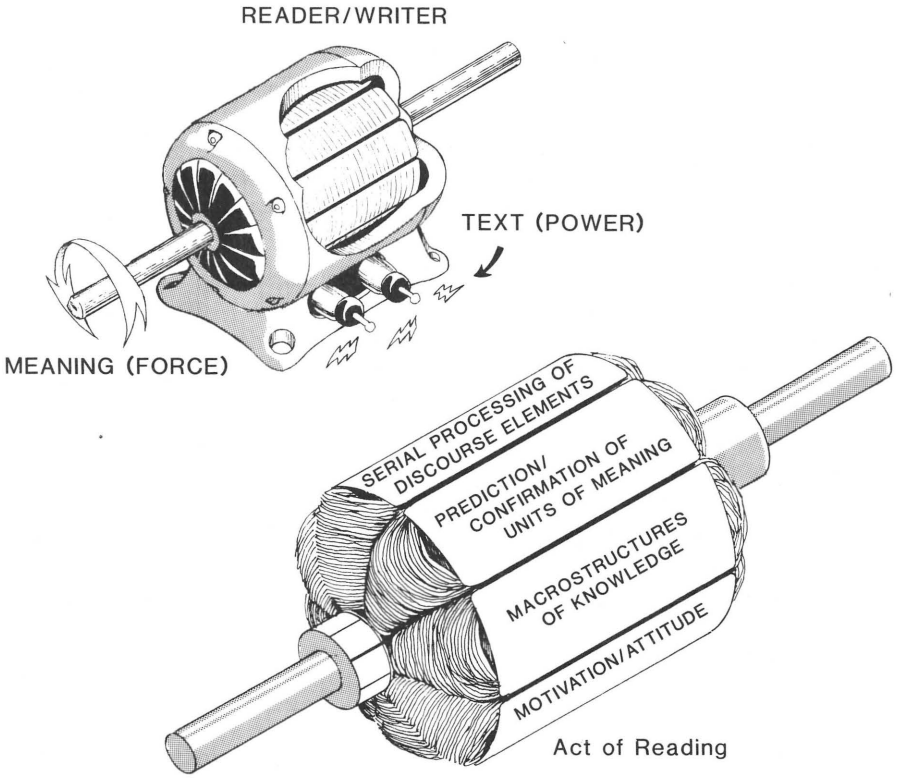


Figure 1. (Figures 1 and 2 were drawn by Karl Dolgener of the Learning Resources Center at the University of Texas)

does hermeneutic reciprocality build between the reader and the text; and this construction usually progresses into new stages of understanding by moving through some (arithmetic) first stages and later (geometric) middle stages of context establishment. Linear to *Gestalt* to global *Gestalten:* critical double play.

A writer beings with an idea and starts the crafting of the text; soon the already crafted portions of the text demand certain craftings-to-be. At this point the text has become a dynamic force, synthesizing and synthesized out of the interaction of the intent of the writer and the crafting of the text. The text becomes something apart from either the author's intent or the crafting of it. (See Burke's *Counter-Statement,* especially "Poetic Process,"[13] for a more complete discussion of this idea.) If reader as well as text can each be particle, then each could (as change occurs) be wave. Reader, text (both part and whole,) and context become--by extension--field.[14]

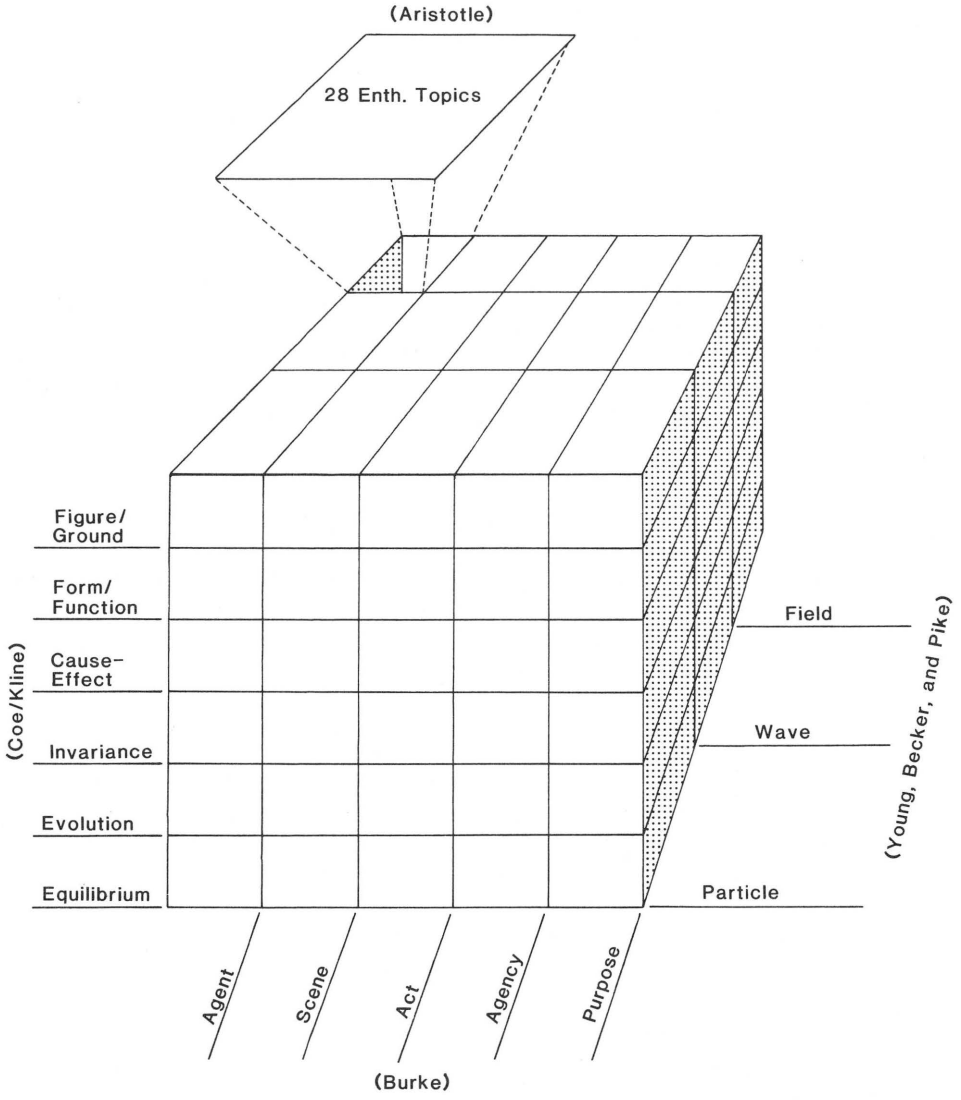


Figure 2.

Integrative, configurational heuristic. Could we generate now a configurational heuristic which allows the *linear* to *Gestalt* movement? We think so--and it might begin to look like Figure 2. Note that we have portrayed Burke's pentad,[15] the Coe-Kline isomorphs,[16] and the tagmemic particle-wave-field division. The result is a 90 cell matrix; simply place into *each* cell the Aristotelian 28 enthymemes [17] and we can derive a 90 x 28

matrix; that is, 2520 possibilities at the basic non-branching level. We have found this multidimensional heuristic array to be useful in asking questions before or about reading, in generating *in vacuo* topics for writing, and in generating writing topics of response to just-read literature. Polyvalent heuristics may be the radix.

All this is to set up a simple sentence: *the essential* (text, context, emerging sense), *the elemental* (five steps and the part-whole interaciton), and *the substantial* (heuristic and hermeneutic) elements of reading and writing, of interpreting and composing, are shown to be radically similar.

Our hermeneutic model can be seen as:

Ergodically viable. Its elements and postulated interrelationships function similarly at quite different levels of interpretations. In this sense, it is non-reductive; the model does not remove the text from the context, nor does it define a separate context for the work.

Isomorphically consistent. Our interrelated heuristic model shows how the Burke pentad/heuristic, the Aristotelian heuristic, and the tagmemic heuristics co(r)-relate and how those systems work in a (dynamic) interplay with isomorphic patterns as discourse organizing and interpretive principles. In short the model has "horizontal erogody."

Categorically non-modal. It is equally applicable to composing or interpreting. It becomes the radix of reading and writing.

III

> Let us first posit the image of a triumphant plural, unimpoverished by any constraint of representation (of imitation). In this ideal text, the networks are many and interact, without any one of them being able to surpass the rest; this text is a galaxy of signifiers, not a structure of signifieds; it has no beginning; it is reversible; we gain access to it by several entrances, none of which can be authoritatively declared to be the main one; the codes it mobilizes extend *as far as the eye can reach,* they are indeterminable (meaning here is never subject to a principle of determination, unless by throwing dice); the systems of meaning can take over this absolutely plural text, but their number is never closed, based as it is on the infinity of language. --Barthes, *S/Z*

At another level, too, this radical essence may be known. In our readings we have discovered that correlates of the points advanced thus far may be found within the nervous system and the brain. In order to demonstrate this warrant, we present an example of the connection of the brain, the central nervous system (CNS), and the cueing system(s) which keep all the message traffic going the right way at the right rate. Consider Figure 3. The important aspects for our present discussion are the mid-line and the thalamus. Note the signal from the body passes up the spinal cord, crosses

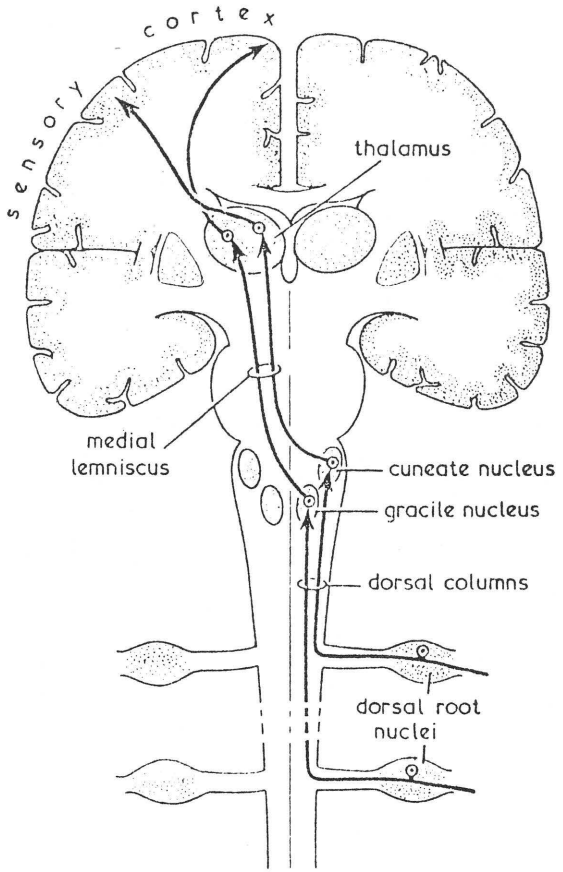


Figure 3. The pathway of some fibres conveying somatosensory information. First order afferents travel in the dorsal roots to the spinal cord where they pass upwards as the dorsal columns to end in synapses within the cuneate nucleus and gracile nucleus. Fibres from these two nuclei cross the midline (as the senory decussation) and have their terminals on cells in the thalamus, reaching the latter via the medial lemniscus. The thalamocortical radiations transmit impulses from the thalamic nuclei to various regions in the cerebral cortex on the same side. (Figures 3-5 are from Bindman & Lippold, 1981)

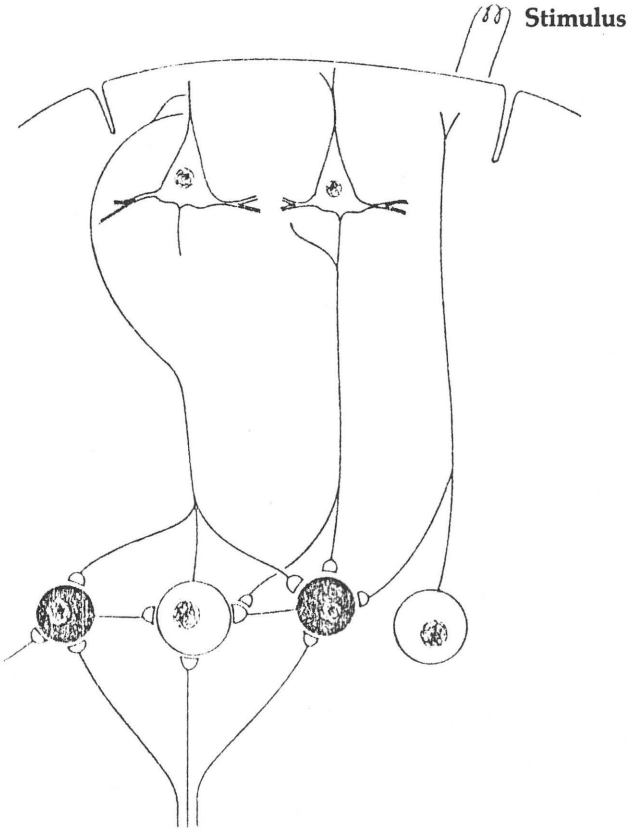
the midline above the top of the spine, and passes into the thalamus. The thalamus is the routing center. Through it *come* the signals from the periphery of the system (afferent pathway) and go the signals to the periphery (efferent pathway). The thalamus has connections to the cortex; given the natures of cortical and thalamic nerves, exitation (stimulation) of

one small area of the cortex can have widespread action (response) in other areas of the cortex and of the thalamus (Figure 4).

We are not neurological specialists in medicine, psychology, or zoology, but as we ponder these ideas certain conclusions begin to become more meaningful, viz.: 1) We know now that memory is not localized, but diffused (Figure 5). 2) We know now that the central nervous system cannot possibly relay all sensory signals, the ocular pathway cannot transmit all visual stimuli, and so on; some reduction and selection of neural data is required. In Bindman and Lippold's words:

> It is well established that there is a limit to the amount of sensory material that can be dealt with at any one time; the range of infor-

Figure 4. Diagram showing some possible connexions between cells of a thalamic nucleus and with the cortex. Stimulation of the cortex can excite corticofugal axons but also the axons of the thalamocortical cells having collateral branches running back into the thalamus.

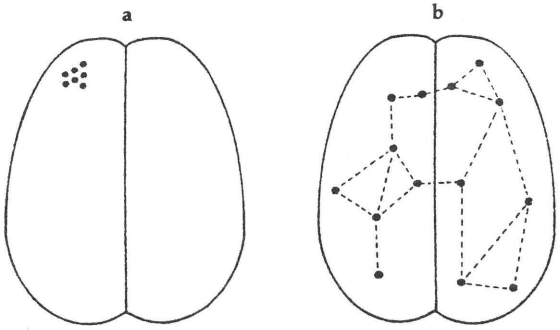


mation which can attain awareness is relatively small. This limitation is of biological value in that the animal is enabled to concentrate upon one particular facet of the environment, to the exclusion of most of the environmental stimuli which would be irrelevant, distracting, and which would hamper rapid data processing by the cortex. At any instant of time, it is not possible to deal with or to memorize more than very few inputs of information although receptors can be simultaneously activated by very many sources and information storage exceeds this capacity very greatly. (p. 130)

Sensory inputs are subject to control from higher regions of the central nervous system at the level of the first synapse on the afferent pathway. The descending control can modify the inhibitory or excitatory effects of other stimuli, applied simultaneously to other skin regions or to other types of receptor. Because there is often convergence of more than one type of input into a single cell in the pathway, selective control of one of the inputs can result in a change of responsiveness of a cell to a particular type of stimulus. (p. 54)

Most sensory pathways have a synapse within the thalamus. This applies not only to the somatosensory pathways which end in the ventrobasal complex, but to the neurones of the visual pathway that terminate in the lateral geniculate body, and those of the auditory pathway that relay in the inferior colliculus and medial geniculate body. The congregation of sensory inputs within the thalamus allows

Figure 5. Location of the memory trace. In the early part of this century, it was thought that specific memories were stored in a well localized group of cells in the brain (a). (b) shows the kind of neuronal organization of memory traces which would accord with the finding that discrete brain lesions do not remove particular items of remembered information. The memory deficit produced by a cortical lesion is related in extent to the size of the lesion and not to its location.



> for both intra- and intersystemic integration. Each of the main sensory systems projects from the thalamus to a particular region of the cerebral cortex--one of the primary sensory receiving areas. They also project to secondary and other sensory receiving zones. The fibres pass from thalamus to cortex in the thalamocortical radiations. (p. 56)

The thalamus is the switching center. And it is in the thalamus that "intra- and intersystemic" integration can occur. Signals can excite not only their own pathway but sometimes an adjoining pathway. (The commonest example: loud noise or severe blow to the body produces "visible lights" in the mind's eye.) Repeated transmissions of a given signal give rise to two events: 1) inhibition--that is, the cortex tells the thalamus, which relays to the sensing nerves: "Let me know if there is any change." 2) Sympathetic signals--that is, in adjoining pathways signals are generated by inadvertent enervation, and these signals are generated every time the originally separate signal comes along. Hence, an elaborating context and a polyvalent--global--network of approaches to a point are conceivable in a biological metaphor. "Thalamic switching" allows elaboration and constraint of conduct. All cortically received signals are both reductions of input and integrations of input.

Coda

We believe with Barthes that a readerly text is fully comparable to a classical music score. In a score parts (notes, a mellisma, measures, motifs) are built up into wholes which cannot be divided into their linear sets of parts. Since they are woven together, the warp may be studied, or the woof, but the whole is the total of (the hearer's perception of) the small and large interactions of warp and woof. At each point in the score, in the text, a polyvalent symbol exists, with horizons of potential meanings.

To read well, the reader (re)constructs the whole from the parts, noting the value (positions, frequencies, definitions, contexts) of each part, each small set of parts (the emerging whole), and so on. Similarly, the writer builds the whole by crafting the parts. Just as the emerging context is field for new figures for the reader, so the already crafted portions of text are for the writer. Each successive line is elaborated and simultaneously constrained by what came before and in turn elaborates and constrains what follows. It is with this understanding that we comprehend "interpretation" in its potentiality.

1. "Powers and limits of signs," in *Media and Symbols: The Forms of Expression, Communication, and Education* (David R. Olson, ed.) (Chicago: University of Chicago Press, 1974), p.114.

2. See "Logic as semiotic: The theory of signs," in *Philisophical Writings of Peirce* (J. Buchler, ed.) (New York: Dover Publications, 1955).

3. We do not doubt that at the level of recognition of letter shapes--on the one hand--and at the level of critically looking back across the canons of texts read in ones field--on the other--the circle exists. The "identifiable range" is considerably smaller, though; it encompasses that immediate recognition stage up to the analysis of a single work or a genre analysis.

4. That is, a higher order generalization controls its constituent, lower order ones; and, the higher order generalization is in turn part of yet another even higher order generalization. We think these relationships and interrelationships (exponential) are the fabric of memory in that they serve as the structural strings holding together component parts of concepts and real world relationships.

5. An easily read discussion of Gödel's theory concerning the inability of a rule-based system to produce all and only derivations which conform to the rules posited is in W.V. Quine, *Methods of Logic* (new York: Holt, 1950), pages 246ff.

6. For an overview of current awarenesses, see Roger Brown, "A new paradigm of reference," and G.A. Miller, "Pastness," both in *Psychology and Biology of Language and Thought, Essays in Honor of Eric Lenneberg* (New York: Academic Press, 1978), pages--respectively--151-166 and 167-185.

7. P. Gough, "One second of reading," in *Language by Ear and by Eye: The Relationships between Speech and Reading* (ed. J.F. Kavanaugh and I.G. Mattingly) (Cambridge: MIT Press, 1972), pages 331-358.

8. New York: Harper & Row, Publishers, 1968, page 11.

9. While he adduced this in an unknown fashion and he did not report researches which corroborate his point, his decision makes sense. Mutes can learn to read. The potentially massive job of storing all "prints" as meaning defies belief.

10. Like Gough's model, Goodman's has been widely discussed. To capture most quickly the flavor of these discussions, see K.S. Goodman's "Psycholinguistic universals in the reading process" in *Psycholinguistics and Reading* (F. Smith, ed.) (New York: Holt, Rinehart and Winston, 1973), pages 21-27 as well as other essays in that volume. Then see the articles by Goodman ("From the strawman to the tin woodman: A response") by Peter Mosenthal ("Bridge principles in an abridged reply to Goodman"), and by Brian Cambourne ("Getting to Goodman: An analysis of the Goodman model of reading with some suggestions for evaluation") in *Reading Research Quarterly*, XII (1977), 4: pages--respectively--575-585, 586-603, and 605-636.

11. J.A. Holmes and H. Singer, *The Substrata-factor Theory: Substrata Factor Differences Underlying Reading Ability in Known-groups at the High School Level (Washington: Office of Education, 1961).*

12. H. Singer, *"Substrata-factor theory of reading: grade and sex differences in reading at the elementary school level,"* in *International Reading Conference Precedings* (Neward, DL: IRA [Vol. 9, pp. 313-370], 1964).

13. Kenneth Burke, *Counter-Statement* (Berkeley: University of California Press, 1968), especially "The poetic process," on pages 45-62.

14. We use the "tagmemic" concepts of Kenneth Pike, Alton Becker, and Richard Young. See Young, Becker, and Pike's *Rhetoric: Discovery and Change* (New York: Harcourt Brace and World, 1971)

15. See Kenneth Burke's *A Grammar of Motives* (Berkeley, University of California Press, 1969) and *A Rhetoric of Motives* (Also University of California Press, 1969). The "pentad" is a division of the communicative/dramatic moment into the five elements shown; also important are the "ratios" which are the interrelationships of elements (e.g., act-agency).

16. Drawn principally from R.M. Coe's "Isomorphic processes" (speech at the Conference on College Composition and Communication, Philadelphia, 1976) and emended through the years by both Coe and Kline. Coe's idea was that interpretation was based in only a few algorithm-like relationships which closely paralleled creative procedures; Kline first turned that idea into a set of activities useful ("heuristics") in inventing, arranging, and presenting prose (cutting across *heuresis, phrasis,* and taxis, that is); then, the two ideas were merged giving the creative-interpretative axis and the rhetorical process dimension. See Roland Huff and C.R. Kline, Jr.'s *A Composing Curriculum Based on Rhetorical Processes,* forthcoming from Teachers College (Columbia University) Press.

17. We prefer the Lane Cooper translation of *Rhetoric* (Englewood Cliffs: Prentice Hall, 1932). See sections 2 of Book I and 22, 23 of Book II.

Other references

Roland Barthes, *S/Z,* trans. R. Miller (New York: Hill and Wang, 1974).

L. Bindman and O. Lippold, *The Neurophysiology of the Cerebral Cortex* (Austin: University of Texas Press, 1981).

R. Conrad, "Speech and reading," in Kavanaugh and Mattingly, *ibidem.*

Edmund Husserl, *Cartesian Meditations, An Introduction to Phenomenology,* trans. Dorion Cairns (The Hague: Martinus Nijhoff, 1960).

P.A. Kolers, "Three stages of reading" in *Basic Studies on Reading* (eds. H. Levin and J.P. Williams) (New York: Basic Books, 1970), pages 90-118.