Puppet Language: The Science of Communicative Play

Hypothesis: The puppet-dynamic is evolutionary behavior unique to human play that attracts, harnesses, and mirrors the forces of consciousness inherent in brain process. In this little thing we prop up by hand outside the self, the workings of the mind become manifest in a symbolic language, a language that children experience as larger-than-life, a language they speak instinctively.

The archetypal hand puppet is a physical form of internal mental states. It induces human play, audio-vocal and psycho-social communication. It synthesizes symbolic thought and visualization, emotion, humor, and nurturance.

Hand-held representations of clouds, planets, seeds, raindrops, gears, ears, germs and flowers are but a few isolated symbolic life forms part of an infinite symbolic and communicative species. They may be described as morphic fields of information capable of fostering evolutionary changes in educational behavior, and appear to possess the physical forms of automata that rely on the mechanisms used by the real brain. Like the flowering plants that once spread across a monotone green earth, these forms give rise to a multidimensional, integrated, ever-unfolding landscape for learning and discovery—the way the brain intended.

Play and Laughter

Play and laughter are elusive, subjective forms of behavior that infiltrate human communication. Communicative play, which combines elements of play and laughter, punctuates and facilitates thought and communication—but does not impede it. There is much research on the vocalization of animals, such as bird calls and animal calls, but related behavior of homo sapiens is largely overlooked. Laughter is both a universal private and social act.

According to Robert R. Provine, professor of neurobiology and psychology at the University of Maryland, laughter provides a foothold on the neurobiology of behavior. "It is a species-typical behavior common to human beings that gives us the opportunity to go back and forth between the neural circuitry and higher social act," says Provine.

Play and laughter appear to be different branches of behavior that lead to a common source. Both are private and social phenomena that are spontaneous, infectious, and indicative of some deeper neurological principles. Similarly, play behavior has roots that extend deeper providing the emotional trigger or tickle required for the typical explosion we take for granted as a "laugh." Play is a mammalian birthright leading to family life and education. Play has been identified as a
critical factor in socialization and child development. It is also the mental soil upon which great inventors and scientists establish their work. In an evolutionary sense, play is wellspringing of learning.

**Play Overlooked**

In the field of brain science and the study of behavior, play has been ignored. Paul D. MacLean, Senior Research Scientist in the Department of Neurophysiology at the National Institutes of Health, writes:

*In view of the prominence of play among mammals and its civilizing influence in human evolution, it is curious that it has received so little attention in neurobehavioral research. In one handbook of experimental psychology, for example, the subject of play is dealt with in less than a page, and in a three-volume handbook of neurophysiology, there is no reference to play.*

In the field of education, the subject of play fills bookshelves. Nevertheless, an article about play (Young Children, November, '94), a publication of the National Association for the Education of Young Children, Research Editor, Laura E. Berk, reveals an extraordinary educational blind spot: "a search of the literature reveals no studies of teachers' participation in young children's play."

According to Berk, in typical early childhood education settings play is not recognized as a primary basis in communication between adults and children and is used haphazardly depending on the individuals involved. Berk's disclosure suggests that play behavior between teachers and children is not viewed as an important subject for research. As you move up the institutional classroom ladder, play behavior is almost extinct.

Understanding play and its appropriate application will allow educators to make a significant instructional shift from the overreliance on words for communication into natural, biological drives such as play. If play can be defined as an evolutionary invention, there is, interestingly, a related a behavioral expression of play and communication unique to the human realm. This refers to play media, or what are commonly called "puppets."

**Puppets: Communicative Play Language**

In a popular vein, puppets are widely recognized for their beneficial influence on learning and social development. They exert a powerful influence on children of all ages. Puppet language is unique in its ability to help teachers and children learn from one another, grow, relate openly, to be self-confident and self-expressive. Speaking this language, a teacher can personally transform common learning barriers--oppositional behavior, negative moods, defensive attitudes--into a windfall of leaning benefits and surprises. Children become more responsive and motivated. Teachers find themselves suddenly having fun, unable to wait for the next day. Teachers who keep themselves and their emotions at arm's distance in the classroom are suddenly enthralled by the impact of puppets and their children's response to them. "This has been one of the most enjoyable first few weeks of school I can remember, wrote one teacher who had recently
discovered the medium. Puppets call up in teachers and children something spiritual and vital to a learning process struggling to rise above itself.

Stripped of its theatrical trappings, the hand puppet is a part of speech in a limitless learning language based on the need to communicate through play. Simple puppets made of paper are hand held ideas, a powerful, cost-free communication resource. Re-cast in this way, puppet language is akin to Fortran, the language that made computers programmable; puppet language works at the "high touch" end of the communication spectrum, making brain science "programmable" for the classroom from preschool to college foreign language classes. The elements of paper and play behavior constitute "a language of hand held symbols and concepts." The dynamism of puppetry may be harnessed and mainstreamed as a practical model of interactive play language.

That puppets appear to do this almost magically--teachers often observe behavioral patterns otherwise unnoticed--is actually a function of natural forces at work. Puppet language operates according to principles of biology and brain science.

Puppet Behavior & Brain Science

When used as applied behavior--that is, when they're not used as shills in the negative or manipulative sense--puppets represent a form of spontaneous, species typical behavior that induces predictable individual and group responses similar to behavior in other life forms with which we share common neurological building blocks. Like laughter, puppet behavior can be understood, quite literally, as a tool that provides insight into learning behavior. Puppets are at once a scientific looking glass and a mirror complete with a handle by which to gain an objective sense of our subjective selves.

Since linking puppets with brain science is sure to induce waves of contempt and ripples of curled lips, there are recent articles and studies which provide a context for serious consideration of puppets as valid subject of brain science. "Why Children Talk to Themselves," by Laura E. Berk, (Scientific American, November, 1994), explores the phenomenon of private speech of children. Berk's "Vigotsky's Theory: The Importance of Make-Believe Play," Young Children, November 1994, targets a critical link between play and learning in communication between adults and children that appears to be overlooked by educational researchers. By contrast, a paper entitled "Why Dogs Bark," presented at the 1993 American Association for the Advancement of Science annual meeting, suggests that the question raised here, "Why Children Talk to Puppets," offers a reasonable basis for research and broad interest given the need for education reform and brain science applications.

The concept of the left and right brains is well established. The concept of a Gut Brain (the brain that gives your stomach "butterflies") has been offered. "The Triune Brain," introduced by Dr. Paul MacLean, Senior Research Scientist in the Department of Neuropsychology at the National Institutes of Health, Bethesda, Maryland, establishes the biological and social relationship between play and learning in his book, *The Triune Brain in Evolution* (Plenum Press, 1990). His study of brain evolution explains the emergence of nonverbal behavior, emotional and
rational brain processes. MacLean views play as a product of evolution in mammals with its primary role in human socialization and learning.

The idea that puppet behavior could offer a practical handle on aspects of brain science was first presented by the author at a meeting of the Greater Richmond, Virginia Council of Science Educators, in March, 1995. It establishes the scientific basis for the "puppet dynamic" as an evolutionary fact of human behavior.

Brain science is important to the average classroom teacher. Exploring the deeper architecture and expressions of brain formation and function (and the behavior linked to these) will shed new light on how children are programmed to learn. Brain Science takes educators into the last and highest level expertise in education: to master the game, adults must be willing to engage in appropriate forms of communicative and conceptual play.

The brain has evolved as an incredibly complex selection and recognition instrument that works according to identifiable patterns and plans. Once educators begin to grasp its essential nature, teaching can begin to work in synch with natural principles.

A Handle on Brain Science

Three basic lessons educators can learn from brain science are as follows:

1. The brain is a selection instrument. It seeks new information on the basis of recognition--not instruction--and play. Play process provides ingredients that foster a healthy quality of mind: openness, spontaneity, unpredictability--all-important operating characteristics of the brain.
2. The brain's primary mode of communication is nonverbal and visual.
3. Play is an evolutionary invention linked to speech, nurturing, and learning in mammals and can be harnessed to drive the learning process and used to lead us into a greater understanding of our intelligence.

Play: The Taproot of Learning

MacLean's research includes an analysis of reptilian behavior and reveals 25 special forms of basic behavior that are also found in mammals. Those conspicuously lacking--nursing, maternal, audiovocal, and play--belong to mammals.

MacLean's research identifies and organizes brain mechanisms underlying nonverbal behavior forms, paleopsychic process and paleomentation|the bedrock brain program established by nature; the behavioral and neurobehavioral aspects of which are shared between animals and human beings. For example, the behavior known as "display" is common innate behavior in animals as diverse as lizards and monkeys, and is broadly involved in the organized expression of species typical, prosematic behavior of a ritualistic nature.
MacLean notes that primitive man may have learned that by covering himself he reduced the unpleasant social tensions arising from the archaic impulse to display and that this, rather than modesty, led to the civilized influence of clothing. It could be argued that the act of covering up the hand when slipping on a puppet has a similar effect of lowering tension in a class of children.

*Thus wrapped in the temporal puppet dynamic may be found the physical expression of neurological and evolutionary events foundational to human learning.*

In MacLean's outline of specific behaviors related to the older, reptilian brain formation, aspects of the puppet dynamic can be observed and identified in context of MacLean's criteria. Its effects are described in the journals of teachers who record its impact for the first time. "I can hardly believe that a paper puppet can be so magical." "The children were mesmerized."

What is mistaken for the "magic" in puppets may simply be the visceral workings of the brain's deeper nature in response to vocalization, movement, and visual information associated with a powerful species-typical behavior.

**The Biological Foundations of Play**

**TROPISTIC BEHAVIOR**

Tropistic behavior refers to the positive or negative response of an animal to partial or complete representations, whether alive or inanimate. "Tropo:" "a turning" as a plant towards sunlight/positive tropism. Tropism also signifies an inborn or innate inclination. Tropistic behavior includes behavior ethologists attribute to "innate releasing mechanisms." The OED uses an example of tropistic behavior defined and driven by play: "Gestures made by cock birds to attract the hens." Naturalist Conrad Lorenz referred to the unlearned response of animals to certain "sign stimuli" as innate motion patterns, recalling the actions of a cat or kitten at play. According to MacLean, ethological writing describes the stickleback fish as a favorite subject for illustrating a fixed action pattern. Red color on the belly of a dummy is sufficient for eliciting the fighting response of an adult male stickleback. More intense response is obtained by placing the dummy in a non vertical position.

In humans there is the infant's Tropic Response to features on the face, first smiling in response to 2 or 3 round circles. Students of human ethology draw upon illustrations from the visual and performing arts, commercial advertising. Tropic response can be found in patients' reports of what they see in inkblots. The puppet is a form of "sign stimuli" that elicits a positive or negative response. The individual or group response to a puppet and the child's assemblage of features on a puppet might suggest a form of self-identification, nonverbal, self-similar response.

A puppet has of course been colloquially described as a "dummy." Color, movement, exaggeration are all qualities in a hand puppet that capture attention when used with a group of children. When children attach themselves to a puppet, the dynamics of imprinting or identification are at work.
"Although I was inexperienced using the puppet with the whole class, I found it quite enjoyable and was amazed at the complete attention of the class." Another teacher: "They were so happy to see 'Who.' It was wonderful to watch them verbalize and converse. Their attention was fantastic: with no disruptive problems, they took turns, and needed no reminding to stay on task. They really worked harder and thought of very appropriate questions."

Observations of adults who are always with children report sudden, significant changes in behavior as a result of introducing their puppets. Their adult perceptions of the children are altered, as well. "I've seen a side of my students I will never forget."

Repetitious Behavior

Repetitious behavior is common to both lizards and humans. Ritual is an example of repetitious behavior: weekly church services, ritual, refrains, repetitive visual messages, such as a lighthouse beam, or participatory exclamations. Human examples that reflect repetition brain behavior include reenactment: a repeated performance in which a number of activities are meaningfully related (Eg. a learning drill or story reading which can be integrated or detached so that there is no meaning as when the eyes move over the page of book with no active input). A cardinal rule of the Reenactment Game: The greatest number of displays (charades, body movements) eventually wins out. Displays are comparable to exclamation points. MacLean cites the telephone that gets attention because of the number rather than the loudness of the rings. TV and radio advertisers apply this repetition strategy ad nauseam. Rote activity in a learning drill is reinforced and punctuated to create smiles and increase heart rates in the group. Another technique employs the puppet to signal a transition in activities.

DECEPTIVE BEHAVIOR

The snapping turtle's tongue is designed to fool fish into mistaking it for a worm. Even though the turtle is unaware of his tongue's power, it is a tool built into his nature. Similar illusion and deceptive behavior are at work in a fishing lure which may be viewed as a combined rod puppet and marionette. MacLean describes a dark spot on a green anolis lizard while performing a series of challenge displays makes the eye appear larger in size. The hand puppet represents hiding or filtering essential for communication and at the same time overcoming resistance. With its exaggerated features, movement, color, and vocalizations, the hand puppet functions for the teacher on the hand as irresistible, eye-catching larger-than-life bait that is alive and kicking. "My purpose," writes one teacher, "was to develop eye-contact and to encourage the use of the 'good morning' greeting."

"Students of behavior," writes MacLean, "might contend that it requires more guise and ruse to avoid failure than to achieve success. The capacity for patience, persistence, endurance is crucial," suggesting that the genetic mental chemistry for survival is an important, but overlooked ingredient in human education; not just imparting knowledge and testing for its retention, but calling upon the mental resources crucial to individual strengths and resources concerned primarily with survival instincts.

ISOPRAXIC BEHAVIOR
Left to themselves, animals engage not only in species typical pair or group activity of the same kind, but may also adapt some novel practices of one of their group. Isopraxic Behavior is observable in most forms of communication involved in self-preservation and preservation of the species. Isopraxic Behavior means performing anything in a like manner. Doing something the same way. Not imitated. Not learned. In circular language one might define a species as a group of animals that had acquired the perfect ability to imitate themselves.

Human activity with puppets is a form of self-imitation, self- mimicry, self-reflection. A puppet on the end of an adult's hand that asks a question will generate an unconditional response from the group. Increased levels of interest, energy, communication, and identification with the moving object.

Just as isopraxic behavior is involved in conspecific (group) recognition, so does it serve in the opposite sense to promote species isolation, or behavior which makes it distinct or different, setting it apart from other species. The simple act of human mimicry represented in the existence of the puppet itself propped, as it were, like a mirror of consciousness, is a distinct form of behavior. When use of a puppet is involved, the group tends to identify, follow and communicate with the symbol. As a species typical display greeting, puppets exert a strong effect on children.

According to MacLean, it is the neural network to which the cells belong that accounts for the selective and identifying responses. He cites the example of the squirrel monkey in which some cells in the limbic cortex and neocortex will respond only to species typical vocalizations of another squirrel monkey. The reflection of a single eye may be sufficient to elicit the full greeting display in the squirrel monkey. The presentation of partial representations with respect to other sensory systems might activate the cells within neural networks "genetically tuned" to particular partial representations. If children are attracted to puppets, isopraxic behavior is partly the reason.

THE LIMBIC SYSTEM

Paul MacLean introduced the term "Limbic System" in 1952. The Limbic System has no representation in the reptilian brain. MacLean tells us that "the history of the evolution of the limbic system is the history of the evolution of mammals. It is our history, the driving force behind human development; While the history of the evolution of mammals is the history of the evolution of the family."

MacLean tells us that play represents one of the three cardinal forms of behavior that characterized the evolutionary transition from reptiles to mammals. He cites no persuasive evidence that reptiles play. Hence, it might be argued that individual play, and most particularly long bouts of social play, represents a uniquely mammalian trait. MacLean suggests originally that play may have served to promote harmony in the nest, and then later on affiliation of members in a group. His experimental findings that were described suggest that the function of play is identified with the most recently evolved division of the limbic system.

The Limbic System is divided into 3 parts: 2 older olfactory sections involve oral and genital functions necessary for self-preservation and procreation. The third has no counterpart in reptiles
and involves parental care, audiovocal communication, and play. The fact that parenting, human vocalization, and play are together a genetically inherited human brain program suggests why puppets, which characterize two of the three components, exert such a strong influence on children.

The hand puppet dynamic is behavior rooted and reflected in the workings of the emotive brain in the limbic system. Teachers' reports and observations suggest that use of a hand puppet allows them to guide the behavior and the emotions of their classrooms.

The puppet is a communication device--a mental satellite that not only mirrors--but actually engages the limbic brain's capacity to relate to both the inner and outer world; a microphone, a technical communication device which amplifies and modulates qualities of the limbic system. The satellite's primary function is to beam emotive information back and forth. Norbert Wiener (cybernetics) said that communication must involve behaving entities. Back and forth interaction within the circuits between the inner and outer world produces excitation, a state of experience necessary for learning, retention, memory, and identity. (MacLean)

The Limbic System derives information in terms of emotional feelings that guide behavior required for self-preservation and preservation of the species. The Limbic System is involved in emotional behavior or in the subjective experience of emotion. The term Limbic refers to the creation of what we call the "realm of human experience" and the expression of emotion.

Limbic refers to the generation of free floating, affective feelings conveying a sense of time, of what is real, true, and important. Limbic brain activity is essential for interoceptive and exteroceptive (give & take) systems required for a sense of personal identity, memory of ongoing experience and dreaming.

If the brain were likened to a detecting, amplifying, analyzing device, the limbic cortex is designed to amplify or lower the intensity of feelings to guide the behavior of self-preservation and preservation of the species. The teacher, for example, who uses a puppet with an eleven-year-old-blind student does not benefit from the puppet's visual element. Instead, the relationship between teacher and student moves, by virtue of the puppet as a third party, a dynamic driven by emotions. It's a place not unlike computer memory, which speeds specific functions and communications. The puppet's net effect lowers resistance to learning, adds a feeling of warmth and security essential to receptivity, and fosters personal growth and expressiveness.

**NEOMAMMALIAN FORMATION (the neocortex and thalamic structures; the outer brain)**

Compared to the limbic cortex, MacLean describes the neocortex as "an expanding numerator, ballooning out in evolution and reaching its greatest proportions in the human brain." The neocortex has extensive roots in visual, auditory, and somatic systems and appears to be primarily oriented to the external world. The neocortex has progressive capacity for problem-solving, learning, and memory of details.
The neocortex is responsible for linguistic translation and communication of subjective state accompanying various forms of mentation. Education's primary focus on the acquisition of facts and knowledge, and the testing to verify the retention of that knowledge, is well intentioned. But Berk's report on the dearth of playfulness in communication in teachers suggests that current training and orientation of teachers, indeed the vision of education leadership, is focused myopically on the neocortical world. The neocortex governs verbal communication and is able to promote the procreation and preservation of ideas (pure information; no mass or energy). The neocortex not only affects the transmission of culture, but also affects the course of biological evolution. The neocortex may appear to be the leader, but following the leader in this case is like following the proverbial horse to the water: without addressing the requirements of the inner brain formations, the horse is not likely to drink.

A conclusion that may be drawn from MacLean's organization of the brain is that by harnessing brain energy generated by the inner and older brain formations, there are benefits to be gained from the biological forces which naturally drive and propel human learning. By engaging the resources of the limbic system, learning activity can be made to work according to its natural principles. To strike a household analogy: if you run a typical kitchen appliance you only need 110 amp service; if you want to run air conditioning you need a 220 hook up. If more electrical service (brain activity in children) is called for, then tools which draw upon the brain's full power must be applied.

MacLean's research considers the possible role of the frontal lobes in the regulation of play and laughter and in the intellectual, creative process as it is influenced by wit and humor.

MacLean tells us that there is little experimental information bearing on the role of the frontal cortex in play. However, lobectomies have resulted in cessation of play. Play behavior can be erased by lesions. If play behavior is not regularly engaged, it disappears. If play can be erased from the brain, then it may be advanced that the fertile ground upon which educational processes grow may be erased as well. If the quality of play is absent from learning activity, it is like trying to grow plants without the essential nutrients that foster life.

PLAY AND CREATIVITY

MacLean provides numerous examples of how play on words, punning, and wit have contributed to creative thought. In literature and theater, one hardly needs to look beyond Shakespeare. He points out that Friedrich Schiller, poet and friend of Goethe, popularized the game metaphor at the end of the 18th century," tracing the human urge to create to the spieltraub, the play impulse. MacLean refers to O.B. Hardison who described the play of modern science as "serious but that its games are so exhilarating, and the rules often so strange, that the play becomes overtly playful. The playfulness spills over into mathematical and logical puzzles and into language that is intentionally paradoxical, whimsical, and absurd."

Hardison refers to the origins of such words as quarks and gluons. Then turning to quite a different game, he refers to Mandelbrot's book The Fractal Geometry of Nature that offers picture after picture of breathtaking playfulness, commenting that part of the playfulness comes from its unpredictability.
For the interplay of such factors in science, art, and music, Thomas G. West's *In The Mind's Eye* provides abundant illustrations. Albert Einstein's assistant, Banesh Hoffman, once described the great scientist's quality of mind:

"Einstein's method, though based on a profound knowledge of physics was essentially aesthetic and intuitive. Watching him, and talking with him, I came to understand the nature of science in a way that I could not have possibly understood it merely from reading his writings or the writings of other great physicists or of philosophers and historians of science. Except for the fact that he was the greatest physicist since Newton, one might almost say that he was not so much as a scientist as an artist of science."

Recent studies on the brain (West 1991) indicate that brain development and evolution is based on spontaneous and unpredictable action otherwise known as play.

With the soaring of the world's population, MacLean asks us to consider the role of play in coping with crowding. The number of offspring in a mammalian family is limited by the number of nipples. It may be partially for this reason that the optimum number in mammalian social groups tends not to exceed 12. Play language offers a means by which to offset the adverse affects of full classrooms.

Whatever the reason, it would appear that, except for matters concerning family and language, the limbic cortex and the neocortex have few inborn programs for regulating behavior, and none in particular for coping with large numbers of individuals. In other words, it would appear that the adoption of a family way of life has made it awkward for most mammals to adapt to crowds. Even herd animals tend to group as families.

When human beings meet in large numbers, they seem to do best in situations in which they are feeding together, as at feasts and music festivals; or, taking advantage of the mammalian trait of play, are engaged in local, national, or international games, including the Olympics. But even in the case of international games, there appears to be a primitive, childlike fine line between enjoying fun at play and getting mad and fighting.

Puppet language makes it possible to exercise greater control over a large group using the forces of play and brain activity. Given the media's capacity for individualization, it is possible to shift its impact from group focus to individual focus, thereby maintaining the crucial involvement of the child. ...thus reducing student anonymity.

Teachers using puppets report that they are more inclined to joke and improvise with children either through their own puppet or the children's. This activity adds more of the adult's emotive touch and personality in communication.

**NONLINEAR BRAIN SCIENCE**

The above descriptions of the Puppet Dynamic linked to evolutionary brain science are based on what is viewed as a Linear interpretation of science or a history of cause and effect. The linear explanation MacLean provides give us a glimpse of the inner workings and organization of
deeper parts of brain function. But the fact that puppet behavior has evolved at all, that human beings readily engage in its mirroring, self-reflective behavior, opens a window on synchronicity. If suns sit host to planets, and planets sit host to moons, humans too have evolved a self-similar, self-revealing relationship with their inner world in the external Puppet Archetype: a form of behavior that combines pre-organized, recognition programs for play, communication, and learning.

Synchronicity (Peat 1989) is defined as "meaningful coincidence, the significant relationships and patterns of chance, the glimpse beyond conventional notions of time and causality into the immense patterns of nature, the underlying dance which connects all things, the mirror which is suspended between inner and outer universes. The joker in nature's pack of cards for they refuse to play by the rules."

Synchronicity takes place under the influence of acausal connections rather than by the familiar pushes and pulls of physics. Physicist Paul Kammerer, whose work supported was by Einstein, advanced argument for the existence of an underlying harmony or mosaic of nature. He referred to synchronicity as "the umbilical cord connecting thought, feelings, science, art with the womb of the universe that gave birth to them."

Like Kammerer, Carl Jung saw the workings of the brain rooted in the subcellar of consciousness. He referred to this realm as the collective unconscious as the realm that connects all human beings. Jung worked with physicist Wolfgang Pauli in a collaborative attempt to link psychology and physics.

What differentiates mere coincidence from synchronicity is its meaning. And it is the search for meaning, recognition, and connections that embodies the selective workings of the human brain. The special flavor of synchronicity lies in its being a unique and individual event and the manifestation of universal order. Wrapped within the temporal moment, a synchronicity exhibits its transcendent nature. It is in this relationship between transcendent and coincidental arrangement of mental and physical happenings that the synchronicity acquires its meaning.

Reading the journals of teachers in which they record experiences with children as they use puppets to establish rapport and present ideas, one sees the degree of special meaning and intense feelings that are generated in both child and adult alike.

Personal experiences are almost synchronistic in their nature for they are always concerned with the way things happen together. Synchronicities have their origins in combinations of mental and physical that produce, for the experiencer, a strong sense of meaning.

The catalytic effect of puppet behavior between the person behaving, the brain processing, is synchronistic.

Peat paints the following picture of the scientist who stands outside the system as an impartial observer, able to predict all events according to deterministic laws and without disturbing events in any way.
"If Newton stood next to God on the day of creation," writes Peat, "he would have asked him for positions, masses, and velocities of the bodies He had created and could have predicted every subsequent event that was to occur in the entire universe."

Today the spectator is replaced by participator.

With the advent of quantum theory, physics and physicists are no longer separable. Quantum theory does not allow the event to pinned down in any exact way. It is fundamental and absolute indeterminism lying at the most basic level of nature rendering Newtonian causality and determinism invalid--especially in matters that pertain to the mind.

In the first years of this century it was natural to speak of the elementary particles as being the building blocks of matter. Matter consisted of atoms made up of a tiny nucleus surrounded by a cloud of electrons. In the nucleus were protons and neutrons so that the whole of nature could be broken down into 3 elementary particles: electrons, protons, neutrons. Then a new generation of elementary particles was discovered as the internal structure of the nucleus was probed. Since then 100 elementary particles have been discovered, a veritable zoo of different particles. The latest discovery is the Top Quark. "Something is profoundly wobbly with this ultimate level of reality," writes Peat.

Before his death Werner Heisenberg the creator of quantum theory argued that what was truly fundamental in nature was not the particles themselves but the symmetries that lay beyond them. These fundamental symmetries could be thought of as archetypes of all matter and the ground of material existence the elementary particles themselves would be simply the material realization of these underlying symmetries.

Heisenberg argued that the ultimate reality is to be found not in electrons or protons, but in something that lies beyond them in abstract symmetries that manifest themselves in the material world. There are archetypal, clearly visible patterns of matter found in nature that we call symmetries.

Examples of symmetries include the fivefold sea star, the sixfold snow flake, the lateral fish, leaf, the human body, sea weed, the ram's horn, and the nautilus. Such objects posses a basic form in order which relate to the way they occupy and grow in space. Symmetry is ordering that arises through growth. Peat explains that spatial symmetry underlies a wide variety of different structures, including the brain.

Symmetry is a synchronicity which is a scientific term used to describe events in nature that are made up of more than a mere chance arrangement of disconnected parts into a pattern for it connects the individual with the global. It arises out of the operation of some deepery principle that binds the elements together into a fundamental pattern. Behavior in which human consciousness is symbolically materialized qualifies as a form of descriptive symmetry.

**Descriptive Symmetry**
Descriptive Symmetry refers to an ordering that arises in the mind. The mind creates subtle degrees of order and symmetry and projects these onto nature. Total order is perceived within the mind of the observer, and is an integral part of the constitution of material objects.

**Dynamic Symmetry**

Form and pattern emerge as a system grows and evolves and it is therefore possible for symmetries to be broken and then returned as a structure changes.

The hidden symmetry will therefore exert a formatting influence on each element as it behaves and enfolds. Symmetries of this nature could be said to have constitutive potential in that they govern the motion and evolution of each of the system's parts. When an explicit symmetry emerges out of a system it is not by chance but out of the very existence and essence of the system.

It is possible that the Archetypes and formative fields have a universal aspect, being formative fields of information that have an active role within the processes of matter, thought, and behavior. These symmetries have a formative role that is responsible for the exterior forms of nature. According to Peat, it is possible that archetypal symmetries of this nature could also manifest themselves in the internal structures of the mind.

The special flavor of synchronicity lies in its being a unique and individual event and the manifestation of universal order. Wrapped within the temporal moment, a synchronicity exhibits its transcendental nature. It is in this relationship between transcendent and coincidental arrangement of mental and physical happenings that the synchronicity acquires its meaning.

This is precisely the dynamic manifest in puppet behavior between the person behaving, the brain processing, and the catalytic effect of the puppet.

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Physicist David Bohm has advanced the idea that information can have an active or formative effect on matter. He calls this the Quantum Potential. Information acts like a radar signal received by ship at sea. The energy in the signal is minuscule compared to the energy that powers the ship yet the information in the signal has a formative effect upon the course of the ship. This is also a useful description of the puppet's impact on a child's mental growth and development.

Bohm’s causal interpretation suggests that matter has orders that are closer to those of mind than to a simple mechanical order.

The everyday world of solid bodies that are unambiguously located in space and of sequences in a linear time are what he calls the explicate or unfolded order. Orders of matter, space, and time are all explicate manifestations of the underlying implicate order.
It is well known that the illusion of continuous movement is produced in a movie by the rapid succession of still images.

All human vision is built out of information gathered in the very short pauses between the rapid ballistic movements of the human eye as it scans an object. What is seen as solid, explicate form is in fact built out of an extremely rapid succession of snap shots taken by the eye of various parts of the object.

As this jumble of discrete images enters the nervous system, it is unfolded across the various regions of the visual cortex and folded back again. This indicates that the implicate order may be the natural order of the mind.

According to Bohm, Mind and matter are not separate and distinct substances but that like light and radio waves they are orders that lie within a common spectrum.

A two-way flow is established between the mental and material orders of nature. This flow is described at length in MacLean's descriptions of physical brain organization and structure. In fact this back and forth activity is the benchmark of human thought, and may be seen at work in the hand puppet dynamic.

A synchronicity can therefore be looked upon as a microcosm which reflects the dynamic of the macrocosm as it unfolds simultaneously into the mental and material aspects of a person's life.

**Conclusion**

We know that the hand puppet represents one of the most powerful learning media and yet it is not generally used. In an effort to promote awareness of the medium I have pursued the notion that not only should it be seriously considered as a research subject; it is a medium intended for full unfolding of human potential, a humanizing medium that truly reinforces, validates, and promotes the best of human traits and capacities. Its operation and application represents a giant step away from reliance on strictly verbal communication and a shift into a visual, emotive, interactive way of communicating and problem-solving. In terms of its operating characteristics and the host of positive behaviors it induces, the hand puppet qualifies as a unique brain media and brain language.

One body of research will not in itself support this notion, but a reading of many of the current books about brain science and complexity reveal a pattern of insight and information that offer a developing picture of puppet behavior as a lens through which to observe and experience learning-- the way the brain intended.

Potential Impact of Puppetools on Reading Culture and Book Design.