Very Young Children's Drawings and Human Consciousness:

The Scribble Hypothesis.

A plea for brain-compatible teaching and learning by S.R. Sheridan

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This paper is about the unfolding of human marks, starting with scribbles. Scribbles reveal a neural substrate destined for marks and influence that substrate significantly, cue-ing what is distinctly human in linguistic behavior and consciousness:marks of significance, or symbolic thought. As neurobiological impulse and as language instinct, scribbling activates the human brain for a unique kind of self-organization using symbols. This cognitive self-organization is transmediational. The bihemispheric brain has evolved to interpret and respond to information across multiple sign systems. This complex, integrated process is nonlinear, continuous with principles for dynamic systems in the natural world.

The author is an artist/writer/ mother/teacher who has spent twenty years researching the connections between drawing and writing. The results are an educational theory Neuroconstructivism (children construct not only knowledge but mind on neural levels depending upon how they learn to learn), a practice Drawing/Writing (if the brain's right and left hemispheres exchange information, brain-compatible learning strategies will exchange visual and verbal information, too), and the fourfold Scribble Hypothesis.

I propose the following: **Very young children's scribbling serves four critical purposes: to train the brain to pay attention and to sustain attention; to stimulate individual cells and clusters of cells in the visual cortex for line and shape; to practice and to organize the shapes and patterns of thought; and, through an increasing affiinity for marks, to prepare the human mind for its determining behavior: literacy. This literacy is multiple: visual and verbal, artistic and scientific, mathematical, musical, and literary.**

To speak, children must hear spoken language. To write, they must be shown how. Children scribble and draw spontaneously. Mark-making is an instinct. More than sounds or gestures, marks organize human consciousness. Children's marks are universal and pluripotential. Like stem cells, they can become drawings, numbers, musical notes, equations or words. Whether a child develops many literacies or a few (parents, schools, society, and culture determine how literate a child becomes), the human instinct for meaningful marks persists, coded in the brain, eye, arm and hand. More than speech - a language instinct which we share with other vocalizing creatures - drawing is our determining capability.

The child's brain - the human brain - all brains are holons: self-constructing, self-maintaining, integrated, phenomenological. non-linear systems. As such a system, the child's brain is linked to, or continuous with the natural world (Scott, 1999). The child's brain differs from other mammalian primate brains because it spontaneously generates marks of meaning. As neurobiological impulse and as language instinct, scribbling is the basis for human notational systems upon which self-reflection, or self-organization via symbols depends. Children's brains are designed for multiple intelligences *and* for multiple literacies. Dogs and cats, monkeys and rats have multiple intelli-

gences, but they do not draw, and they are not literate.*

Consciousness in all brains, human or creaturely, depends upon certain oscillations (Hugh Wilson, 1999, 111-195). These specially calibrated oscillations, these relationships between excitation and inhibition, call and response, make it possible for brains to identify and pool information, coordinating, for instance, an object's orientation in space with its shape and its color in one unified moment of visual awareness. Does human awareness differ from animal awareness? Since we make marks and animals do not, it must.

Consciousness is physical and emergent like light. Light behaves as a wave and as a particle, and is often described in an oppositional manner:wave/particle. Amherst College professor Arthur Zajonc describes light as wave-particleness; light is an emergent, embedded phenomenon. Unless human consciousness is discontinuous with all other dynamic systems, it is an embedded phenomenon, too, both physical and emergent. "All complex neural phenomena are emergent properties determined by combinations of elementary nonlinear phenomena" (Hugh Wilson, 1999, 173). One of the physical and emergent phenomena connected with human consciousness is marks. Physical marks stand for (as yet) strictly non-reducible mental events.This unified duality, this emergent physicality is system-wide, cosmos to brain to quanta. The biological usefulness of this unified duality for brains is the possibility of transformation. The input to one brain system, translated by another, yields an output greater than and other than the input. The brain can correct and re-invent its behavior like *other* dynamic systems in the natural world to which it belongs.

If what is unique about human consciousness is marks, and if interhemispheric transfer logically applies to marks as well as to other mental processes for exchanging and pooling information, then brain-compatible teaching and learning strategies will organize exchanges between systems of representation - like drawing and writing, for instance - to maximize the transformational aspect of human consciousness.

The Scribble Hypothesis predicts that young children who are encouraged to scribble and draw, and to talk and to write, to compute and to compose about their scribbles and drawings will read more easily and will continue to read for pleasure and for information, will write more easily and will continue to write for pleasure as well as to disseminate information, will show an "innate" affinity for geometry, and, in general, will think more connectedly and unpredictably, or creatively. By making use of Neuroconstructivist theory and cross-modal teaching and learning strategies like Drawing/Writing, the brain of the child practices thinking as its brain has evolved to think using nested and unified systems of marks.

* Marks made by chimpanzees and cats are addressed in the paper. (RESEARCH QUESTIONS ON NEXT PAGE)

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Research questions:

Neurobiological research relevant to education in connection with reading, writing, mathematics

and “creativity:”

- When young children scribble, what happens to their brain waves?
- When young children talk about their scribbles, what happens to their brain waves?

DRAWING AND TALK RESEARCH

- When young children draw, what happens to their brain waves?
- When young children talk about their drawing, what happens to their brain waves?
- How do these brain waves differ from children talking about someone else’s drawing, say, an illustration in a book?

DRAWING AND WRITING RESEARCH

- When young children write about their drawing, what happens to their brain waves?
- How do these brain waves differ from children writing about an assigned illustration?
- How do normal writers and ADD (attention deficit) and LD (learning disabled) writers differ on the same tasks?

DRAWING AND READING RESEARCH

- When children read their own writing about their own drawing, what happens to their brain waves?
- How do these brain waves differ from children reading from an assigned text?
- How do normal readers and ADD and LD readers differ on the same tasks?

DRAWING AND MATHEMATICS RESEARCH

- When children scribble and talk about scribbling, do they generate proto-geometric shapes, Euclidean and non-Euclidean?
- If they learn the names of such shapes, do they show an “innate” interest in the geometry of shapes around them in the world?
- How do the brain waves of such children differ from children who do not scribble nor draw who are taught, say, triangles, squares, circles and spirals as external to their experience?

DRAWING AND CREATIVITY RESEARCH

- Do young children who scribble and draw and who talk about their scribbling and drawing on their own terms with an interested listener produce more unusual, inventive phrases and “turns of speech?”
- Is this effect due to the drawing and talking done by the child alone or is it an effect of the responsive listener, or both?
- Does interested listening without scribbling or drawing elicit the same kinds of talking and interaction?

DRAWING AND EXPERT MODELS

- **How do the brain waves of very young children who are scribbling and drawing compare with the brain waves of experts working with abstract mathematical models of brain functions?**
- How do children’s scribbles compare with the abstract mathematical models of brain functions, including strange attractors? Also, how do very young children’s scribbles compare with the **scribbles and doodles mathematicians describe as**: Finite-order invariants of closed plane triple point free plane curves both smooth and immersed curves

(Vassiliev, V.A., "On finite order invariants of triple point free plane curves,"*Differential topology, infinite-dimensional Lie algebras, & applications*,.Amer.Math.Soc.Transl.Ser.2, 194, Providence RI, 1999); and with proper immersions of the real line including invariants of smooth triple point free plane curves (Tabachnikov, Serge. "Invariants of smooth triple point free plane curves" J. *Knot Theory Ramifications* 5 (1996), no.4, 531-552); and with collections of piecewise linear closed curves without triple intersections on a closed oriented surface, including "doodles on the 2-sphere" and "thick doodles" (Khovanov, Mikhail, "Doodle Groups," T*rans. Amer. Math. Cos.* 349, (1997), no.6, 2297-2315); and with the "dipsy-doodle," (or what SR Sheridan calls "googley eyes" in the paper "The Scribble Hypothesis) or double strange attractor (Newton, Tyre A. "A double strange attractor," *Dynamical systems approaches to nonlinear problems in systems and circuits*, Henniker, NH, 1986, 117-127, SIAM, Phila, Pa, 1988); and with Jordan curves lying in the 2-sphere with no triple intersections including isotopy and cobordism (Fenn, Robert;Taylor, Paul, "Introducing doodles," T*opology of low-dimensional manifolds* (Proc. Second Sussex Conf., Chelwood Gate, 1977) ppp.37-43); and with marks which solve points on a plane" (Heacock, Larry, "A doodling problem involving the density of segment-generated sets of points in regions of a plane," *Math Mag.* 42, 1969, 60-66); and with many other geometric combinations which can be classified as nondegenerate quasiperiodic curves on the 2-sphere" ("Geometric combinatorics," Satellite Conference, Kotor, August 28-September 2, 1998, ed. Rade et al, Publ. Inst. Math. (Beograd) (NS). 66 (80) 1999.*Institut Mathematique*, Belgrade 1999, pp 1-189). Children's scribbles are classifiable, neurally and mathematically.

Practical research for parents and teachers:

- What happens when parents and teachers allow children to scribble and draw and talk about their scribbles and drawings and write about their scribbles and drawings, exploring them geometrically, as well as figuratively (my scribble/drawing looks like a cloud), and narratively (the firetruck is going down the street)?
- What kinds of thought, emotion, and action do parents and teachers observe?
- Does this behavior in thought, emotion and action differ from other children in the family, in the town, in the classroom?
- If there is a change, or a difference in thought, emotion and action, to what do parents and teachers attribute these changes?
- To the quality of their attention as parents and teachers, or to the effect of scribbling and drawing on human thought? Or both?
- If working with scribbling and drawing helps children and parents and teachers interact with more mutual interest and enthusiasm in ways that enhance the use of words, we do not have to know what the brain waves are doing, do we?
- The language gap is what separates the advantaged from the disadvantaged child. A child needs to know a certain number of words to be able to read new words in context - 95%, in fact (E.D. Hirsch, Jr., American Educator, vol.25, No. 2, p.4 Summer 2001). A child's scribbles and drawings can be used to build a vocabulary that will even the playing field for all students. The articulate child is understandable, to him/herself and to others.

This bit wasadded to my poster presentation:

At the June 2001 MIT conference on visualization, three “icons” of science were demonstrated as inaccurate: the atom, evolution, the Neaderthal.(*N.Y. Times* Science Section, 7/17/2001). It is part of this paper’s hypothesis that children who are allowed to scribble and to talk about their scribbles will be able to construct new images appropriate to new understanding.

A protein called scribble is responsible for growth (S. Greaves, “Growth and polarity: the case for scribble,” *Natural Cell Biology,* 2000 Aug:2(8):E140). The fact that the visual model for growth is named for the marks it resembles may or may not be significant neurologically. The covers of *Science* magazine provide pictures of proteins, enzymes, genes, and “unwound nontemplates” as scribbles, including evenly braided scribbles, or the double helix of a strand of DNA. Motion or disorder at the level of gene transcription also registers in the visual model as scribbles. If the scribble model or icon is accurate, then proteins map onto children’s scribbles and vice versa. It is this paper’s hypothesis that scribbles are visually potent images, across levels, from DNA to the consciousness of the child.

This paper submits that the isomorphism between proteins and children’s scribbles is profoundly signficant for the connections between human consciousness and the natural world of growth and change including polarity which this paper redefines as a unified duality. As the scribble protein is responsible for human growth, so the child’s scribble generates the basic units on which all its mark-making, or symbolic thinking will be constructed.