Language and Style
XIV, #4 : 251-270, 1981

LUST IN ACTION: AN ABSTRACTION

WILLIAM L. BENZON

PHONOLOGY, MORPHOLOGY, AND SYNTAX belong to linguists. Semantics belongs to us all. Philosophers and semioticians, logicians and literary critics, computer scientists and psychologists, anthropologists and linguists—all are attempting to answer the questions: What's in an utterance that it can mean? What's meaning that it can be uttered? Semantics is dazzling and incoherent in its diversity, immature and rich in promise.

My approach to semantics draws heavily on recent work in computational linguistics and artificial intelligence, looks toward cognitive and perceptual psychology, and aspires to a home in neuropsychology. The cognitive network theory developed by David G. Hays provides the unifying model.[1]

In this essay I am concerned with the semantics of abstract concepts which refer to states of mind and mental events. More particularly, I am interested in the conception of *lust in action* embodied in Shakespeare's sonnet 129, *Th'expence of Spirit.* I begin with a brief presentation of the sonnet and then move to a presentation of the theory (exemplifying it, where possible, through reference to the sonnet), coming to a close with a more detailed discussion of the poem.

SONNET 129

While sonnet 129 has received extensive critical treatment, there is little to be gained by discussing that literature here—the method of my madness is so different from that of conventional literary critics that it is difficult to bring their arguments to bear on my questions (and vice versa).[2] The poem, as given in the 1609 Quarto but with modernized spelling, goes as follows:

1 Th'expence of Spirit in a waste of shame
2 Is lust in action, and till action, lust
3 Is perjur'd, murderous, bloody, full of blame,
4 Savage, extreme, rude, cruel, not to trust,
5 Enjoy'd no sooner but despisèd straight,
6 Past reason hunted, and no sooner had

7 Past reason hated as a swallowed bayt,
8 On purpose laid to make the taker mad.
9 Mad in pursuit and in possession so,
10 Had, having, and in quest, to have extreme,
11 A bliss in proof and prov'd a very woe,
12 Before a joy propos'd behind a dream,
13 All this the world well knows yet none knows well,
14 To shun the heaven that leads men to this hell.

The first twelve lines move back and forth in contemplation of the following sequence of events.

I. DESIRE: The principal actor (in this little story) becomes consumed with sexual desire for another and will stop at nothing to have his way (i.e. he is "perjur'd, murderous . . . cruel, not to trust").
II. CONSUMMATION: The actor gets his way and so expends his spirit (semen), experiencing "bliss in proof."
III. SHAME: His desires satisfied, the actor now despises sex and, presumably, himself as well.

This sequence is beyond reason and the person trapped in it (having swallowed the bait) is mad.[3]

The final couplet makes a powerful assertion. Someone who knows that fire burns can use that knowledge to prevent pain by not picking up burning sticks, walking into fires, etc. But, even though everyone ("the world") knows that sexuality is madness leading from unreasonable desire to unreasonable hate, no one is able to use this knowledge to avoid sexuality.

In the Elizabethan worldview Reason was the highest mental faculty, while sex belonged to the lowest.[4] Sonnet 129 thus contemplates the paradoxical powerlessness of the highest faculty in the face of the lowest. The purpose of this essay is to show how cognitive network theory can be used to investigate the relationship between the Elizabethan account of lust and the operation of the nervous system. The twist, of course, is that the Elizabethan account (*any* account) is constructed within that same nervous system.

A Brief Overview of the System

The system is organized into four *degrees:* 1) Sensorimotor, 2) Systemic, 3) Episodic, 4) Gnomonic. The sensorimotor degree is organized in a hierarchy of feedback orders according to principles set forth by William T. Powers in his *Behavior: The Control of Perception* and is probably located in subcortical brain tissue.[5] The other three degrees are cognitive, probably neocortical, and belong to the *reorganizing* system in Powers' model. Following Powers, consciousness is identified with the operation of the reorganizing system (the cognitive degrees of the system) on the sensorimotor system. Correlatively, the internal structure of these degrees is unconscious; yet it is this internal structure which provides the grammar of perception and action. Information processing which is internal to a degree is unconscious; information processing on the

interface between the sensorimotor degree and any or all of the other three degrees is conscious.

This conception of unconscious process is to be distinguished from the Freudian conception.[6] The contents of the Freudian unconscious are kept unconscious by repression. When the repression is lifted, the repressed material becomes available to consciousness. The inner structure of the degrees of this system is, in principle, unconscious. It is not repressed nor can the relief of repression make this structure conscious. These two conceptions of unconscious mental processes, while different, are not antithetical; rather, they complement one another. The Freudian concept concerns the effects of motive and emotive systems on mental processes. The other conception asserts that the structure of an information processing system is not part of the information processed by the system.

A useful way to get an intuitive feel for the nature of the postulated relationship between the sensorimotor degree and the cognitive degrees is to imagine a TV set which monitors sensorimotor activity. This TV set is the sensorimotor/cognitive interface. The cognitive degrees observe the activity on the screen and reconstruct that activity in their own terms. By turning the dials of the TV set (imagine hundreds of controls) the cognitive systems operate on the sensorimotor system.

The systemic degree regulates the activity of the sensorimotor degree. The episodic degree has access to both the sensorimotor degree and the systemic degree and regulates the interaction between them. The gnomonic degree in turn has access to the sensorimotor, systemic, and episodic degrees and regulates their interaction. This is diagrammed in Figure 1. Information can travel in either direction along the arrows. The direction of the arrow indicates dominance; the system on the tail end of the arrow is dominated by, controlled by, the system at the head end.

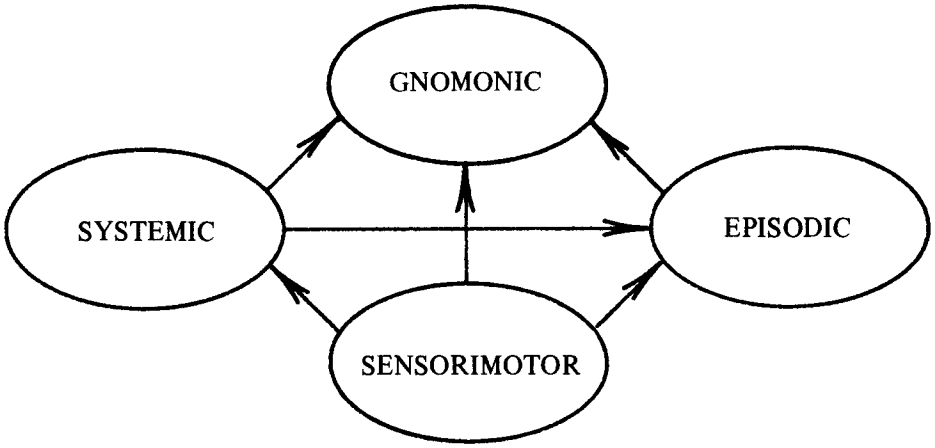

FIGURE 1

The systemic degree maintains an inventory of basic concepts and propositions. They are organized along axes of selection and combination.[7] Along the axis of selection, an oak is a variety of tree, a tree is a variety of plant; crawl, walk, and run are modes of locomotion; carrots, apples, trout, and pig can all be used as food. On the axis of combination, four legs, a tail, a neck, a head, and a torso combine in the form of a beast; hand, fork, a hunk of meat, and a mouth combine in an act of eating. The systemic degree can be thought of as the dictionary of the system.

The episodic system regulates and records transactions between the sensorimotor and systemic degrees. Consider some object for which the system has a schema. The image that object projects onto the retina depends on the shape of the object, the quality of light, and the relationship between the object and the system. It will present one appearance when viewed from the front in dim light and a different appearance when viewed from the side in a bright light. These different appearances correspond to different images projected onto the retina; those different images will excite different populations of retinal receptors. But the object is the self-same object even though it presents different appearances and those different appearances correspond to different patterns of neural excitation. The episodic regulation of systemic/sensorimotor interaction helps the system to identify the self-same object through the variety of appearances it presents.

The episodic degree locates perceived events and entities in time and space —the tree Abel planted when he was a boy is to the left of the old barn. It contains a record of the system's history. The events which make up the three-episode lust sequence (desire, consummation, shame) are recorded in the episodic degree. If the systemic degree is the system's dictionary, then the episodic is its encyclopedia.

It is one thing to see an apple and another thing to imagine one. That difference is regulated by the gnomonic system. The gnomonic system also notes the level of confidence to be placed in a given piece of knowledge. That Ronald Reagan is the President of the United States is absolutely certain; that he is doing a good (or a bad) job may be less certain.

The gnomonic system also regulates point of view. Of course all transactions between the system and the environment, which includes other people, are made from the system's own point of view. But, through the mediation of language, many events are entered into the episodic system which the system never experienced directly. They must be marked for point of view—from which actor's point of view is this story being told? Further, the complexity of social interaction demands that we be able to assume the point of view of another, to evaluate situations as others see them, to evaluate our own activities as others would.[8] By operating appropriately on the contents of the sensorimotor, systemic, and episodic degrees, the gnomonic degree enables a given event to be examined from several points of view.

The cognitive degrees are organized as a cognitive network. Consider Figure 2. The ellipses represent *nodes* in the network, which are connected by *directed arcs* or *links*. A node specifies a concept while the links between nodes specify relationships between concepts. Thus *tree* and *oak* would be connected

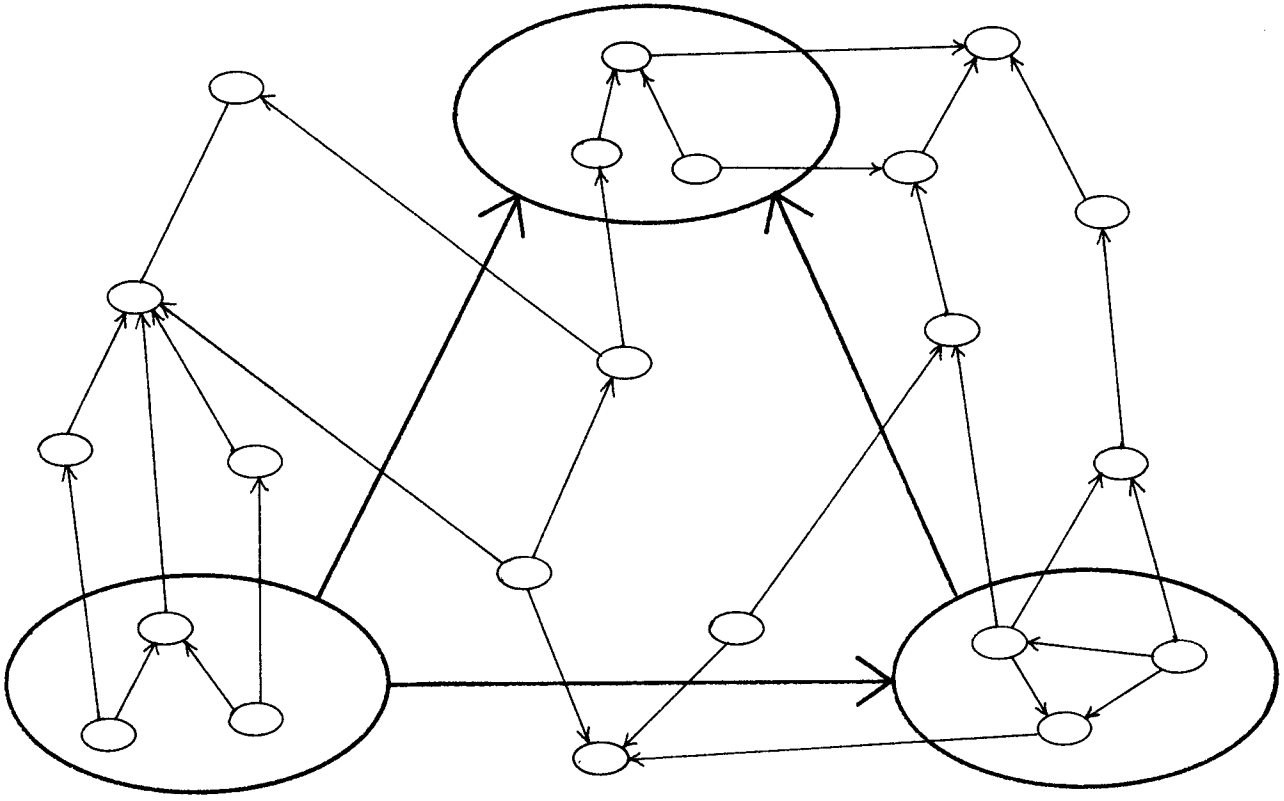

FIGURE 2

by a link which indicates that *oak* is a *Variety* of *tree* while *man* would be connected to *hit* (as in "The man hit the ball") by a link indicating *man* as the *Agent* of *hit.* Note that the arcs in Figure 2, as in Figure 1, don't indicate direction of information flow, but rather they indicate dominance: oak is a variety of tree, not vice versa, and man is agent of hit, not vice versa.

In Figure 2 one network has been superimposed on another. The superimposed network is of higher degree than the network on which it is superimposed. Thus the nodes of higher degree networks represent fragments of lower degree networks. An episodic node represents a fragment of systemic structure (e.g. John eating his steak) and a gnomonic node represents a fragment of episodic structure (e.g. the desire/consummation/shame lust sequence).

It is important for my subsequent argument that these nodes and arcs be interpreted as representing the information processing structure of some physical system, specifically, the human nervous system. Fortunately nothing in that argument depends on the details of correspondence between the cognitive network notation and the nervous system; it is the physicality of the represented system which is important.

THE LINGUISTIC SIGN

The system is broken into different degrees along one axis and into different *channels* along an orthogonal axis. Color and form are channels in the visual system. The visual system itself is but a channel, comparable to the auditory, haptic, olfactory, taste, and motor channels. Our perceptual and cognitive accounts of entities and events combine information from many channels. The apple has a visual appearance, a haptic appearance, an olfactory appearance, and a gustatory appearance.

The major channel division of the system separates the *General Cognitive* channel from the *Linguistic* channel and runs from the sensorimotor degree up through the systemic and episodic degrees and probably into at least part of the gnomonic system (i.e. it seems likely that some gnomonic structures are purely linguistic, others purely cognitive, while yet others have both linguistic and general cognitive components). The linguistic sensorimotor system is responsible for articulatory output and the initial analysis of auditory input; it is the phonetic component of the system. Phonology is handled by the linguistic systemic degree and morpho-syntactics by the linguistic episodic degree. The linguistic gnomonic degree handles operations corresponding to transformations.

Concepts in the general cognitive systemic degree are linked to concepts in the linguistic systemic degree by NAME arcs. Figure 3 shows the relationship between a cognitive episode and a linguistic episode. (Note: The vertical arcs are REPresentation arcs, which connect concepts of different degree.) During the production of an utterance, excitation flows from the general cognitive channel along the NAME arcs to the linguistic channel; in comprehension the direction of flow is reversed. The gnomonic system regulates the interaction between the linguistic and general cognitive channels.

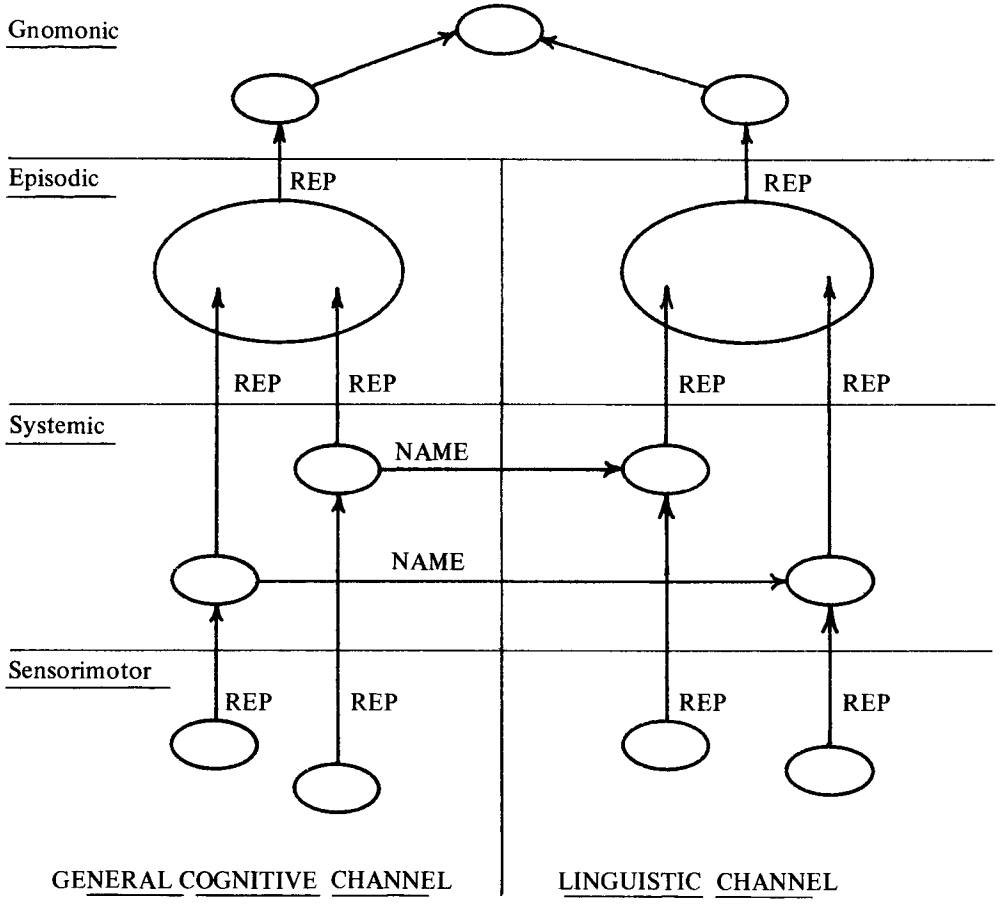
Gnomonic
Episodic
REP
REP
REP
REP
REP
REP
Systemic
NAME
NAME
Sensorimotor
REP
REP
REP
REP
GENERAL COGNITIVE CHANNEL
LINGUISTIC CHANNEL

FIGURE 3

By using the speech channel the system can operate on the systemic network in the absence of any external input to the system. The word *apple* can conjure up the image of the apple even when no apple is present. Once the child learns to activate the linguistic systemic channel without activating the linguistic sensorimotor channel he has learned the trick of inner speech.[9] While all of the activity of the system is, within the terms of this theory, thought, the commonsense notion of thought seems to be derived from the activity of inner speech: (commonsense) thought is the subjective appearance of inner speech.

Abstract Patterns and Metalingual Definition

The cognitive systemic degree contains the dictionary of basic concepts. These concepts can be defined in one of three ways: 1) by reference to the sensorimotor system, 2) functionally, 3) metalingually.

The simplest concepts are defined by sensorimotor concepts. The sensorimotor schema for an apple is connected by a representation arc to the cognitive node for apple (see Figure 3). Similarly for horses, mountains, colors, sounds, gestures, physical motions–just about anything which can be pointed to will have a sensorimotor definition.

Concepts are said to be functionally defined when their meaning depends on the syntagmatic pattern in which they participate. The concept *eat* takes an agent (someone or some animal which is doing the eating) and a patient, that which is eaten. The concept of *food* is the concept of an entity which can play the patient role in the syntagmatic pattern for eating. Food is functionally defined. Similarly, hammers, hoes, and forks are all *tools* because they play the instrumental role in patterns for pounding nails, digging the earth, and stuffing the face, respectively. Tools, furniture, clothing, garden plots, all are physical objects whose cultural sense comes from the roles they play in various syntagmatic patterns of concepts.

Metalingual definition comes in two forms. Simple metalingual definition allows some episode to be the patient of concepts such as *see* and *say*. Consider Figure 4. John is the agent (AGT) of a saying and some other systemic node is the patient (PAT). That node is metalingually (MTL) defined by an episode giving the content of John's saying (which could be quite long and complex).

If what John asserts as true is in fact false and John knows it to be false, then John is lying. The concept of lying is abstract and, as such, it is metalingually defined over a pattern of episodes. Three episodes are involved in the pattern which defines lying: 1) the episode in which the liar asserts something (the only episode given in Figure 4), 2) the episode giving the true state of affairs with respect to the liar's assertion, and 3) the episode asserting the liar's knowledge of the falsity of his statement. The metalingual arc is directed from the head of the gnomonic network defining the abstract pattern to the systemic degree (see Fig. 4).

Systemic nodes which have been abstractly defined can be organized into selectional and combinatorial patterns. And they can appear in episodes which are parts of other abstract patterns. Thus the mechanism of abstract metalingual definition is *recursive*, for there is no limit to the process of creating abstractions

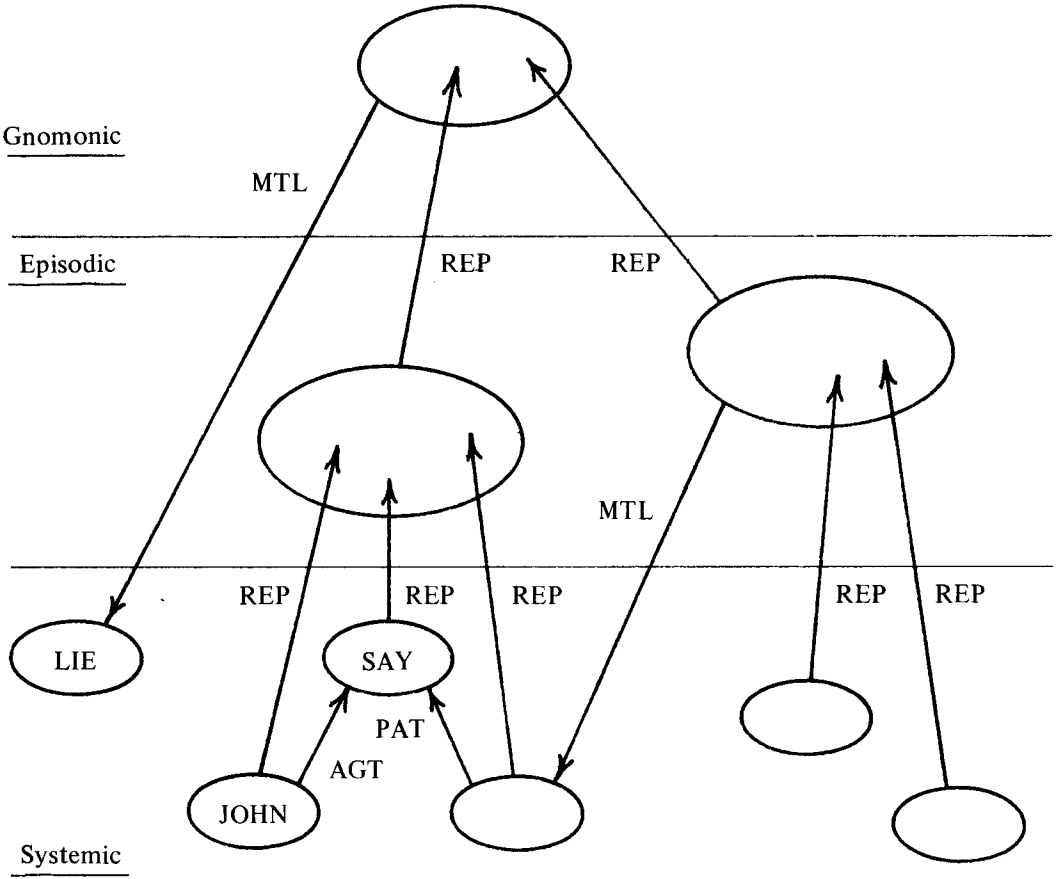
Gnomonic
MTL
Episodic
REP
REP
MTL
REP
REP
REP
REP
REP
LIE
SAY
PAT
AGT
JOHN
Systemic

FIGURE 4

over episodes containing abstractly defined terms. The concept of *reward* is abstract and appears as a term in the pattern which defines *charity* as *doing something nice for someone without thought of reward.* And charity could appear as a term in the definition of some other abstract concept. An abstract term defined over a set of episodes in which none of the terms is abstract is a *first order* abstraction. A *second order* abstraction is defined over an episode set which contains at least one term which is a first order abstraction. Higher order abstractions are defined in a similar fashion.

The pattern which defines an abstract concept is internal to the gnomonic degree and is, as such, unconscious. The definitions I've given of lying and of charity are *rationalizations* of abstract concepts. A rationalization is, in effect, a set of systemic propositions which reconstructs the gnomonic pattern of an abstraction. The nature of the process by which a rationalization is constructed is obscure, but the distinction between the abstraction and its rationalization is clear enough. The former is a set of gnomonic relations over exemplary episodes while the latter is a systemic reconstruction.

This account of abstraction is consonant with Thomas Kuhn's theory of scientific knowledge.[10] Kuhn argues that the deep governing principles of scientific thought and discourse are unconscious; scientists are not, for the most part, consciously aware of the principles which govern their activity. An essential part of learning these principles is exposure to exemplary instances (experiments, observations, applications) which illustrate the abstract principles. Kuhn's exemplary instances are, in the terms developed above, episodes over which gnomonic patterns are defined. These gnomonic patterns are the governing principles of scientific knowledge, the principles which guide scientific intuition. In Kuhn's account the explicit rules of scientific practice are relatively unimportant--much less important than exemplary instances, and tend to be formulated only in times of intellectual crisis. These explicit rules are rationalizations, in the technical sense of cognitive network theory, of the abstract patterns. They are only approximate reconstructions of the governing principles.

Levels of Arousal and Patterns of Activity

A cognitive network is an information processing structure. Over a long period of time (days, weeks, years, decades) the structure of the network will change. New network structures will be added and perhaps some old structures which aren't used very often will disappear. Let us assume that over a short period of time (seconds, minutes, hours, perhaps even as long as a day or two on occasion) no changes are made in the basic structure.

The short term operation of the network will be manifested in patterns of activation and arousal in the network. Each node is a small computer, analyzing its inputs and generating appropriate output. An *aroused* node is one receiving inputs; a node receiving no input is *quiescent.* Arousal can be at various levels and perhaps even of various kinds; when fully aroused a node is *active* and transmitting signals to other nodes. At any given moment some nodes will be quiescent, others will be active, and others will be in various states of arousal. A node which is highly aroused can be more easily stimulated to full activity than one

which is weakly aroused or quiescent.

(Note: While the terms used to discuss the network are similar to those neuropsychologists use to discuss neural activity, it would be a mistake to think of nodes as neuron cell bodies and arcs as axons and/or dendrites. Individual cognitive nodes and arcs probably represent fairly large populations of neurons or, more abstractly, patterns of energy distribution in neural tissue.)

There is now considerable evidence that organisms recognize entities and events by matching internal representations with environmental input.[11] One of the processes performed by a cognitive network is the inference of as yet unperceived aspects of a situation on the basis of the immediately perceptible aspects. We see or smell (or both) the smoke and infer the existence of a nonperceptible fire. The node representing smoke is fully active and arouses the node representing fire, which is closely linked to it in the network. This arousal constitutes the system's expectation that it will perceive fire if it moves toward the smoke. When the system gets close enough to the fire it will be visible (and perhaps the heat will also be perceptible). This input will be sufficient to bring the fire node to full arousal and now the complete fire-causes-smoke pattern will be active. The system's expectation will have been confirmed.

This process is especially important in the system's use of abstract concepts. Consider lying. Assume that the network of Figure 2 represents the gnomonic pattern for *lie* (the three large nodes) as defined over the appropriate portions of the episodic network (the small nodes). The system has heard John make some assertion (Figure 4) and something in his tone of voice suggests that he may be lying. At this point one of the three components of the abstract concept of *lying* has been matched. One of the three gnomonic nodes in Figure 2 is now fully active, as is the episodic fragment represented by that node. The activity of this gnomonic node arouses the other two gnomonic nodes to activity and they in turn arouse the episodic fragments they represent. In order to validate its suspicion that John is lying the system must find environmental input which matches the two newly aroused episodic fragments, one indicating that John's assertion is contrary to fact and the other indicating that John knew his assertion to be contrary to fact. When this input has been found, the episodes become active and the abstract pattern for lying has been satisfied. The initial suspicion has been validated.

In order to make this analysis more realistic we must take the system's capacity for inner speech (commonsense thought) into consideration. The input which arouses a cognitive node to activity can enter the general cognitive channel either through direct perception of the external world or from the linguistic channel (or both). The episodic arousal which results from the initial inference beyond the perceived episode is internal to the episodic and gnomonic degrees and is, as such, unconscious. What then is conscious inference? By using its capacity for inner speech the system can bring the aroused episodic fragments to full activity. That activity organizes a sensorimotor/systemic transaction which is, by definition, conscious (recall that conscious experience is hypothesized to occur only on the interface between the sensorimotor and cognitive degrees). That transaction is an imaginary episode. John asserted that the apples are ripe and so the system, suspecting John of lying, imagines that the apples

aren't ripe. It then seeks perceptual verification of the imagined situation. It goes into the orchard and sees green apples–they aren't ripe. And it then uses the capacity for inner speech to recollect, to imagine, John's assertion that they were ripe. The entire process involves complex transactions under gnomonic regulation.

	PERCEIVES	INFERS	RECALLS
MOMENT I	John asserts X.	X is false. John knows X to be false.	
MOMENT II	X is false.	John knows X to be false.	John asserts X.
MOMENT III	John knows X to be false.		John asserts X. X is false.
MOMENT IV		John is a liar.	John asserts X. X is false. John knows X to be false.

FIGURE 5

Consider Figure 5. The rows indicate the internal activity of the system at successive moments in its activity. Propositions in the PERCEIVES column are activated by environmental input. Propositions in the other columns are imagined, activated by inner speech. Figure 5 gives one of several possible sequences of inferential and perceptual activity justifying the conclusion that John is a liar.

Chances are that only the conclusion, John is a liar, and the propositions justifying it will be permanently entered into the episodic system. But a more complete record could be made. The exact sequence in which the propositions entered the system could be retained, along with gnomonic contents indicating whether the proposition was perceptual, inferred, or recalled. In effect, the system could record the complete sequence given in Figure 5. That record would, like any other, be available to the gnomonic system for organization into an abstract pattern. That abstract pattern would be a full abstractive rank above any of the abstract patterns guiding the inference processes manifested through the episodic base (e.g. Figure 5).

Note that the inferences the system can make at any time depend on the internal structure of the system. A *sequence* of inferences depends both on the external environment and the internal structure of the system. Consequently, any abstraction based on an episodic record of inference sequences would contain information both about the external environment and about the inner

workings of the system. The rationalization of such a pattern would refer to the operations of the system and the structure of the system's environment. In this way the system could formulate explicit and consciously available rules of logic, reconstructions of the activity of the gnomonic system—and perhaps that is how Aristotle came to write his accounts of logic and rhetoric.

Having thus briefly considered how the system might come to formulate rationalizations reflecting the structure of gnomonic processes, let us consider how it might arrive at rationalizations concerning motive and emotive processes.

It is well known that experience is affected by the biochemical environment of the brain.[12] The most dramatic evidence comes from observing the effects of powerful hallucinogenic drugs, such as LSD. The immediate sensory environment becomes radically changed, hallucinations and even open-eyed visions occur.

A more humble example will serve my purposes. An experiment was performed in which subjects were asked to memorize nonsense syllables while drunk.[13] They had difficulty remembering the syllables when sober, but their memories improved significantly when they got drunk again. It seems that the neural record of the syllables was more accessible, more readily aroused, when the biochemical environment of the neural tissue during recall matched the biochemical environment during the initial learning than when recall was attempted in a different biochemical state. Thus it seems reasonable to assume that biochemical factors affect the arousal level of nodes and arcs in a network, that some nodes will be readily aroused in one biochemical environment and aroused only with difficulty in a different biochemical environment. The network structure readily available for information processing at any given time will depend on the biochemical state of the system at that time.

It is well known that motivational and emotional states are correlated with hormone activity, though the nature of that correlation is obscure.[14] Thus it might be the case that networks acquired during anger will be most readily aroused in the biochemical environment typical of anger, while networks acquired during love will be more responsive to the biochemical environment correlated with love. Note that I am not asserting a strict partitioning of the network by biochemical states such that a given structure can be aroused only in one biochemical state. That might be the case for some structures, but we obviously can remember something of what we said, did, saw, and heard while in an emotionally intense state even after the state is passed. I am only arguing that the arousability for a structure is lower if the biochemical state is different from the one which obtained when the structure was created. We might have easy access to a vague and general account, but the details are difficult to reconstruct.

Certainly motivational and emotive states are influenced by perceptual and cognitive processes—the sight of a rampaging bear causes fright, the odor of broiling meat sometimes engenders hunger, reading about Watergate causes anger. But the direct neural control over hormonal states is lodged in a subcortical brain structure called the hypothalamus.[15] I imagine that the perceptual and cognitive systems arrive at a general appraisal of the situation and transmit

a rather vague and general message to the hypothalamus; perhaps the message is stated in terms of goodness, strength and activity, the parameters of affective meaning investigated by Osgood.[16] The hypothalamus then organizes an appropriate biochemical response, which is actually effected by the pituitary gland. Consider Figure 6. (In this diagram the direction of the arrows indicates only direction of information flow.) Cognition appraises the situation and signals the result to the hypothalamus. A biochemical response is organized and the hormones are dumped into the bloodstream. Blood flows to the brain and the hormones become part of the biochemical environment in which the cognitive networks are operating.

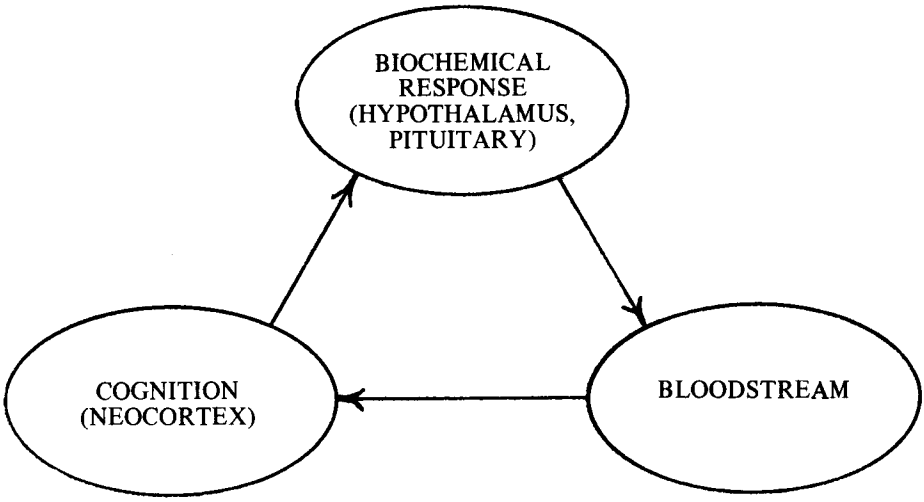

FIGURE 6

So, a given cognitive state has engendered a biochemical response which facilitates the arousal of some network structures at the expense of others. The system makes inferences which will most likely utilize the most arousable portions of the network. An appropriate action is taken—the attacker is clobbered, the cake is eaten, a letter of protest is written, a body is stroked. As a result of the action the cognitive state is changed, the change is signaled to the hypothalamus, and appropriate adjustments to biochemical states are made. Pretty soon a different biochemical soup bathes the brain and the arousal characteristics of the network change accordingly.

Now imagine a sequence of such interactions (conjure up a table similar to that of Figure 5). Successive episodes in the sequence are characterized by different motive/emotive states and the correlated biochemical states. An abstract pattern formed over such a sequence of episodes will contain information about the interaction of the lower degrees (sensorimotor, systemic, and episodic) and the subcortical mechanisms which organize motive and emotive states. Rationalization of that abstract pattern will yield propositions which refer to the motive/emotive states of the system.

If the sequence of such interactions is generated by imagined events, fictitious events, by a story, then the abstractions formed over such sequences constitute the grammar of myth, of poetry. If one identifies the biochemically mediated effects of affective states on the cognitive networks with the Freudian id, then the formation of abstract concepts over a sequence of episodes involving significant biochemical effects would correspond to the Freudian dictum, where id was, there shall ego be. Thus we arrive at a fairly conventional conclusion: Literature is the organization of unconscious (in the Freudian sense) fantasies in ways acceptable to the ego, to reason.

But of course it is not quite the conventional conclusion. For the argument which supports it is not exactly any of the conventional ones. The argument, formulated in terms of cognitive networks and a bit of neuropsychology, suggests ways of putting new flesh on an old insight—dare I stoop so low?—new wine in old bottles.

LUST IN ACTION: SONNET 129

In order to understand this sonnet we have to reconsider the three-episode lust sequence: DESIRE, CONSUMMATION, SHAME. Figure 7 gives a rough sketch. The unlabeled arcs all go from one degree to another and so are representation arcs. Component (CMP) arcs connect parts to the whole; in this case, parts of the lust sequence are connected to an episodic node governing the complete sequence. Temporal order is indicated by sequence (SEQ) arcs. Each of the three episodes represents a fairly complex fragment of systemic network. I've indicated only one (of many) systemic node for each episode. Each of those is connected by a manifestation (MST) arc to *John.* John is the main actor in this little drama (though not the only actor—there is the object of his desire). A manifestation node indicates a spatio-temporal localization; thus we have John-as-he-desires, John-as-he-consummates (consumes?), and John-as-he-is-ashamed, each at different times and quite possibly in different places. The entire pattern defines an abstract conception of lust, which is different from the simple physical desire.

Figure 7 represents a relatively coherent version of the lust sequence, one in which the component episodes have become organized into a complex episode (indicated by the connection to a common superordinate). But it would be a mistake to think that the first time the system went through the lust sequence it did so by executing the episodic pattern in Figure 7. The behavior of the system depends on the structure of the external world, the structure of the perceptual/cognitive system, and the structure of the motive/emotive system. The first time

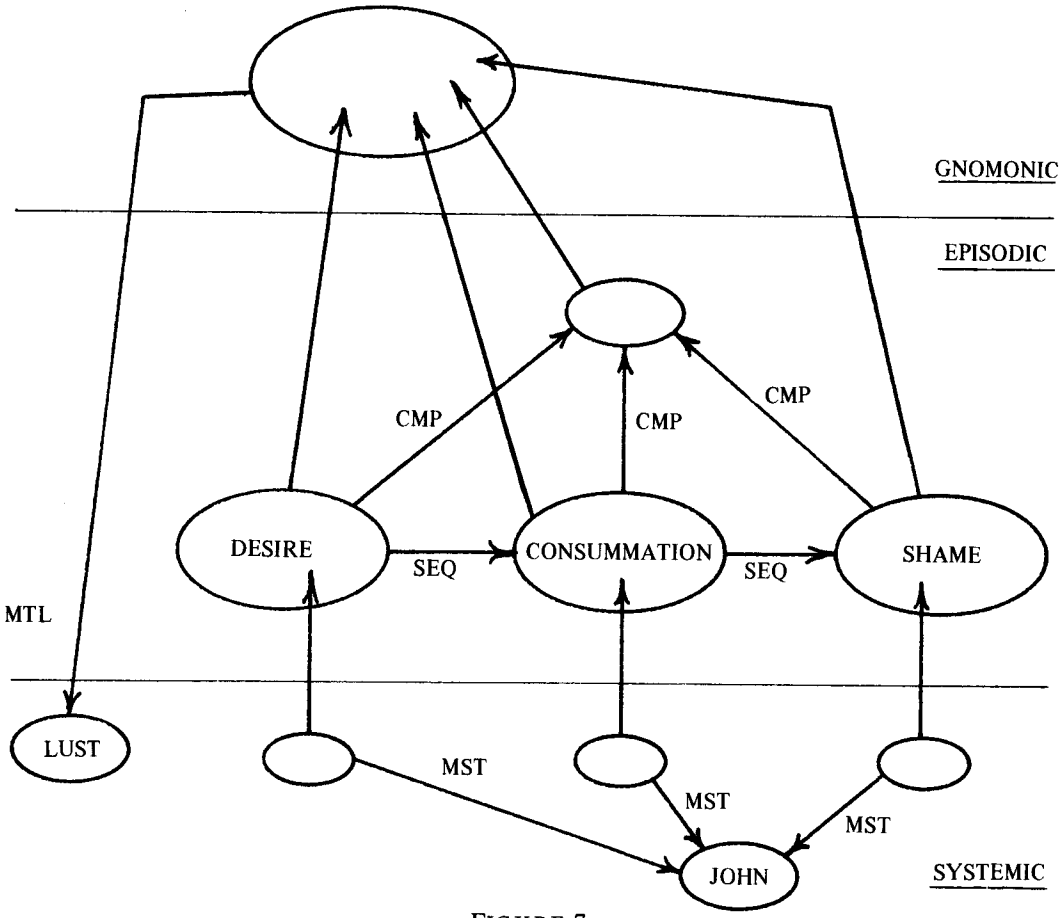
GNOMONIC
EPISODIC
CMP
CMP
CMP
DESIRE
SEQ
CONSUMMATION
SEQ
SHAME
MTL
LUST
MST
MST
MST
JOHN
SYSTEMIC

FIGURE 7

the lust sequence appeared it was the result of interaction between the external world, cognition, and affect. Only as that interaction was repeated did the episodic degree develop a pattern giving a coherent representation of the complete sequence. The *explicit connection* between the three phases represented in Figure 7 developed through repetition of the sequence, which initially had no explicit representation within the cognitive system.

Given the explicit sequence, the system can explore it using inner speech (i.e. the system can 'think' about it without having to do any of it). To the extent that the network structures can be aroused in an affectively neutral state the system can indulge in dispassionate contemplation. But to recover more detail the system might have to allow the activation of appropriate affective states—contemplation is no longer dispassionate. One can imagine a situation where the explicit sequence is unavailable during an affectively neutral state, but that it becomes available with moderate affective arousal.

It is easy to draw diagrams to represent network structures. But one must remember that in a network whose arousability depends (at least in part) on its biochemical environment, structure isn't nearly so definite as the lines on paper. Rather, one should imagine some lines getting heavier and others getting weaker (even to the point of fragmenting and disappearing) as biochemical state changes. The point is an important one, for without it we cannot understand the system's helplessness in the face of lust.

The final couplet of sonnet 129 asserts that knowledge of the ravages of lust is powerless to protect one from them. Why? My explanation is: Because that knowledge is embodied in biochemically sensitive cognitive networks. During sexual excitement the networks embodying knowledge of the evils of lust and moral strictures against fornication and adultery disappear because the biochemical environment of sexual arousal is unfavorable for their arousal. Once sexual desire has been satisfied the biochemical state of neural tissue changes and the previously unavailable networks become available. This is when shame sets in.

But that is not the Elizabethan account. In Elizabethan faculty psychology the *soul* is connected to the *body* through *spirits* (Lewis 1970, Tillyard n.d.). Sexual desire was attributed to the *vegetative* soul (the lowest of three souls, or, to put it differently, the lowest part of a tripartite soul). The vegetative soul communicated with the body through the *vital* spirits. Reason and moral resolve were attributed to the *rational* soul (the highest), which communicated with the body through *rational* spirits. Madness was explained as the loss of rational spirits leading to a condition in which the rational soul can no longer control the body and consequently, the person is ruled by the vegetative and *sensitive* (middle of three) souls. Abstract lust (see Figure 7) is simply that variety of madness engendered by sexual desire (a more concrete form of lust). Faculty psychology is a rationalization (in the technical sense of cognitive network theory) of abstract patterns over episodes containing information about the effects of the motive/emotive system on the network (as discussed in the previous section).

The opening lines of the poem are a pun, conflating abstract and concrete lust:

> Th'expence of Spirit in a waste of shame
> Is lust in action . . .

"Th'expence of Spirit" designates both ejaculation of sperm (spirit) and the loss of rational spirits. Consequently the lust designated in the second line is both a species of madness (abstract concept) and simple sexual desire. These lines constitute an extended pun in which one string of signifiers designates two strings of signifieds. One of these strings of signifieds is a part of the exemplary story governed by the abstract concept of lust (i.e. simple sexual desire is but a part of the episodic structure). The other string belongs to the rationalization of that abstraction.

Jakobson defines the poetic function of language as the projection of similarity from the paradigmatic axis onto the syntagmatic axis.[17] The two lusts occupy places in the paradigmatic system and have just that similarity which allows one to be a part of the pattern which defines the other. By using a clever extended pun Shakespeare projects these two senses of lust onto the same syntagmatic sequence of signifiers.

Now let's go back to shame. Why is shame the aftermath of sex? Elsewhere I have attributed it to the loss of voluntary control of the skeletal muscles during intercourse.[18] A function normally invested in the cognitive networks, the initiation of control over the skeletal muscles, has been pre-empted by a "stranger" in the body (a subcortical brain center) and a sense of shame accompanies this loss of control.

Let us assume a lust sequence in which disgust is caused by shame at the loss of muscular control. And let us assume a system sufficiently sexually experienced to have explicitly formulated the lust sequence (Figure 7). The final couplet is concerned with the inability to use knowledge of the sequence to prevent participation in the sequence. I submit that inability to use that knowledge also engenders disgust (despair, shame, etc.) and that that is a rather different phenomenon from the response to loss of control over the skeletal muscles. Concrete lust engenders concrete shame; abstract lust engenders abstract shame —"a waste of shame" is also a pun.

Concrete shame is the result of the role which subcortical brain structures play in the control of the muscles. Abstract shame is the result of the effects of subcortically organized biochemical processes on the cortical neural tissues in which the cognitive network is embedded (Figure 6). The final couplet of the sonnet asserts that both are inevitable. As such it embodies a more realistic account of the nervous system (in which it is embedded) than that presupposed in a morality which demands rigid self-control.[19] And that more realistic account plays an important role in maintaining the stability of the control system of which it is a part.

There is no way the system can execute patterns made unavailable through biochemical means. Any attempt by the gnomonic system to maintain control will simply end in failure. But it is that failure which the gnomonic system is trying to eliminate. Another attempt to eliminate the failure, to master the situation, will inevitably fail. The system is hopelessly locked into the pursuit of an aim it cannot achieve.[20] To say that the gnomonic system's attempts to maintain control can be restored is to say the system is out of control. The only way control can be restored is to admit that control is impossible—a very para-

doxical strategy. Only through learning that the lust sequence is inevitable can the system eliminate that failure attendant upon attempts to avoid lust. By not attempting to avoid sexuality the system frees itself of that abstract which follows the inevitable failure of its attempts. If you don't attempt to do something then you can't be disgusted with yourself for a failed attempt.

Notice that this strategy for avoiding abstract shame doesn't in any way eliminate the cause of concrete shame. The system must still deal with that—perhaps deciding that it too is acceptable. But at least one source of pain has been eliminated.

So, the first twelve lines of sonnet 129 are based on an abstraction defined over the three-phase lust sequence: DESIRE, CONSUMMATION, SHAME. This abstract pattern is rationalized in the terms of Elizabethan faculty psychology. The final couplet is the rationalization of a cognitive structure which restores a measure of stability to the system by asserting that lust is inevitable, the lust sequence is unavoidable. As such it must be defined over an episodic structure which records attempts to avoid lust by using inferences employing the structure of Figure 7. Thus if abstract lust is defined by a gnomonic pattern of rank N, then the abstract pattern defined over episodes containing inferences guided by the pattern of abstract lust must be an abstraction of rank $N + 1$. Thus *Th'expence of Spirit* is based on a conceptual structure spanning (at least) two abstractive ranks.

Having expended all this effort on an account of the conceptual base of *Th'expence of Spirit*, I've said relatively little about why this particular embodiment of that conceptual structure is a work of literary art. That is because I have relatively little to say about poetics from the standpoint of cognitive network theory. The subject is, at present, just too difficult to yield much which can be used in the practical analysis of the poetic features of literary texts ("poetic" taken in a broad sense to mean those devices typical of literary art in any genre). Such analysis requires a deeper account of the linguistic channel of the system than is currently available.

But I do wish to offer a final, and very general, speculation. A long intellectual tradition going back at least as far as Plato's assertions that poets are inspired albeit mad, associates literary creation with involuntary utterance, with inspiration. Involuntary utterance (or Yeatsian automatic writing) implies the involuntary movement of the skeletal muscles. It is thus like sex. Could it be that many of the peculiarly poetic devices of literary art facilitate involuntary, inspired, utterance?

RENSSELAER POLYTECHNIC INSTITUTE

1. On computational linguistics see William L. Benzon and David G. Hays, "Computational Linguistics and the Humanist," *Computers and the Humanities*, 10 (1976), 265-274; for cognitive and perceptual psychology, William T. Powers, *Behavior: The Control of Perception* (Chicago: Aldine, 1973), Ulric Neisser, *Cognition and Reality* (San Francisco: Freeman, 1976); neuropsychology, Karl Pribram, *Languages of the Brain* (Englewood Cliffs: Prentice-Hall, 1971), Robert W. Thatcher and E. Roy John, *Foundations of Cognitive Processes* (Hillsdale: Lawrence Erlbaum, 1977). The cognitive network theory of David G. Hays can be found in the following: "Networks, Cognitive," *Encyclopedia of Library and Information Science*, 1976; "On 'Alienation': An Essay in the Psycholinguistics of Science," in *Theories of Alienation*, ed. R. Felix Gever and David R. Schweitzer (Martinus Nijhoff, 1976); *Cognitive Structures* (New Haven: HRAF Press, 1980).

2. The reader wishing an entree into those discussions can begin with Richard Levin, "Sonnet CXXIX as a 'Dramatic' Poem," *Shakespeare Quarterly*, 16 (1965), 175-181; Roman Jakobson and Lawrence Jones, *Shakespeare's Verbal Art in* Th'Expence of Spirit (The Hague: Mouton, 1970); Helen Vendler, "Shakespeare's Sonnet CXXIX," in *I.A. Richards: Essays in His Honor*, ed. Brower, Vendler, and Hollander (New York: Oxford, 1973).

3. For a detailed account of the sonnet's movement through these episodes see William Benzon, "Cognitive Networks and Literary Semantics," *MLN* 91 (1976), 952-982.

4. C.S. Lewis, *The Discarded Image* (Cambridge University Press, 1970), E.M.W. Tillyard, *The Elizabethan Worldview* (New York: Vintage, n.d.).

5. The following discussion of the network model and of Shakespeare's poem is based on the detailed presentation in William Benzon, "Cognitive Science and Literary Theory," Diss. SUNY at Buffalo, 1978.

6. Freud's theory of the unconscious underwent continuous alteration, but the following article is representative, Sigmund Freud, "The Unconscious," in *Collected Papers*, IV (New York: Basic Books, 1959), 98-136.

7. Roman Jakobson, "Two Aspects of Language and Two Types of Aphasic Disturbances," in *Fundamentals of Language* by Roman Jakobson and Morris Halle (The Hague: Mouton, 1956), 69-96.

8. Talcott Parsons, *The Social System* (New York: The Free Press, 1951), 10-11; David G. Hays, "Language and Interpersonal Relations," *Daedalus* 102, No. 3 (1973), 203-216.

9. Lev Semenovich Vygotsky, *Thought and Language* (Cambridge: MIT Press, 1962).

10. *The Structure of Scientific Revolutions*, 2nd ed. (Chicago: University of Chicago Press, 1970).

11. See Pribram; Neisser; Thatcher and John.

12. The literature is extensive, for a start see R.E.L. Masters and Jean Houston, *The Varieties of Psychedelic Experience* (New York: Dell, 1966); Charles Tart, *Altered States of Consciousness* (Garden City: Anchor/Doubleday, 1972); Solomon H. Snyder, *Madness and the Brain* (New York: McGraw-Hill, 1974); Ronald K. Siegel and Louis Jolyon West, *Hallucinations* (New York: John Wiley & Sons, 1975).

13. Roland Fischer, "Cartography of Inner Space." in *Hallucinations*, p. 199.

14. Perry Black, ed., *Physiological Correlates of Emotion* (New York: Academic Press, 1970).

15. See any decent textbook in neurophysiology, such as Murray L. Barr, *The Human Nervous System* (New York: Harper & Row, 1972); Peter L. Williams and Roger Warwick, *Functional Neuroanatomy of Man* (Philadelphia: W.B. Saunders, 1975).

16. Charles E. Osgood et al., *The Measurement of Meaning* (Urbana: University of Illinois Press, 1957).

17. Roman Jakobson, "Linguistics and Poetics," in *Style in Language*, ed. Thomas Sebeok (Cambridge: MIT Press, 1960), 350-377.

18. See Benzon, "Cognitive Science and Literary Theory," pp. 46-59, 312-315.

19. For an account of the ultimate futility of such self-control see Powers, pp. 250-252.

20. I am reminded of the account of alcoholism given by Gregory Bateson, *Steps Toward an Ecology of Mind* (New York: Chandler, 1972), 309-337.