SEMIOTICS
AND SYMBOLISM

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The evolution of language abilities may have begun as far back as 2.5 million years ago, and was well under way by the time *Homo erectus* evolved some 1.6 million years ago. We have no way of knowing what language was like, how extensive was the vocabulary, or what quality of thought was promoted by any early proto-language. Not until 80,000 years ago do we begin to see evidence of reflective consciousness in the production of art, the burying of the dead, and the care of the injured.

30,000 years ago the phases of the moon were carved onto a piece of bone, indicating the surprising evidence of observation, abstraction, and documentation. But there is little additional evidence of this kind of cognitive skill until 17,000 years ago when cave paintings begin to appear in abundance throughout the area north of the Mediterranean.

The first evidence of recorded symbolic activity is artistic, the reproduction of visual and tactile form. Paintings reproduce visual form; sculpture reproduces tactile form. Sculpture may be built upon the preliminary skills involved in fashioning stones and other objects for practical uses, but sculpture represents a cognitive departure from tool use when it begins to embody aesthetic purposes. Humanly created artifacts like sculptured figurines are psychologically significant because they indicate an ability to "see" something in the imagination before rendering it in clay or stone. The gradual refinement of tool cultures is evidence of this ability steadily improving over the long two million year span preceding the advent of civilization. The cognitive "structure" of the object has to be built up in imagination and held in memory as the craftsman begins to make it take shape in a physical medium. This is the evidence that tells us that a certain level of cognitive ability had been developed by the time these objects were created.

We can only imaging the extent to which language was employed at various times over the past two million years. Many animals employ vocal sounds to express themselves. There are elaborate signal systems in animals as diverse as birds and monkeys, dolphins and whales. These systems of sounds constitute a means of communication, like the famed dance of honeybees. There is intelligence implicit in this kind of activity. But we should be careful not to attribute to animals the kind of reflective, and self-reflective consciousness humans have. Animals have intelligence and awareness, but their thinking is connected directly to environmental events and their behavior is largely instinctual. Humans have these capacities also, but upon that immediate and instinctual base humans evolved languages that are able to house reflective consciousness, and refined cultural systems that add whole new domains to cognition and new ranges of affective experience. We are justified in seeing these additional refinements as emergent qualities, and not merely as extensions of abilities that exist elsewhere in the animal kingdom. Once humans began to represent objects and ideas with symbols, and began to use those symbols in abstraction from the events that gave rise to them, intelligence entered a remarkable new phase of development.

Originally, humans made sounds as other animals do, to signal distress, to signal interest, to signal warning, etc. Humans also had the ability to mimic, to make sounds representative of other humans, of animals, or of thunder, etc. This ability to capture and reproduce some quality outside ourselves is referred to as **mimesis**. The ability to mimic serves as the foundation for later developments. Let us imagine a band of humans residing in a cave twenty thousand years

ago, one of whom has the odd habit of grunting "ungf, ungf, ungf" when he is working on something. Behind his back, other members of the tribe amuse themselves by mimicking this noise. The recognition and the connection between the sound and the individual being mocked forms a basis for humor. In that person's absense, though, the uttering of the sound "ungf" serves to call that person to mind. The thought-image of that individual can now be evoked simply by grunting the familiar sound. The sound signifies that person. With sufficient use of this sound, "ungf" becomes a label, or what we would call a *name* for that person. If it passes into language, Ungf becomes a symbol for that person. Onomatopoeia (ie. words that sound like the thing they signify) suggests a transition between words which signify, and words which in later linguistic development serve to symbolize. We will look at the distinction between *signs* and *symbols* in a moment.

Mimesis is used in other ways to communicate. Besides mimicking sounds, we can mimic actions, facial expression, postures, and other features. Our cave dwellers can indicate thirst by imitating the act of drinking; they can indicate hunger by mimicking the act of eating. They can indicate prey by pretending to throw a spear, or putting their hands up to their heads and mimicking the sight of antlers. Each of these pretend acts embodies the actual act that it imitates. Imitation, mimesis, is a strategy for learning. It helps the learner internalize features of the external world, such as a pattern of human activity. Play serves this function in both young animals and children. Play is mimetic.

Objects can also be imitated by a drawing. The term **represent** (re-present) means, literally, "to present again." Movement of the hands can indicate the pouring of water, which is an action, but shapes or forms can also be imitated. The shape of an animal, the shape of a tool or food item, the shape of a clay pot, a simple geometric figure, may all be imitated by motion of the hands as if the hands are passing over or handling the object. The hands can be used to form clay into the shape being imagined. The hands can also record a shape by scratching its image onto a surface – an image made in the sand, an image made on clay, an image scratched onto a rock surface, or an image painted with blood or made using charcoal from the fire. This, too, is a kind of mimesis, a re-presentation of an image in the absence of the object itself. The drawing of a tree evokes the memory of the image of trees. It may be a particular tree, but it may also be simply trees in general. In these first primitive acts of representation and mimesis we see the beginnings of human cognitive activities that would eventually blossom into art, into writing, and into our human ability to abstract forms and ideas from physical objects.

A drawing can be used to represent an object. A drawing of a reindeer on a cave wall represents the reindeer itself. Writing systems began with simple drawings to represent objects and with marks to represent amounts. In this manner the amount of taxes paid, sheep traded, or other items accounted for could be recorded. This kind of written device extends memory.

The images used to represent an object in early writing were eventually simplified, but also distorted from the original image. When this occurred, it became necessary for the reader to learn which symbol to associate with which object.

In addition to objects, pictographs could be used to represent ideas, concepts, actions, and so forth. The symbol now tended to have little or no literal meaning. One could not "see" the idea in the image. These symbols are called ideographs, and in order to read the meaning the learner had to be schooled in their use.

A major advance in writing systems took place around 3400 BC in Mesopotamia (the area now Iraq). Ideograms evolved into pure symbols called cuneiform. In cuneiform writing, the medium of wet clay dictated a different kind of representation. Since it was easier to press a reed stylus or wedge into clay than it was to draw pictures in it, cuneiform was made up of dots and wedges, and each idea represented in this system required a different pattern of these marks.

Unfortunately, in any writing system that seeks to represent each idea, action, or object with a separate symbol, a minimum of about 6000 different symbols is generally needed.

Occasionally in the history of intellectual culture some genius hits upon a strikingly original idea. That happened in the development of writing. The most stunning invention in the entire history of writing was the development around 800 BC of symbols that were used to represent the sounds of the spoken language. This kind of writing system is known as a **phonetic alphabet**. The one we use is a direct descendent of that original system developed by the Phoenicians and adopted shortly thereafter by the Greeks, and from them the Romans.

The archaeological record indicates that humans may have spoken languages for at least a hundred thousand years. We do not know how complex those languages were, or the speed with which they moved away from descriptive and prescriptive utterances to more creative and speculative uses. We do know that by the time writing came along, a mere four or five thousand years ago, the languages rendered into written form were already very complex, subtle, and capable of great beauty and contemplative depth. But there was a serious limitation in the ability to preserve ideas, so no matter how thoughtful an individual may be, most mental experience was fleeting. It is only with the advent of symbols that the accumulation of wisdom and thought, speculation and knowledge can begin its exponential growth.

To begin our discussion of language we should examine carefully this quote from Sapir:

"Human beings do not live in the objective world alone, nor alone in the world of social activity as ordinarily understood, but are very much at the mercy of the particular language which has become the medium of expression for their society. It is quite an illusion to imagine that one adjusts to reality essentially without the use of language and that language is merely an incidental means of solving specific problems of communication or reflection. The fact of the matter is that the 'real world' is to a large extent built up on the language habits of the group. No two languages are ever sufficiently similar to be considered as representing the same social reality. The worlds in which different societies live are distinct worlds, not merely the same world with different labels attached... We see and hear and otherwise experience very largely as we do because the language habits of our community predispose certain choices of interpretation." (Sapir, quoted in Hawkes, 1977, p. 31)

As we examine the role of symbols, the role of metaphors and other figures of speech, and the manner in which cognitive schemata are creatively acted upon, we should bear in mind the meaning of Sapir's suggestion. The physical world is one realm in which we exist, but as we humans have multiplied our symbolic systems we have created a vast intermediary structure that serves to constitute our mental landscape. Philosophers from the time of Immanuel Kant (two hundred years ago) have been careful to draw a distinction between <u>the-world-as-it-is</u> and <u>the-world-as-I-know-it</u>. We are products of our symbolic environment as well as of our physical environment.

SIGNS AND SYMBOLS

The human mind actively processes sensory data. The mind is a pattern-seeking mechanism. From a purely biological point of view, its purpose is to gather information about the environment and about the organism, and to affect movement that will increase chances of survival. Such activity is built into even the most basic life forms. Simple bacteria respond to environmental conditions, moving up the gradient of nutrition, down the gradient of acidity, though they have no nerves, and no nerve systems. Single-celled organisms process information in more complex ways. Multi-celled organisms begin to differentiate both cell types and cell functions, giving rise to nerve cells which transmit information to other cells within the

organism.

Initially, the information we harvest from our environment consists of millions of pieces of sensory date coming in from hundreds of thousands of individual sensory nerves. The eyes and the skin, the ears, the nose and mouth are all richly endowed with sensory nerves to harvest massive amounts of information about our environment. This information has to be coordinated to yield the "images" of reality that we experience. Such coordination is a matter of pattern recognition. Even before they are born babies begin learning how to coordinate sensory data into intelligible patterns. Intelligence works by matching these immediate "patterns" of sense perception with the memory of patterns experienced previously.

Gestalt psychology established the fact that the entire constellation of patterning at any given moment is experienced as a whole unit. That unit of perception is referred to as a **gestalt** (a German work, it means *pattern*). Within that gestalt the myriad details fit into sub-patterns, subordinate structures. Gestalt psychology attempted to describe the relationship between the entire gestalt, the structural patterns, and the elemental details. When we look into the night sky, we apprehend the whole sky as a gestalt. We also see individual stars. It is also interesting, though, that our mind quite naturally seeks out patterns among the stars. In ancient times these were the constellations, and many were endowed with mythic significance.. The mind not only discovers patterns, in a sense it also creates them. Thus, the mind is both a pattern-seeking and a pattern-making mechanism.

Phenomenology investigated this pattern making feature of the human mind. We do not passively receive the representative images of reality, we actually create them on the basis of patterns we have already acquired. We impose structure and order upon the chaos of sensory input in any act of perception. This helps explain why people from different cultures have different perceptions of reality – their pattern making abilities are constrained by different sets of prior images. The schemata they use to "make sense" of the world are acquired from prior experience, most of which is social and cultural.

In its simplest state the mind not only seeks patterns, but it also seeks relationships between these patterns. It looks for **structural homologies**. If I have seen a bear in the forest, and now I see another one, then I am able to recognize the one I am seeing as somehow "similar" to the one I saw before. Current perception is being matched in my imagination with the record of previous experience, and I know this is a bear because my perception of it is structurally similar to my memory of that other bear I saw before. From this kind of activity, matching similar items to one another, we form classes of objects. **Classification** is a basic cognitive activity. From our classification schemes, we then create abstractions – general ideas that cover a whole class of objects. The idea of a tree, the idea of a human being, the idea of a circle, a triangle, and so forth.

Having seen a bear in the forest, and having observed other bears, I form a general concept of this class of animals. Perhaps I admire the way this bear conducts itself. It is large, powerful, slow but strong, fearless. It moves quickly when provoked. *I admire these qualities. I see them in myself (or would like to). I compare myself to this bear. I identify myself as a bear. I am a bear...* This is how the imaginative act of totem operates to create a tribal or clan identity. I see patterns in the external world, and I use those patterns to organize my internal world, the landscape of my own mind. I use those patterns, taken from the natural world, to define myself.

The anthropologist, Levi-Strauss identified this imaginative act as a kind of logic unique to pre-literate peoples. He called it "bricolage." According to Terence Hawkes, bricolage "... refers to the means by which the non-literate, non-technical mind of so-called 'primitive' man responds to the world around him. The process involves a 'science of the concrete' (as opposed to our 'civilized' science of the 'abstract') which, far from lacking logic, in fact

carefully and precisely orders, classifies and arranges into structures the minutiae of the physical world in all their profusion by means of a 'logic' which is not our own.... The bricoleur constructs the totemic 'messages' whereby 'nature' and 'culture' are caused to mirror each other.

"A significant feature of the bricolage is clearly the ease with which it enables the non-civilized, non-literate bricoleur to establish satisfactory analogical relationships between his own life and the life of nature instantaneously and without puzzlement or hesitation. His 'totemic' logic is not only structured, but structuring: its use of myth enables it to move effortlessly from one conceptual level to another..." (Hawkes, 1977, p. 51).

From the raw material of sensory input the human mind seeks and identifies patterns. It compares these patterns from immediate experience with the memories of patterns already acquired. By this means it makes sense of current experience. The recognition of patterns is not a passive process; the mind not only seeks patterns, but it seeks to impose order on sensory experience by actively creating patterns. Where immediate recognition is not possible, patterns that are close may be used. When I see a hog for the first time in the forest, I may assume that it is a bear, since I have already seen bears. The hog "becomes a bear" for me. Once I have acquired a pattern – a conceptual scheme – I can "transpose" that scheme from its original mode of experience to another. This is what I did when I "became a bear." I took the schema of the bear and I imposed it upon my sense of my self. I became a bear.

So, let us think for a moment about how the schema for a bear can be used by human **imagination**: it can be used to build up a general concept of bears as a class of animals, it can be used to recognize new examples of bears as we come across them in the world, it can be used to rearrange our own internal sense of being (in the case of the bricoleur)... it can also be used to misinterpret a new experience (a hog, for example) or to become part of a wholly imaginative creation, such as in crafting a mythological "flying bear with the head of a lion, the wings of an eagle, and cloven hooves". In this last example, no such creature exists, but we have little or no trouble imagining it anyway. We simple detach the general concept of bears from any real instances of bears, and piece this concept together with other concepts we have – or portions of other concepts, such as the wings of an eagle, the hooves of a goat, the head of a lion. Mythological creatures like the griffin or the sphynx were never hard for people to imagine, and could be terrifyingly real.

Another thing I am able to do with my imagination is to **associate** one thing with another. Patterning is not strictly elemental. It is not the case that every object in the world has its representative pattern associated with it in my understanding and each item remains separate from every other item. Instead, I look for connections, or associations, between items. The whole of experience is a unified field, infinitely complex perhaps, but the manner in which I partition that field is culturally determined. Classification schemes are, to a great extent, arbitrary. The degree to which I isolate various features from one another, combine features with one another, or otherwise adjust the structural arrangement of my existence is all culturally determined. Smaller patterns can merge with one another seamlessly to become larger patterns. With great power and dexterity – imagination – the human mind looks for and imposes connecting relationships between objects in the world, and/or thoughts in the mind. It creates classification schemes that differ from culture to culture. Schooling is one of the means by which each member of our society acquires the ability to use these classification schemes in a standard fashion.

The human mind actively discovers "associations" and similarities between features of the environment. One bear is similar to another. All bears will therefore be seen as having an association with one another. They form a "class" of objects in my system of classifications.

Two features of the environment can also be associated with one another simply because

they occur together. I associate lightning with thunder. I associate heat with fire. I associate snow with the cold. When it becomes cold out, I begin to look for the snow. These are naturally occurring associations. But associations can also be arranged, as in the case of Pavlov associating the ringing of the bell with meat powder. As we will see, a certain mark on a piece of paper can be associated with an object, and so becomes a "symbol" for that object.

When one thing can be taken as evidence of another, we call the first thing a **sign** of the second. Smoke, for example, is associated with fire. We say that smoke is "a sign" of fire. The sound of running water coming from the woods tells us that water is up ahead; the sound of the water "signifies" the presence of water. The sound of the wind signifies that the wind is blowing, even if we cannot feel it from within our cave. The footprint of a bear signifies that one has passed this way. The scream of an animal signifies pain, even when we cannot see it in its agony.

In our primitive imagination, we see the entire world as a realm of signs. We see the world as a realm where almost anything can have significance, or meaning. The ability to signify is extended even beyond what simple association would tend to warrant. The flight of an eagle overhead can mean that the hunt will be successful today. The sight of a comet flashing across the night sky can become a sign that some great tragedy may soon befall us. We are prone to look for "signs." Yet these signs are not entirely arbitrary. They are probably based upon historical memories. A comet occurred once, and tragedy befell us, and now we know to regard the sight of a comet as a sign of ill fate.

The characteristic of a natural sign is that it has some kind of logical connection in experience to the thing that it signifies. The **signifier** and the **signified** are somehow connected. But the ability to continue making connections beyond those which are "given" in nature foreshadows the fertility of human imagination that would eventually lead to the crafting of whole systems of thought and meaning beyond those "given" by the immediacy of natural occurrences. So, once again, we have identified a naturally occurring act of the human mind – observation of naturally occurring associations between two or more events – and the extension of that act by the workings of human imagination.

Not all signs are found in nature. Humans can also make signs. A flag lowered to half mast signifies that someone important has died. Flowers presented to a loved one are given as a sign of our love. Gestures made with the hands can signal a greeting, a farewell, approval, or contempt. These are signs – gestures, objects, sounds, behaviors – that are understood by social convention to represent something else. Here the connection between signifier and signified is largely or completely arbitrary. The meaning is established simply by social agreement. Our reaction to signs, whether natural or man made, does not require a high level of processing. The sign causes us to react much as we would to the thing it signifies. The smell of smoke prepares us to respond as we would to the presence of fire. Simple behavioral conditioning turns one stimulus into a substitute for another. Pavlov's ringing bell operates more or less as a signal for the food that is imminent. Animals can often react to signs in much the same way humans do, but they do not react to symbols as we do. It is in the use of symbols that humans are unique.

Defining symbols, and making clear how they differ from signs, is not easy. To confuse matters somewhat, there are some instances in which a symbol may function as a sign, or can be mistakenly treated as a sign. A sign evokes a response appropriate to the thing it signifies. A symbol, as we are going to use the term in this course, is an arbitrary image which we learn to associate with something else. Furthermore, as Suzanne Langer explains, "Symbols are not proxy for their objects, but are *vehicles for the conception of objects*. To conceive a thing or a situation is not the same thing as to 'react toward it' overtly, or to be aware of its presence. In talking about things we have conceptions of them, not the things themselves; and *it is the*

conceptions, not the things, that symbols directly 'mean'." (Langer, 1979, pp 60-61). It is worth pausing for a moment to understand the distinction.

The most common of all symbols are words. A word brings to mind the conception of its referent. A word can sometimes be used as a sign. The word "STOP" on an octagonal red piece of metal posted along the side of the road is a sign which signifies a specific action to be taken by the driver. But in its more common usage, say when we encounter the word "stop" as we are reading a text, we incorporate the concept that this word stands for into the matrix of other ideas that we are processing. These written symbols evoke thought. Language may have begun, long ago, as signs. But modern languages are understood to be symbolic systems which serve to generate and structure the flow of thoughts and ideas. Symbol systems sustain entire realms of thought in pure abstraction (mathematics comes to mind). In so doing they create additional ranges of human consciousness that simply would not exist in their absence.

Consider how efficiently the word "apple" manages to evoke a whole set of conceptual features you would associate with that particular type of fruit. The word itself as you see it is made up of letters A-P-P-L-E which are symbols for the sounds of the spoken word, which in turn is a symbol for the concept of that type of fruit. The fact that the mind decodes these sequences of symbolic representation so efficiently makes it easy for us to overlook how complex these processes really are. As teachers, we find ourselves working at the social processes in which children acquire these abilities. There we do face their complexity because children struggle with the work before it becomes easy and automatic, and the processes can break down or hang up at any one of the many steps involved. We do not have the luxury of seeing these processes as easy and automatic – we must take the time to dissect how the mind manages its use of symbols, and how meaning emerges from these processes.

A symbol, then, is "an instrument of thought." They are, in Vygotsky's phrase, "tools for the mind." Symbols create those possibilities of thought that are uniquely human. Symbolic systems provide the structuring matrices of human consciousness.

Ernst Cassirer describes the difference between signs and symbols in this way. "Signals and symbols belong to two different universes of discourse: a signal is a part of the physical world of being; a symbol is a part of the human world of meaning. Signals are "operators"; symbols are "designators." Signals, even when understood and used as such, have nevertheless a sort of physical or substantial being; symbols have only a functional value." (Cassirer, p. 32)

Formal intellectual culture is built up from the intricate use of written symbols which serve to extend memory onto paper, and to provide a different dimension in which thought may be conducted. Practical mathematics, the counting of things or the measurement of space, is different from abstract mathematics because the one takes place in the physical realm while the other takes place in a purely symbolic realm.

Symbols do not need to have any logical or natural connection to the thing they represent. We humans simply agree to an association and live with it. Somewhere in the past someone decided that the symbol "+" would be used to represent addition. Sometime during the 1800s the phrase "is equal to" was replaced with the = symbol.

We say that the letter "S" is a symbol of the sound "s-s-s-s-s-s". It may have started out as an icon, perhaps as a representation of a snake, which makes a hissing sound and curves itself into the shape of a letter "s" as it moves. But if so, the iconic value has been lost to memory and the association of the symbol with the sound is now purely a matter of convention. It is a blunt association, a connection made simply by social agreement.

We say that the black dot with an extended line placed on the middle line of the musical staff is a symbol for a quarter note with the tone of "b", signifying both the duration and the tone of that musical sound. These associations take time to learn because they may not contain any

kind of intrinsic logic. It is not possible to see *why* this symbol is used to represent that object, or why the symbols for sharps and flats look the way they do. The association must simply be made by a process of repetition and familiarity. The symbol "6" has to be associated with the image of six items and the attention must somehow be focused not on the items themselves but on the number of them. Six apples, six pennies, six pebbles, six spoons... until the quantity of six stands out from the examples and is grasped as an abstract concept. As we are schooled we learn the symbol, we learn the meaning of the symbol, and we learn the use of the symbol. These meanings and uses are established in relation to the other symbols in the system. The whole gestalt of meanings has to be negotiated, revisited from time to time, and adjusted as necessary.

Once the symbolic connection has been established between the symbol and its object, then we are able to set the objects aside and operate only with the symbols. This is what we mean by **abstract thought**. In doing so, however, we entertain a very different manner of consciousness. Our thinking is different, and our awareness of that thinking is different. The advent of symbolic systems creates new realms in which human cognition may operate. New "semiotic" systems actually serve to extend the cognitive environment. But at the same time, something is lost to us. The immediate, purposeful and meaningful connection to the natural world recedes behind a wall of symbol-based cognition. From then on, thought is disconnected from the immediate, visceral "participation" of the mind in nature, and is constantly and ineluctably "mediated" by schemata produced from symbolizing activity.

Hawkes writes, "We should like to avoid describing negatively the tremendous revolution brought about by the invention of writing. But it is essential to realize that writing, while it conferred vast benefits on humanity, did in fact deprive it of something fundamental." (Hawkes, 1977, p. 50).

That "something fundamental" is the mental life of so-called primitive people discussed earlier. That mentality is different from the mentality of people whose mind is fashioned by association with others in cities, and by association with print medium and other semiotic systems. The easy assumption a century ago was one of smug superiority by "civilized" people over "uncivilized" or "primitive" people. That smugness remains, but its justification has been seriously eroded, both by a deepening awareness of the occasional evil, emptiness, and meaninglessness of modern life, and by the recognition that simpler ways of life have distinct advantages that are missing – having been traded off – in literate, techno-culture. Native peoples have been warning the 'civilized world' that the disconnection from nature is a spiritual tragedy of massive and irredeemable proportions. This caution is even recognized within "western culture" in the romantic protest against enlightenment values, as seen in the works of Rousseau, Goethe, Emerson, Keats, and others. But that is another topic.

The task before us, for better or for worse, is to begin to understand how symbols and symbolic systems (semiotic systems) participate in and contribute to our mental life and our intellectual landscape. We tend to think mainly of written and spoken language as the typical symbolic systems, though we should also consider some of the other familiar notation systems that serve to enable various formal intellectual disciplines. Mathematics is the most abstract and "pure" of our symbolic systems since its subject matter is entirely cognitive. Musical notation is not needed to produce music, but it does serve to increase the range, complexity of orchestration, and the permanence of our musical repertoire. We could also consider the arcane symbols used in electrical engineering to represent various components of electrical circuitry. A trained electrical engineer "reads" schematic diagrams much as the layman reads a book, deriving meaning from the way those symbols are linked together.

Symbol systems are those cognitive "tools" that, often in written form, allow us to record

and communicate ideas without the immediate presence and participation of actual things in the environment. Symbols allow us to entertain ideas because they serve by their presence to evoke those ideas. Some symbols represent things, physical objects, but symbols are also used to represent mental operations, aesthetic qualities, or anything else – anything at all – that the mind is able to grasp. We generally reserve the use of the term *symbol* for something that is designed specifically as a symbol, such as written notation systems. We refer to the symbols used in math, in music, in electrical engineering drawings, in formal logic, in literature and poetry, and so forth. But we should also realize that anything, anything at all, is, potentially, a symbol. Anything that evokes further meaning is a symbol. When we open up to this notion, we find ourselves in the formal discipline known as "semiotics."

Social arrangements are symbols of power or of subordination. The posture of a person – their body language – symbolizes their sense of self, their attitude, and their relationship to others. The architecture of a building, a community, a shopping mall, a church or cathedral, or any other public or private space has "semiotic" value. Symbols mean something; semiotics is the study of meaning derived from symbols. But in a broad sense, almost anything can be or become a symbol. The massive, sprawling field of semiotics that has evolved during the 20th century is a discipline that seeks to understand the meanings embedded in all of the various symbols and symbolic systems that constitute our world. Everything from the semiotics of cinema to the semiotics of human conduct, fashions, scents, bodily motions, and so on, has been looked at for its semantic content. Of course, the unavoidable problem with semiotics is that anyone can see almost any meaning in any thing.

METAPHOR AND OTHER TROPES

Metaphor is the dreamwork of language and, like all dreamwork, its interpretation reflects as much on the interpreter as on the originator. (Davidson, in Sacks, ed. p. 29).

The notion that the mind constructs the representative images of reality is tied up with the notion that the use of language is largely and importantly metaphorical. This view is in stark disagreement with the classical notion that language can be mapped precisely onto the real world with a kind of one-to-one correspondence between objects and symbols. Aristotle's view of metaphor and other tropes was that these figures of speech were unnecessary ornaments. A disciplined use of language, he believed, would be perfectly capable of conveying all meanings by using language in a literal manner.

Vico (writing in the 17th century) and others have disagreed with Aristotle's view. They have argued that the world does not consist of ready-made images which we can identify and name. Instead, it is our experience of the world that we are trying to identify and name, and in the process of doing so we not only clarify our meanings, we actually create them. This suggests that our use of language is interactive: it does not just name things after the fact of seeing them, but works to help us create meanings. It was not until we humans began to name things, to classify things, and to assign positions for all those things within an organized classification scheme that we began to see them in the way that we do. Our system of language generates meanings as it develops. If you do not believe this, it is easy enough to prove. Study a second language. Or purchase a comprehensive dictionary for your own language and begin adding to your own vocabulary, and you find that ideas begin to emerge from your mind that never could have occurred to you otherwise.

In this section we will examine what metaphors are, and how they are produced. We will look at other "tropes" (figures of speech) as well. We should bear in mind that this careful examination of metaphor is not undertaken simply to study creative uses of language, but is intended to shed light on an enormous range of creative activities. Metaphor-making is therefore

being viewed as a representative creative act. How does the mind come up with a metaphor, and how does the mind of the listener make sense of it?

The interpretation of metaphor and our ability to appreciate its significance as a linguistic device depends heavily on the way we view language. The following passage describes how a French linguist, Ferdinand Saussure, contributed to a realignment of our basic understanding of what language is and how it conveys meanings:

"Saussure inherited the traditional view... that the world consists of independently existing objects, capable of precise objective observation and classification. In respect of linguistics this outlook yields a notion of language as an aggregate of separate units, called 'words', each of which somehow has a separate 'meaning' attached to it, the whole existing within a *diachronic* or historical dimension which makes it subject to observable and recordable laws of change.

"Saussure's revolutionary contribution to the study of language lies in his rejection of that 'substantive' view of the subject in favour of a 'relational' one, a change of perspective closely in accord with the larger shift in perception mentioned above....

"... In short, [Saussure] proposed that a language should be studied as a *Gestalteinheit*, a unified 'field', a self-sufficient system, as we actually experience it now." [Saussure presented these ideas in a series of lectures between 1906 and 1911]. (Hawkes, 1977, pp. 19-20).

A similar change, in the method of analysis of kinship systems, was introduced to the field of anthropology by Claude Levi-Strauss. He demonstrated that it was not enough to indicate the nature of relationships within a tribe by simply designating the status of individuals. The relationships linking father and son, brother and sister, maternal uncle and nephew, husband and wife, for example, needed to be examined as a whole structure, and predictions could be made regarding portions of this whole system of relations based upon knowledge of other portions.

In both linguistics and in anthropology, the study of relationships, or structures, became a way of moving away from an excessively reductionistic strategy into one more capable of viewing complex fields as gestalten, and of recognizing patterns of relationship and interaction within those fields. To view language in a reductionistic manner inevitably leads to the tendency to see words as isolated units of meaning. It also encourages us to view metaphors in the most insignificant light, as words that have been plugged in for other words. If we insist on reducing linguistic analysis to the level of the individual word, then our interest in metaphor tends to focus on instances in which the metaphor is contained in a single word substitution, such as "George is a horse." George is not a horse, of course, but the metaphor (assuming George is a human) is intended to convey that George is in some respect like a horse. In that case, the conservative viewpoint would have to argue that we can do without the metaphor and just tell it like it is – just say directly in what manner George is like a horse, and be done with it.

The creative use of language is not constrained to the making of simple, substitution type metaphors. Metaphor – or something like it – operates at the level of word phrases, but also at the level of entire sentences, at the level of entire passages, and at the level of entire works, be they poems, prayers, or novels. The same process that produces a simple metaphor also elaborates into the creation of allegories and parables. Our interest in metaphor is that the process itself may be studied at a relatively simple level, and once we have understood how the mind plays imaginative games with the use of single words to make new meanings we can then turn to more complex acts of the imagination. We can discover how far more elaborate acts of creativity are possible, and perhaps why they are necessary. In Metaphor, Terence Hawkes comments on the powerful imagination of Coleridge:

"One of the first Englishmen to have read and pondered the work of Vico, Coleridge

conceives of metaphor as Imagination in action.

"His notion of the mind was revolutionary. He saw it as 'an active, self-forming, self-realizing system' (I. A. Richards, Coleridge on Imagination) which, far from being passive in the face of so-called 'reality', actually imposed itself on the world, and creatively adapted and shaped it. Imagination acts as the chief instrument in this process." (Hawkes, 1972, p. 43).

By imagination, we mean the abstraction and creative rearrangement of images – images of the mind, which can be visual images, auditory images, or even conceptual images. We will refer to such "images" as *conceptual structures* (Piaget spoke of schemata). These structures, somehow, are remarkably interactive, flexible, interchangeable, malleable. We want to know how.

All figures of speech are called tropes. There are different types of tropes. The main ones normally discussed in an essay of this sort are metaphor, simile, metonymy, and synecdoche.

Hawkes writes: "The word *metaphor* comes from the Greek word *metaphora* derived from *meta* meaning 'over', and *pherien*, 'to carry'. It refers to a particular set of linguistic processes whereby aspects of one object are 'carried over' or transferred to another object, so that the second object is spoken of as if it were the first." (Hawkes, 1972, p. 1).

Metaphor is different from simile. The difference is not minor. In a simile, every word retains its original meaning. To say that "Arnold is as ugly as a catfish" is to make a comparison between the aesthetics of Arnold and the aesthetics of a catfish, but every word in the sentence keeps its normal meaning. Something different happens in metaphor. "She's a butterfly," is not literally true when Arnold's sister is being compared to the elegant flying insect. It is a common metaphor, to be sure, but one that gains its effect on imagination by the very fact that it is not literally true. Confronted with this claim, the learner has to hold these two incompatible images (Arnold's sister; a butterfly) together and try to make them equivalent. Notice that some features of each term necessarily drop away, while new features from the second term become incorporated into our knowledge of the first – Arnold's sister ends up losing some characteristics of a human being and acquiring some of the features we would otherwise associate with a butterfly. In imagination, the metaphor causes features from each term or image to fuse together into a single representation. The rhetorical device is not necessarily precise or accurate (which is why the scientific mind avoids it), but it is striking in its effects (which is why the artistic mind embraces it). Somehow, the concept of a butterfly, and the concept of Arnold's sister, are not stable, fixed, permanent ideational structures. They are structures, to be sure, but they are fluid, dynamic, adaptable, transportable structures which we can take apart and rearrange in surprisingly versatile ways. And that is the point. If we can understand how this occurs in the making of metaphors, at a deep psychological level, then we can understand something generally about the workings of thought, perception, understanding, and imagination.

Before heading that direction, we will mention the other two tropes.

Synecdoche. According to Hawkes, "the word is Greek, derived from *synekdechesthai* meaning 'to receive jointly'. Here the transference takes the form of a part of something being 'carried over' to stand in place of the whole thing, or vice versa. 'Twenty *summers*' for twenty years; 'ten *hands*' for ten men; or, in Milton's Lycidas, 'blind *mouths*' for the corrupt priests."

Metonymy. "This word comes from the Greek word *metonymia*, derived from *meta* 'change' and *onoma* 'name'. Here the name of a thing is transferred to take the place of something else with which it is associated: 'The White House' for the President of the United States; 'The Crown' for the Monarch and so on. Clearly the process involves *personification*, and is closely related to that of synecdoche. The Old English form of transference known as *Kenning* involves the substitution of part for whole, as in 'the whale's way' for the sea, and so

could also be placed in this category." (Hawkes, 1972, p. 4).

We will focus mainly on metaphor.

In doing so we want to move quickly beyond the simplest metaphors in which one thing stands in for something else. Simple substitutions do not reveal the full effectiveness and creative power of metaphor. We want to consider the case of entire, elaborate descriptions in which one thing is being described but with the understanding that it is something else we are talking about. Poetry depends upon this use of language for the power of its imagery and for its capacity to shock us out of the lethargy of ordinary language use and to awaken complex and vivid images in the mind. It is in the conflict between literal and figurative language that a powerful dynamic is evoked. Thought itself is stimulated by the device, and that is a large reason why it is used instead of literal, exact meanings. The other reason, often suggested in the literature, is that metaphor creates new meanings that do not and cannot otherwise exist. Sometimes these novel uses of language pass into regular usage, and when that happens the metaphor becomes an "assimilated metaphor," and is understood thereafter to be merely a word used for a particular, now standardized meaning. When occupations other than farming were being developed, someone might have posed the question, "And what is your *field*?" meaning "Where is your *place* of work?" The field a farmer works in is, literally, a plot of land. The question is asking not what plot of land the other person works in, but the equivalent. It is up to the person being questioned to figure out how to answer the question when, in fact, he or she does not literally work in a "field." But after a while, with repeated usage, the word "field" simply acquires this additional meaning, and so the language expands.

"Why stretch and twist, press and expand, concepts in this way?" Max Black asks. "Why try to see A as metaphorically B, when it literally is not B? Well, because we can do so, conceptual boundaries not being rigid, but elastic and permeable; and because we often need to do so, the available literal resources of the language being insufficient to express our sense of the rich correspondences, interrelations, and analogies of domains conventionally separated; and because metaphorical thought and utterance sometimes embody insight expressible in no other fashion." (in Ortony, p. 34).

Let's take an example close to home. Suppose we were to make the statement that a certain calculus course serves the engineering curriculum as a *threshing machine to separate the wheat from the chaff*. The university in question does not literally participate in the threshing of wheat. Instead, the phrase is elliptical, meaning that some students who begin the course do not pass through to acceptance into the program. We could just say that. But the metaphor carries subtle undertones that suggest the unworthiness of those who do not gain admission. The slight condescension of the remark is cloaked in the reference to the harvest.

Or take another metaphor, mentioned in Black's article. The twenty-third psalm begins, "The Lord is my Shepherd..." While the statement may not be literally true, it is nevertheless a powerful image of the relationship between the speaker and his god. This metaphor creates an analogy to that of the shepherd and the sheep. It carries undertones of the gentle imbalance in power, the dependency and the meek personality of the sheep compared to the protective power of the shepherd. Scripture is full of parables and metaphors that convey insight by means of images which are created by indirect, poetic use of language. What makes this use of language powerful is the manner in which the one-dimensional quality of literal language is transcended and meaning is made to reverberate through layer upon layer of subtle reference, allusion, suggestion, and dynamic tension.

When President Reagan snarled angrily that the Soviet Union was "an evil empire," he drew upon a whole set of images that were in peoples' minds from having watched the original Star Wars movies. Reagan's statement had both a literal intent – it was an empire, of sorts, and

in his estimation it was an evil one at that. But the full power of his statement came from the fact that this other example of an evil empire – the Federation – had been neatly installed in everyone's imagination. By calling the Soviet Union an evil empire he pulled forth all of those powerful cinematic images and attached them to the image of Russia's imperialism. No one missed the allusion, and the Russians were deeply stunned by it.

BEYOND METAPHOR

How do metaphors work? Explanations of metaphor so often tend to resort to metaphorical language, since precise knowledge of the underlying mechanism is not yet available. Perhaps in time neuroscience, cognitive science, and other domains of biology and psychology will be able to produce an explanation of how complex cognitive structures are stored and utilized by the human mind. The time is coming, but it is not here yet. What we do know, however, is that the kind of activity that occurs in the making of metaphors is also present in other acts of the imagination. In the same way that we can understand cognition by studying visual perception, we can understand much about human creativity by looking at the more restrictive domain of metaphors.

Metaphor, simile, metonymy, and synecdoche function generally at the level of words or phrases. Strictly speaking, the term metaphor should be held to this level of organization, though there was a tendency throughout the 1980's to keep expanding its reach to include all kinds of metaphorical processes until "everything" seemed to be included. Those familiar with medieval writing recognize that metaphor, simile, allegory, parable, and, in fact, an entire world view can operate much like a metaphor. Christian theology is rich in symbolism and complex understandings woven into the poetic use of language. St. Augustine's City of God, written after the sacking of Rome in 410 A.D. is an early and extraordinarily powerful example of this. Augustine, following the dualism of Plato, suggested that the world must be understood as consisting of two "cities", the city of man (the earth), and the city of God (heaven). The city of man is the physical realm where the body dwells, where sin and corruption occur, and where we live our temporal lives. As we live our lives in the city of man, we condition our souls, and come to know the nature of good and evil, truth and falsehood, so that we may one day enter the City of God, the immortal, ethereal realm. This world serves a kind of allegorical purpose in the grand scheme of things.

Medieval and Renaissance writers built upon this elaborate parallelism between events in the world of flesh and events in the realm of the soul. It was because heaven itself existed that events in this world had meaning – meaning and significance far beyond their face value as objects and events determined by their physical properties. Dante (1265-1321 A.D.), writing almost a thousand years later, said of his Divine Comedy that it should be understood to operate on several levels – literal, allegorical, mystical, and theological.

It is a story about a journey, but the journey is an allegory for the soul's descent into hell and its eventual redemption. It begins...

Midway this way of life we're bound upon,
I woke to find myself in a dark wood,
Where the right road was wholly lost and gone...

How I got into it I cannot say,
Because I was so heavy and full of sleep
When first I stumbled from the narrow way;

By a literal reading it is a story about a man waking up to find himself lost in the woods. As an allegory, though, the "narrow way" is the way of righteousness, and the sleep he speaks of is the slumber of his moral reason. The dark wood represents the beginning of his descent into lost confusion.

Allegory is often defined as a kind of "extended metaphor" in which an entire story is understood to be about "something else." The story of a man lost in the woods is actually "about" the soul being lost from the straight and narrow.

ART

There are also allegories in painting which draw not upon words but upon images. Winslow Homer painted a picture of a farmer out harvesting wheat with a scythe. A simple enough picture. But look closer. Robert Hughes gives the following description:

"The painting that sums up the meaning, if not the whole story, of Homer's Civil War experience was done in 1865, a few months after Lee's final surrender at Appomattox. It is *The Veteran in a New Field*. Not one of his Civil War paintings shows a dead body, but this one allegorizes death. It has both a narrative and a symbolic level. A man in a white shirt, whose face we don't see, has gone back to his farm and is mowing the wheat, which stretches to the blue band of the horizon. His jacket and water canteen, lying on the ground, identify him as a former Union soldier. The composition is stark: one man, two planes of color – the stalks of wheat rapidly conveyed in ocher with umber streaks of shadow rising through them from the ground – and the crooked diagonal of the scythe, at the end of its swing. We are meant to think of Isaiah 2:4: 'and they shall beat their swords into plowshares, and their spears into pruning hooks: nations shall not lift up sword against nation, neither shall they learn war any more."

Those who saw the painting in 1865 would have needed no reminder that the Northern armies were largely volunteers, not professional soldiers; that they went back to a very different life after the South surrendered; that they all had something in common with that earlier ideal of American citizenship, the Roman general Cincinnatus, to whom George Washington was frequently compared.

"But why 'a *new* field'? The wheat is mature, the land (presumably) belonged to this veteran before the war. Here a darker allegorical level comes in. One of the commonest images

in writing and preaching about the Civil War was that of Death the Reaper. It was reinforced with Biblical texts, such as Isaiah 40:6-8: 'All flesh is grass, and all the goodliness thereof is as the flower of the field: The grass withereth, the flower fadeth: because the spirit of the Lord bloweth upon it: surely the people is grass. The grass witheresth, the flower fadeth: but the word of our God will stand for ever.'

"The new field of ripe wheat is meant to remind us of the soldier's previous, 'old' field: the ghastly battlegrounds where the ripe youth of America was mown down. (And two of the bloodiest battles of the Civil War, Antietam and Gettysburg, were fought in wheat fields.) Homer will not let you forget that this reaper was also Death. To make sure of this, he used a deliberate anachronism: the single-bladed scythe, Death's immemorial symbol but not an implement that farmers, in 1865, were apt to use. They reaped with the 'cradle' a scythe with five or six parallel slats to hold the wheat stalks – or, on larger and more prosperous farms, with the steam-powered harvester." (Hughes, 305-6).

This particular painting by Homer is an allegory. Allegorical meaning is not a feature of every painting, of course. But the fact that the device *can* work in painting as well as in literature indicates that it is not a purely word-based construct. The principle issue has to do with the illustration of one image or idea by means of another. The conflict and the similarity combined create a dynamic tension that evokes thoughtfulness in the mind of the viewer. The images thus obtained are not flat and one dimensional but dynamic, multi-dimensional, and shimmering. It churns complex schemata into action and causes us to move deeply beneath the 'surface' into the depth of things. Feelings and images come together to enlarge the sense of the image, the wholeness of the experience.

"So long as we live in a world of sense impressions alone we merely touch the surface of reality, Cassirer said, "Awareness of the depth of things always requires an effort on the part of our active and constructive energies. But since the energies do not move in the same direction, and do not tend toward the same end, they cannot give us the same aspect of reality. There is a conceptual depth as well as a purely visual depth. The first is discovered by science; the second is revealed in art. The first aids us in understanding the reasons of things; the second in seeing their forms." (Cassirer, p. 169).

SCIENCE

So far we have looked at how the mind makes use of its acquired schemata to perform acts of imagination and creativity in the symbolic language of words, such as in literature and poetry. And we have looked at a similar process in the arts, where the mind uses visual images in metaphorical and allegorical roles. In this section we turn to the way scientists make use of language and imagery, concepts and mathematical expressions in order to capture ideas and communicate them.

It helps to understand that, in the history of science, a major advance occurred around the turn of the twentieth century when the "logical positivists" attacked all use of figurative language and began to discipline the field to use language in a precise and literal manner. Newton had deplored those who generate "hypotheses", by which he meant speculative explanations rather than precise descriptions. This is not an easy distinction to grasp at first, but it is critical to an understanding of how modern science works, and how scientists think and communicate. Scientific work focuses on the practical goal of understanding physical processes in order to modify them. Scientists for the most part do not attempt to understand the reason the world is constructed the way it is, they simply try to understand how it is constructed and what one has to do in order to affect predictable change.

We can describe the effects of gravity – that an object is attracted with so much force to the earth and that it accelerates (falls) at 32 ft/sec/sec. But we do not know what gravity is or what causes this attraction. The old philosophers speculated that an object, such as a stone, falls because it has volition to return to its mother, the earth. This is the kind of explanation that positivism sought to get rid of. Separating what we actually know from conclusions, speculation, supposition, and so forth, is a tough discipline. As humans we crave metaphysical understanding. We want to know what purposes and meanings lie behind this magnificent creation. But science as a discipline rejects such speculation.

Still, science has its own version of creative image making in the crafting of models, theories, thought experiments, idealizations, and other conceptual **heuristics**. Each of these creative devices is intended to craft an image in the learner's mind that will organize understanding. The planetary model of the atom was a model, a visual analogy designed to help the learner "see" the arrangement of protons and neutrons in a central core and the circulation of electrons in orbit around this nucleus. The danger in models is that they become "reified" – we forget that they are temporary aids to understanding and we take them to be real (from the latin, *res*, meaning "a thing"). Atoms become real, and they are soon understood to be just like the model suggests.

Models, like metaphors, are props designed to aid the imagination of the learner to understand what the presenter has gleaned from experience. Pure understanding gotten from direct experience cannot be communicated, but must be put into the form of the symbols, words, images and mathematical expressions that comprise modes. The learner must then try to derive from these symbolic expressions a simulation of the original insight and intuition. Thus, the model acts as a kind of metaphor, producing a mental scheme that is structurally homologous to that original intuition.

Models also serve to simplify a concept so it can be worked with in useful ways. When physicists refer to a "point mass" of an object, this is a bit of mental shorthand, a way of identifying a specific theoretical point on or within an object where all of its otherwise distributed mass can be thought of as centered. When we describe inertia, force, density, light, matter, or anything else in science, in spite of ourselves we end up using language that breaches the distinction between literal and figurative. Even the most basic concepts – things like time and space – turn out to be surprisingly complex and allusive. Is space a thing, a substance that we fill with objects? Or is it a relationship between objects, having no independent existence in the absence of objects? If there were no objects anywhere, would space still "exist"? Is time a permanent, objective feature of the physical world, or is it a construct of the human mind? And to the extent that it is both, is there any way to sort out the respective influences of the-world-out-there and the mind? This was one of the questions that intrigued Immanuel Kant early in his career as a philosopher two hundred years ago.

Science is often defended as a purely logical, empirical and experimental process: *There is a world out there, which we can know, and which we can describe accurately.* But the process of both knowing and explaining is not as straightforward as this simple description suggests. Most of our knowledge of the physical world is suspended in formulae, models, theories and idealizations that are, to put it bluntly, artistic renderings of what someone has seen. Science ratifies these descriptions by means of sophisticated social processes and then quickly subordinates the metaphorical and creative elements of the description to the status of a literal explanation. This is not to say that science is a matter of elaborate deception or hocus pocus. To the contrary science is perhaps the most sophisticated and disciplined of all human activities. Its elaborate procedures are designed to minimize the intrusion of subjectivity into the conceptual modeling of the physical world. Compared to other ways of knowing, science accomplishes this

goal admirably, but even in spite of a complex methodology, the world out there is simply not as knowable as we often tend to assume, nor as determinate in nature as we wish it to be.

It was customary earlier in this century to place excessive emphasis on the notion of science as an "empirical"activity, meaning that knowledge comes from the world "through our senses." By learning how to use our senses carefully, we "discovered" how things were. Now, the problem with this kind of explanation became apparent only gradually as old scientific beliefs came under question and were gradually overturned by new understandings, based upon different assumptions, and upon different mathematical or conceptual models. The raw data of observation is not enough to yield a complete understanding of any phenomena. Understanding occurs only when we have organized that information by means of a conceptual model. And these models are manmade, artistic renderings built up from the language of mathematics, the language of visual imagery, the language of everyday speech or of scientific jargon, concepts, and so forth. Can there ever be a pure, objective view of something? Philosophers of science now argue that all observation is "theory laden," that the concepts we organize our understanding with actually determine what we are likely to see, and that we cannot see anything without having some kind of organizing theory to see with.

We have only recently come to appreciate the role models, formulae, idealizations, theories, concepts, etc. play in scientific understanding. Educational practices throughout much of the 20th century were based upon the assumption that science could be learned by empirical means, by careful observation. Jerome Bruner directed a whole generation of reform initiatives starting in the early 1960's based upon the psychological theories of Piaget. By engaging the learner in direct experience with the phenomena, Bruner and others naively assumed that the learner would "discover" for herself the same things scientists knew. *Discovery learning*, based on this assumption (that one learns about the world simply by observing it carefully enough) failed to produce the expected results. No matter how carefully students "looked at" phenomena, they did not "see" what scientists had learned to see.

When the original efforts at discovery learning proved unsuccessful, the strategy was modified to include even more "hands-on" experience. Articles were written on the virtues of "mucking about in science." Lab experiences were enhanced to provide more active participation by the learner in simulated experiments. Science was described then as an "investigative" process. So "hands on investigation" was added to the educational process. But again, no matter how much "experimenting" students did on their own, they still did not end up constructing the kinds of understandings scientists have.

Piagetian concepts of knowledge, which emphasized the roll of active engagement in the universe (ie. experience) for the construction of knowledge still tended to miss something critical, namely the role idealizations and other creative, conceptual modeling play in the learning of scientific understanding.

A second, related problem has become apparent in recent years. The things we kept hoping students would "discover" very often were not at all obvious. Much of our scientific knowledge actually runs counter to common sense and common observation. It is not obvious, for example, that heavy objects and light objects fall at the same rate, or that the earth is a sphere, or that the phases of the moon are due to the position of the moon relative to the positions of both the earth and the sun. Nor is it intuitively obvious that buoyancy is determined by density, or that density involves the ratio of mass to volume. Nor is it obvious that an object set into motion will continue that motion forever unless acted upon by another force. These ideas had to be sifted carefully from the evidence, and they then had to be framed within a manmade explanatory model in order to be grasped. No one 'discovers' these models by accident, especially when they are so subtle and so complex that it took the concerted effort of

generations of geniuses to create them in the first place.

Good science education requires some grasp of the philosophy of science, and its history. If we understand the nature of scientific knowledge clearly we will be less likely to expect students to learn from experiences that do not contain all the necessary components. Clear science instruction must somehow balance the use of hands-on experience with direct instruction by someone able to say, "Look at it this way" (through a particular model, theory, or mental construct). The hands-on portion of the learning is then valuable in helping the learner gain a feel for the phenomena and for then seeing the phenomena again in a new light as he or she maps the experience onto the conceptual model. Unfortunately, some teachers are hesitant to engage in direct instruction because they have been told, under the influence of Piagetian theory, that it is better for students to "construct their own understanding." This is a case of ideology getting in the way of sound practice.

By launching an attack on "telling students what they should know" we inadvertently got rid of something quite necessary. We got rid of the carefully constructed models and idealizations that are needed to frame an understanding of what we are looking at or experimenting with. It turns out that scientific knowledge results only in part from careful observation and experimentation. In addition to learning how to *look* at the phenomenon correctly, we also have to be taught how to *think* about what we are seeing. The theory and the observation have to come together in understanding before either makes sense.

MUSIC

One last exploration may be helpful before we hazard a notion of how the mind does these creative tasks we have been discussing. Let us consider, as Suzanne Langer and Ernst Cassirer did a half century ago, how the mind can take the schemata of a human emotion and transpose it into the schemata of a work of art. How, for example, does a musical composition come to embody such an unmistakable feeling of melancholy, of joy, of anger and turbulence, of gentle loveliness, of playfulness, or of sheer mental complexity? How can music embody the 'spirit' of the Caribbean, or the rationality of the Enlightenment mind? How are these embodiments in musical composition even remotely possible? What is it that the piece of music and the emotion have in common when the joy of a happy moment is somehow captured in a musical passage?

Langer and Cassirer were part of the same intellectual tradition Piaget was a part of, a semantic tradition dating back to Kant and Vico that attempts to understand the role of the mind in structuring our understanding of the world.

Instead of the word 'schemata' Langer used the word "form." The form of the emotion was said to be 'homologous' to the form of the music. But since they are not made of the same stuff, how can that be? What does an organized series of musical sounds have in common with a human emotion?

Is it the case that a melancholy musical passage is a kind of musical symbol? We are presented with the symbol, and it evokes the conceptual and affective structure of the emotion? That would suggest that the connection between the symbol (the music) and the emotion is largely a matter of cultural conditioning and association. And to some extent it may be. But most people would argue that the melancholy quality is somehow "in" the music itself. In the absence of some kind of unusual conditioning no one would mistake a funeral dirge for a love song or a military march for a lullaby.

Langer writes, "The tonal structures we call "music" bear a close logical similarity to the forms of human feeling – forms of growth and of attenuation, flowing and stowing, conflict and resolution, speed, arrest, terrific excitement, calm, or subtle activation and dreamy lapses – not

joy and sorrow perhaps, but the poignancy of either and both – the greatness and brevity and eternal passing of everything vitally felt. Such is the pattern, or logical form, of sentience; and the pattern of music is that same form worked out in pure, measured sound and silence. Music is a tonal analogue of emotive life." (Langer, 1953, p. 27)

Whew! We may have to come back to this question, in a moment.

SYNESTHESIA AND OTHER MODAL TRANSGRESSIONS

There is one more consideration I would ask you to bear in mind as we consider not only how metaphors work, but how other creative acts work. The neat thing about metaphor, methodologically speaking, is that metaphors remain within the domain of language. Ideas coded in language can be metaphorically engaged, and one idea therefore enters into comparison and contrast with another. The fact that the two ideas can be about two entirely different topics makes the understanding of metaphor a challenge. But the fact that metaphor itself is conducted through the medium of language keeps the challenge somewhat manageable. Metaphors work when the two ideas share a common configuration, a common positioning and arrangement within their respective cognitive spaces.

Language is central to our human consciousness, and metaphor is the quintessential creative exercise in the use of language, but there is some important truth to the notion that metaphor is a very restricted case of a far more ubiquitous feature of the human mind. In many cases, our creative abilities do not operate inside of a single cultural domain. Ideas from literature can find expression in graphic art, for example, or concepts from science (like relativity) can find expression in poetry. Nor do schemata derived from one sensory channel (sight, for example) become restricted to that sensory mode when imagination operates. A visual input could be used to fertilize visual imagination, but it could also find expression in music, in logic, in art, in poetry, and so forth. In other words, experiences produce schemata, but those schemata are free to roam.

To understand human creativity, we should recognize that, once a neurological signal leaves the eye, the taste buds, the ears, the skin, or the olfactory bulbs, it becomes identical to all other neurological impulses. These impulses travel as biochemical signals along neural pathways, into the brain. There is no physical difference between the manner in which the information from the eyes is transmitted to the brain and the manner in which the information from touch is transmitted. All sensation enters the brain as neurological signals, electro-chemical action, and the only reason one is experienced as sight and the other as touch is because the processing of these signals is managed by different portions of the brain. So, suppose a certain smell is experienced as a schemata "A", and a certain visual event is experienced as a schemata "B"; and suppose further that these two schemata, even though they were formed from different modes of sensory input, by coincidence have a nearly identical configuration (they are structurally homologous). Would it not be possible, then, to evoke a memory of event "B" by experiencing the scent "A"?

Sensory modes are generally kept distinct from one another in our conscious experience of them, though not always. There are instances when there is confusion between sensory modes. Hallucinations induced by psychotropic drugs can cause sounds to be experienced as visual images, or visual input to be confused with auditory experience. There are also some remarkable cases in which the same thing can happen naturally, a condition known as **synesthesia**. This condition has been known and described for about two hundred years. It occurs in about one person out of a hundred thousand. Even though it is a rare quirk, it does serve as evidence that the human brain is capable of transposing information between sensory modes rather dramatically. (Cf. Cytowic, <u>The man who tasted shapes</u>). In synesthesia, schemata

obtained through one sensory modality are interpolated into another region of the brain and experienced there. While the dramatic, vivid and uncontrollable condition itself is rare, all of us have inklings of this ability in our own creative moments. We do, in fact, speak of colors as warm or cold, loud or soft, and we do speak of sounds as rough or smooth; we do speak of taste as sharp or smooth, and we do experience pure concepts and ideas as if they had properties taken from the visual field.

There are some interesting testimonials from artists whose creativity is grounded in part in some kind of extraordinary condition affecting their senses. Mozart is said to have 'seen' his musical compositions as a kind of architectural structure. He could see an entire composition as a structural arrangement in the mental space before his mind's eye.

Creative acts have this quality sometimes, of crossing the borders between sensory modes or between expressive modes. In such cases, the individual is able to borrow schemata from one mode for use in another, and the resultant creation probably makes sense to the rest of us because we at least have had experience with that first mode and the schemata derived from it. A painter can hear a poem and see its subject matter as a painting. (How many artists have rendered in oil and canvas scenes from the Bible, for example?). An architect can contemplate the social or cultural image of a church, a corporation, or a family and create a building that is expressive of that conceptual imagery. A composer can create music from the aesthetic feel of a sunset, or other event in nature. Vivaldi's Four Seasons comes to mind.

Music is not altogether an "auditory" art, it can also be spatial, rational, emotional, visual, even kinesthetic. Painting is not a purely visual art; it also embodies concepts, emotions, ideas, tonality, texture. There are thousands of examples in the literature on human creativity in which visual imagery blends with conceptual thinking, in which a purely mathematical idea can be illustrated visually, or the sense of a musical composition can be transposed into painting.

Whatever imaginative process is working in these instances appears to be very ancient in human mental life. Mythology, totemic inventiveness, and mysticism involve transposition of conceptual templates within imagination. Our dreams also exemplify a free association and transfiguration of our acquired schemata, as Freud (1965) demonstrated so persuasively.

Dreams can even be a source of creative input to our waking lives. In the history of chemistry, a favorite anecdote is the story of Kekule as he attempted to understand the structure of benzene. He had a dream in which he saw the image of the Oroborus, a mythological snake eating its own tail and thus forming a ring. He awakened to realize that benzene was not based on a straight chain of carbon atoms, but that the 120 degree articulation of bonding sites on a carbon atom would allow the six atoms of carbon in benzene to form a closed ring.

What does all of this have to do with teaching second grade? It has to do with understanding fundamentally how the human mind makes use of the "subject matter" (wretched term) taught in schools, or how the mature human mind produces its complex mental life, based upon all the acquired schemata of a lifetime. Formalized cultural systems are designed to extend the inventory of a society's shared schemata. In effect, this extends the capacity of each citizen's mind. By teaching art, and science, music, history, literature, and all of the other subject areas we are ensuring that a broad range of mental experiences is shared by the members of the society and that in addition to these conceptual templates, these individuals will also acquire complex mental processes, which can also be converted by metaphorical action into use in a variety of situations. Teachers often do not understand why anyone should study a subject they do not need for their future job. Why study calculus if you are never going to be an engineer? Why study are if you do not intend to become an artist? Of all people, teachers at any level of schooling should be able to give a clear and insightful response to these questions, but more to the point, their own professional practice should be based upon a profound and deep appreciation

of the role formal cultural systems play in the life of individuals and in the life of the community.

Every coherent piece of sensory information becomes a "schema" – a patterned knowledge structure. Every new experience is a new configuration – a piece of information that corresponds to a physical change in some portion of the neurological structure of the brain. While the mental and the neural are closely connected and interdependent, they are not the same thing; one is ideational, the other is physiological. When we talk about a schema, we really mean the ideational configuration that is housed in our neurological substrate. Langer and others would make the claim that each of these schemata is characterized by its own idiosyncratic "form" or configuration. The raw material of cognition, gleaned from sensory input, from instinctive patterns already present, from the creative rearrangements, analyses, and syntheses of available schema *are all of a common coin.* Whether visual, auditory, tactile, emotional, or purely conceptual (eg. mathematical), all of our schemata are, potentially, capable of transposition to other sensory domains, regardless of where they originated. Furthermore, any of this material can find expression through any of our various cultural systems. When we create we do so by novel rearrangement of our schemata, and by transposing schemata between any of our various sensory or expressive modalities. Mastery of any domain of learning is bound to contribute a new richness to our work in any other domain. The The poet who gains a knowledge of modern physics obtains conceptual templates that are transportable back to poetry. The mathematician who studies music becomes a more versatile thinker. The graphic artist who masters the English language acquires additional powers of thought that will aid even in the creation of visual art.

We must take a moment to understand what is implied by this. Our human capacity for creativity is derived from the fact that our acquired schemata do not stay where they are supposed to stay, but are free to travel about in the mind and may jump in to any other neurological conversation. A schemata acquired from doing math becomes a configuration that can intrude on our musical ability, and when this happens we end up with music that embodies a rational structure, such as the music of the Enlightenment created by Bach, Hayden, Mozart, and others. The large ideas travel between knowledge domains as easily as the smaller ideas, and when they do they can set the tone for an entire cultural epoch.

So far we have only recognized that schemata are portable between sensory and cultural domains. It is not clear *how* this is accomplished. How can schemata characteristic of one sensory or expressive modality be transcribed for use in another? How does the mind know that such a transposition makes for an appropriate "fit"? How can a musical composition stand in for an emotion? What is it that the two share in common?

A THEORY REGARDING CREATIVITY

I have a theory I would like to share with you. It is not an original theory, nor is it one that can currently be proven. But it can be reasonably inferred from the nature of creative process. The idea is this: In an act of perception our brain harvests sensory input and organizes that input into patterns. Piaget called these patterns schema. Our brain can also call up other schema from memory. It can compare schema from memory to current schema, and if they are the same we can say that we "recognize" the object we are looking at as something we have already experienced. Somehow, the mind compares the two schema. One schema has been held in our long term memory until this moment, while the other is being processed in our present awareness, our consciousness. Some deeper mechanism of the mind is able to compare these two schemata. Now, if the two schemata are identical in content and form, then we say we recognize the object because we have seen it before. But how can we grasp a similarity between

two things that are not at all the same? How can a piece of music be so easily associated with an emotion, for example, when they are made of entirely different stuff? If it is not the actual content that is similar, then it must be the form. And somehow the mind must be able to experience the form. It is as if the mind "looks at" the schemata as an object. But the object it is looking at is not the object "out there" that we are looking at with our eyes, rather it is the pattern of neurological activity that has registered in our mind as we looked at that object. Our mind "apprehends" the form of this schemata. This kind of internal experience is called an intuition. It is not something we can be conscious of. Instead, we "feel" it.

I would like to suggest that any schema can be apprehended from a deep level of processing and treated as a cognitive object which has its own intuitively felt aesthetic quality, the main sense of which is a structural sense that we will refer to as its **configuration**. The configuration of any psychological schema, which we grasp intuitively, serves as a kind of icon, apprehended below the threshold of consciousness. This configuration is "felt" by intuition and that iconic quality then serves as a way of indexing it in memory. Two things can be seen as similar, even though they have nothing in common, when their schemata somehow end up with homologous configurations. When a piece of music can be equated with an emotion what do they have in common? One is sound, the other is affect. There are no external features common to both, yet the connection between them may be unmistakable, and viscerally "felt." This intuitive grasp of schemata probably is a function of our limbic system, at the level where all experience is reduced to a common neurological coinage, and where every schema is known not by its details but by its psychological form, or configuration.

Suzanne Langer uses the term "form" where I have used the term configuration, but her analysis is similar:

"All cognition of form is intuitive; all relatedness – distinctness, congruence, correspondence of forms, contrast, and synthesis in a total *Gestalt* – can be known only by direct insight, which is intuition. And not only form, but *formal significance*, or import, is seen intuitively (wherefore it is sometimes said to be "felt"), or not at all; that is the basic symbolic value which probably precedes and prepares all verbal meaning

"The comprehension of form itself, through its exemplification of formed perceptions or "intuitions," is spontaneous and natural *abstraction*; but the recognition of a metaphorical value of some intuitions, which springs from the perception of their forms, is spontaneous and natural interpretation. Both abstraction and *interpretation* are intuitive, and may deal with non-discursive forms. They lie at the base of all human mentality, and are the roots from which both language and art take rise." (Langer, 1953, p. 378)

What I am suggesting and what I believe Langer was alluding to, is that somehow, deep within our psychological apparatus, we have the capacity to utilize the intuitive feel of a schemata's configuration as a separate kind of information. It is this configuration that gets transposed between modalities. The shape of visual information can be similar to the shape of auditory information, even though color and sound are two different things. When these configurations coincide in structure they can stand in for one another and this seems perfectly acceptable to our understanding.

To summarize: Its **configuration** is the internal iconography of a given memory or experience. By intuition, that configuration can be perceived, but this "internal perception" cannot be brought up directly into consciousness. Thus, it is something we "feel" without being able to know it directly in consciousness. What we feel is not the experience itself but the particular configuration of neuron activity that represents that experience in cognition. This configuration is able to be transposed across sensory and expressive modalities. Moved from one modality to another, say from emotion to musical intelligence, it produces something new

which, nevertheless, reminds us of the original source. The configuration of an emotion, aside from the emotion itself, can be apprehended, transposed, and thereby expressed as music, as painting, as dance. The same emotion can be "expressed" in any of these performance modalities. Human imagination functions in part by transposing cognitive structures across domains.

EDUCATIONAL IMPLICATIONS

The transposing of schemata (or the transposing of the configuration of a schemata) across disciplinary boundaries may help to explain why a given historical epoch can exhibit a characteristic style in every dimension of its culture. A single powerful idea, insight, or ideological structure can serve as a central armature in every single field of endeavor. In classical Greece, the conceptual aesthetic characteristic of rationality became the root metaphor, and every discipline from mathematics to natural philosophy, theater, literature, music, architecture, sculpture, jurisprudence, and so on learned how to express that central conceptual motif in its various products. In our age, several conceptual themes have had a powerful influence on many domains of learning -- relativity, dynamics, evolution, and organicism have all functioned as central motifs and have found expression in every single branch of learning and creativity.

The major creative advances in any discipline are seldom wholly novel but are drawn from an ingenious metaphorical translation of ideas crafted elsewhere. For example, Saussure's contributions to linguistics (mentioned earlier in this article) included the substitution of a "relational" view of language in place of a "substantial" view. An analogous shift had just taken place in physics in the way space was being conceived of – not as a substance, but as a set of relationships between objects. Levi Strauss proposed a comparable insight for the way kinship structures could be understood.

We see similar structural and thematic homologies in the major ideas that define and permeate any epoch. Sometimes an idea is so powerful it seems to show up as a central motif in every art and in every science. Consider how the notion of process spread to every formal discipline since the advent of calculus. Or consider how the idea of evolution became transposed into many disciplines after the work of Darwin. As formalism once defined classical civilization, relativity, process, evolution, and the role of the subjective have come to define ours. In spite of Einstein's caution, relativity became generalized to every field, hence the slogan "there are no privileged frames of reference." Einstein never intended it as a defense of democratic liberties or a release from moral strictures, but potent ideas permeate their age in ways that are not always predictable. The idea that even moral and aesthetic values are "relative" shows how an idea pioneered in a specific context in physics managed to slip its harness and show up in other domains of human learning far afield from its point of origin.

Why bring all of this up in an undergraduate course in educational psychology? Isn't it all too speculative and too theoretical? Perhaps. Somehow it has become increasingly easier to define the goals of schooling in terms of marketable skills than in terms of cultural purposes. Culture is treated as if it is purely ornamental and only for highbrows. What a curious twist of circumstance. Democracy has always depended on the democratization of cultural powers. Yet we act as if that is no longer possible, necessary, or desirable. By defining ourselves narrowly as consumers and producers, we have also narrowed the scope of educational purposes. And then we wonder why education seems so "meaningless."

The whole scene is made very confusing when the compartmentalization of disciplines in the universities and schools is mistaken for a natural compartmentalization of culture itself. In the real world, culture is multi-faceted, but it is organically coherent and its various domains are

deeply interwoven. When we separate them in schooling we lose that sense of interconnection and wholeness. In addition to the compartmentalization of culture into disciplines, and the fragmentation of those disciplines into areas of professional specialization, we further obliterate coherence by the relentless reductionism that emphasizes the planning of lessons but neglects the planning of curricular purposes. Our ancient tradition of education, in any society, is based upon immersion into the life of the tribe and the telling of an epic tale. The story we should be telling is the story of how our shared cultural resources evolved. Schools are built specifically to manage induction into those elements of culture that cannot be taught by the actual living of life in the social setting, namely those formal intellectual disciplines that require mastery of a symbolic system to understand. The teaching of the elements and the basics, facts and algorithms, must be balanced with a purposeful exploration of the overall coherence and the large scale patterning that also define the culture. These patterns are large in scope, and cannot be alluded to in hermetically separate lessons. Something in the design of the whole curriculum must somehow sustain those patterns in order to bring them before the learner's purview. The historical treatment of culture, developing over time and finding expression in various ways is the underlying purpose of *Ourstory*, seen either as a heuristic in teacher education, or as a model for curriculum design.

In the old days, Plato thought that the structure of reality was a property of an external world, a realm in which ideational "Forms" were almost hopelessly remote from human reach. He believed they were a permanent, immutable, immortal feature of the universe. Rationalists continue to maintain this notion, in a more restrictive sense, and find its closest access in the elegant beauty of mathematics. Empiricists see structure not in some external, other-worldly realm, but in the arrangement of matter itself, a structure that the human mind then "reads off" from its inspection of the natural world. Whereas a realm of pure ideas appeals generally to mathematicians, this empirical world of experience is what appeals to scientists. Philosophically they therefore tend to be empiricists.

Is the structure of our world a property of the physical world, as empiricists would have it? Is it a property of an ideational realm beyond the physical realm, as platonists would have it? Kant questioned both of these positions, and suggested a third possibility, that the structure we perceive is actually being supplied by the human mind.

In recent decades a fourth possibility has been suggested, that the "structure" of reality is neither a property uniquely of the-world-out-there, nor of a distinct realm of Platonic Forms, nor an inherent feature of the human mind, but that it is largely a product of our various cultural systems, including our languages, our theology, our literature, our mythologies, our epic tales, our science, and so on. This is the alternative that has largely replaced Plato's notion of a realm of permanent, immutable forms.

Philosophers will sustain this debate by selecting a single one of these options and arguing it toward exhaustion. The rest of us will recognize that, somehow, there is "structure" inherent (and acquired) in the mind, in nature, and in our cultural and linguistic systems, and they all three interact in an eternal dance of mutual assimilation and accommodation. Not so much a dialectic as a "multi-lectic, a conversation of many voices and many influences." We are not so organically isolated from the world as any of these separate philosophical formulations would suggest. Clearly, there is an ongoing resonance between the world <u>and</u> our minds <u>and</u> our cultural systems. The virtue of the historical approach that is used in *Ourstory* is that it relieves us from having to speculate on *why* things work the way they do in the relationship between the individual, the society, the culture, and the natural world. The focus, very pragmatically, is upon the manner in which successive developments in the cultural tool kits of humankind have changed the conditions of human life and of the human mind. When new

cognitive tools are acquired, they enter into the relationship between humans and their environment and modify that relationship in significant ways. We can understand the significance and the relevance of school subjects better if we can see how those disciplines have changed the way we live.

You will not end up teaching a curriculum like Ourstory. But it will be beneficial for you to undergo the process of seeing how it could work and understanding how it incorporates so many of the ideas and concepts we have discussed. You will find it easy enough to adopt some aspects of this approach to your own teaching. Most cultural offerings are simply better understood if they are seen in the context in which the were first created by humans. To make this presentation coherent, it makes sense to use the framework of cultural history as an organizer.

CONCLUSION

The central, defining purpose of schools is to teach the various school subjects. The reason to do so and the reason for students to be motivated are the same – learning these subjects empowers human beings. We can specify some of the ways in which that empowerment takes place, but if we insist on trying to prove this point our effort will end up emphasizing the tangible, and obscuring the spiritual, aesthetic, and philosophical. Material benefits are inherently easier to account for than any other. This is why our practical politicians can only see the benefit of math and science, and are often unable to understand the usefulness of the humanities and the fine arts. Yet it is these disciplines that so often provides the cutting edge of cultural advancement, even ahead of advances in the sciences. The historical record provides the description of our cultural empowerment writ large. We just have to learn how to read it. We can, of course, gain some of that historical insight through reading and reason, through words and ideas, but the kind of learning *Ourstory* embodies is one in which the learner is transported back in time and is taken to the places and into the events in which significant cultural advances took place. It is good to learn about these events, but it is better somehow to relive them, to experience them, to participate in them viscerally. In this way, we engage the whole person in the process of learning, and new members of the human race are given, as their own, those very experiences and advancements in culture which ultimately served to shape who we are. If we could tell the story, and tell it well, then students would no longer need to question why they have to learn it. The reasons for doing so would be felt in their very fulfillment.

> *"The paradox of the poetic can be summed up entirely in this, that the elevation of feeling to fiction is the condition of its mimetic use. Only a feeling transformed into myth can open and discover the world.*
>
> *"If this heuristic function of mood is so difficult to recognize, it is doubtless because 'representation' has become the sole route to knowledge and the model of every relationship between subject and object. Yet feeling has an ontological status different from relationship at a distance; it makes for participation in things."* (Ricoeur, pp. 245-6).

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