

Hand Movements Sculpt Intelligence

by Arthur Auer

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The human hand is a very special organ. A long-time Waldorf teacher, Arvia Mackaye Ege, who taught handwork for many years, characterized beautifully its special role and significance for human existence and education:

Through the fact that man is an upright being and his hands are thus freed from resting on the earth, they have become, down through the ages, the most marvellous instruments. The shape of the hand with its five delicate, mobile fingers surrounding the quiet center of the palm, intimates its connection with the rays and impulses of the five-pointed star, the pentagram—that special creative form found, for instance, in the rose family and also basic to man himself! An organ of the sense of touch, it can be used to feel, to grasp, to move, mold, intertwine, or to relate other objects to one another, but also to make free gestures expressive of the inner dictates of the soul. Through infinite variations of all these, it has become one of man's most creative and, at the same time, selfless organs. Rudolf Steiner has spoken of the hands as the eyes of the rhythmic system. And one who works much with his hands may well feel how an essential part of his being would be blind without them. [The rhythmical use of the hands] works in a mobile, living way upon the development of brain cells, so that [the child's] physical brain will become a far more pliant and sensitive instrument for 'living thought' and for clear, strong, mobile knitting of thoughts when he has grown to full adulthood.¹

The Tapestry of our Mind and Soul

Neurophysiological research increasingly confirms the wisdom and efficacy of what has been called “hands-on learning.” Correlations have been found between dexterity and mobility in the fine motor muscles of our hands and cellular development in our brain which supports our cognitive capacities.

According to the Swedish neurophysiologist Matti Bergstrom:

The density of nerve endings in our fingertips is enormous. Their discrimination is almost as good as that of our eyes. If we don't use our fingers, if in childhood and youth we become “finger-blind,” this rich network of nerves is impoverished—which represents a huge loss to the brain and thwarts the individual's all-around development. Such damage may be likened to blindness itself. Perhaps worse, while a blind person may simply not be able to find this or that object, the finger-blind cannot understand its inner meaning and value. If we neglect to develop and train our children's fingers and the creative formbuilding capacity of their hand muscles, then we neglect to develop their understanding of the unity of things; we thwart their aesthetic and creative powers. Those who shaped our age-old traditions always understood this. But today, Western civilization, an information-obsessed society that overvalues science and undervalues true worth, has forgotten it all. We are “value-damaged.” The philosophy of our upbringing is science-centered, and our schools are programmed toward that end. . . . These schools have no time for the creative potential of the nimble fingers and hand, and that arrests the all-round development of our children — and of the whole community.²

Our brain is an intricate loom of billions of neural pathways with a huge potential for weaving internal interconnections and connections out to the world. The name for a brain cell is “neuron” which derives from ancient Greek roots for “fiber,” “thread,” or “cord.” When our hands interact with the world, they are not only actively sensing and transforming what is “out there” but are also simultaneously acting back upon the human soul and its instrument, the brain. They are weaving the branching, thread-like dendritic connections and patterns into our nervous system which correspond to our cumulative experience.

As our hands touch and play upon surfaces of outer reality, we internalize and inwardly fabricate a personalized tapestry upon the multi-dimensional loom of our mind. The richer and deeper these experiences are, the more *meaningful* the world can potentially be for us. The word “meaningful” is derived from the Old English root *maenen* — “to have in mind or memory.” We come to have the world in our minds, but first, we often have to have it actively in our hands. Furthermore, we become “interested” in things. The Latin *interesse* literally means “between to be;” between child and world is established a linkage, a bridge, a template, an inner patterning that corresponds to the world.

The ancient Greeks had an intuitive sense of this relationship of thinking to weaving and handwork that was reflected in their myths and legends. The inspiring feminine spirit of their culture was Athena, who was born from the head of Zeus. It was she who became the goddess of wisdom and knowledge, weaving, and handwork. In the great epic *The Odyssey*, she acts as the inspirer and mentor to clever Odysseus, whispering thoughts into his ear. His wife Penelope wove on a loom in the great hall of Ithaca and craftily outwitted her unwanted suitors by unraveling her work each night. Odysseus himself was the archetype of the new Greek intellectual thinker. It was he who tricked the Trojans through the device of a wooden horse. The horse as a symbol has been associated with intellectual thinking.

Grasping Objects, Words, and Thoughts

A primary vehicle for weaving the world “into our minds” is the active engagement of our hands. The new-born and very young child has billions of active neurons and passageways eagerly ready to meet reality with incredible openness and selfless imitation. Even before the first smile comes the active movement of the hands immediately grasping at the mother’s breast and soon after stretching out into the world. By the age of two weeks old, newborns already will reach out to things put in front of them.

To start the wonderful process of neurophysiological weaving, the hands first need to grasp and manipulate objects physically. The baby grips the new world with incredible will and intensity. At around age one, when the child achieves uprightness and begins to walk on its legs, a development of similar significance is happening in the hands. They become manipulative organs with fingers that are increasingly able to move independently. This also marks the onset of the next stage of attaining speech in the second year of life. In the first three years of life, the child is also intensively “grasping” and manipulating sounds and words and miraculously absorbing language and complex grammars. Out of his or her grasp of language arises the grasp of thoughts and the first glimmerings of consciousness of self and ego.

Physical grasp and manipulation thus set the stage for emotional and mental grasp of experiences and ideas. The nouns “concept” and “percept” and their related verbs “conceive” and “perceive” are derived from the basic Latin root *capere* meaning “to grasp, to take into one’s hands, to seize.” To conceive an idea is to grasp it. To perceive an object is to take hold of it with our active senses. The grasp of our hands is thus an external protoactivity related to other modes of grasping and sensing reality with an active will. The eyes need to reach out actively and intentionally to “grasp” reality, to really see, observe, connect with something rather than just passively receive impressions.

Hand activity and grasping not only initially help establish the awe-inspiring neural network of the mind in our very early years, but also contribute to keeping it vibrant, flexible and active throughout our most formative learning years—from birth to 21—and into adulthood. Without regular, rhythmic, and active engagement of our hands, many neural pathways would remain unused, underused, or would fail to receive the permanent myelin sheathing they need around them for remembered and repeated action. They would remain disordered and chaotic, atrophy, and wither away. Our minds would be reduced to underdeveloped reflections of their true potential.

Joint Evolution of Hand and Brain

In *The Hand: How It Shapes the Brain, Language and Culture* (1998), Frank Wilson, a leading neurologist, reveals many insights into the latest published research on the human hand, its evolution and role in human development. Wilson called his work “a meditation on the human hand, born of nearly two decades of personal and professional experiences.”

Wilson’s explorations caused him to be highly dissatisfied with what he termed the “cephalocentric” (head-centered) view of intelligence in which the head receives all the credit for knowledge. For him, the human being is a whole in which brain and hand and other aspects of our being collaborate and participate in each other’s development.

I highly recommend this well-written and accessible book to teachers, parents, artists, and anyone with the education of children, and I have therefore included a number of excerpts, with passages in bold indicating my emphasis.

The interaction of brain and hand, and the growth of their collaborative relationship throughout a life of successive relationships with all manner of other selves---musical, building, playing, hiking, cooking, juggling, riding, artistic selves---not only signifies but proves that what we call learning is a quintessential mystery of human life. . .It marks the fusion of what is physical, cognitive, emotional, and spiritual in us.³

The desire to learn is reshaped continuously as brain and hand vitalize one another and the capacity to learn grows continuously as we fashion our own personal laboratory for making things.⁴

There is growing evidence that *Homo sapiens* acquired in its new hand not only the mechanical capacity for refined manipulative and tool-using skills but, as time passed and events unfolded, an impetus to the redesign, or reallocation, of the brain’s circuitry.⁵

It. . .seems most likely that the brain elevated the skill of the hand as the hand was writing its burgeoning sensory and motor complexities, and its novel possibilities, into the brain. . .

The brain keeps giving the hand new things to do and new ways of doing what it already knows how to do. In turn, the hand affords the brain new ways of approaching old tasks and the possibility of undertaking and mastering new tasks. That means the brain, for its part, can acquire new ways of representing and defining the world.⁶

In “The Real Meaning of Hands-On Education,” a lecture related to the theme of his book, Wilson gave a summary of the fascinating evolution of the hand and its imagined emancipation from arboreal gymnastics and limiting specialization:

Somewhere between 200,000 and 100,000 years ago, the hand had reached its present anatomic configuration, the brain had tripled in size, tools were more elaborate, there was a complex society based on the organization of relationships, alliances, ideas, and work, and we started calling our selves *Homo sapiens*. . . The modern human hand acquired] the ability to move the ring and small fingers across the hand toward the thumb—a movement which is called ulnar opposition. Ulnar opposition is a prime example of a small anatomic change with monumental consequences, because it greatly increased the grasping potential and manipulative capacity of the hand. Ulnar opposition made it possible for the thumb to powerfully hold an object obliquely against the palm, as we hold a hammer, a tennis racquet, or a golf club, or as a violinist holds the neck of the violin. This new grip has been called the oblique squeeze grip, and it would have been a major advantage in close combat because in this hand a club could be held tightly and swung on an extended arm axis through a huge arc.⁷

But ulnar opposition also meant that the hand could conform itself to a nearly infinite range of object shapes and could orient and control them, precisely, delicately, or powerfully if need be. Small objects could be taken apart and put back together again, or made into entirely new objects that could themselves be connected, taken apart, revised, reconnected, and so on.⁸

The trick of ulnar opposition is unique to modern humans. . .an effect. . .can be seen in an improved precision grip, in which small objects are manipulated between the fingers without contacting the palm.⁹

The ability of the hand to conform to large spherical objects is due in part to the action of small but powerful intrinsic muscles. . .that help to maintain its arch.¹⁰

Since it does not seem likely that the brain's remarkable capacity to control refined movements of the hand would have predated the hand's biomechanical capacity to carry out those movements, we are left with a rather startling but inescapable conclusion: it was the biomechanics of the modern hand that set the stage for the creation of neurologic machinery needed to support a host of behaviors centered on the skilled use of the hand. If the hand did not literally build the brain, it almost certainly provided the structural template around which an ancient brain built both a new system for hand control and a new bodily domain of experience, cognition, and imaginative life.¹¹

The brain does not live inside the head, even though that is its formal habitat. It reaches out to the body, and with the body it reaches out to the world. Brain is hand and hand is brain.¹²

These last two excerpts reflect an agreement with the philosopher Kant, who said that the hand was our outer brain.¹³

In this remarkable relationship and interdependence of hand and brain function, Wilson discerns other profound ramifications for understanding the development of intelligence and learning,

speech and language, self-awareness, ego development and even our health and inner sense of freedom:

Self-generated movement is the foundation of thought and willed action, the underlying mechanism by which the physical and psychological coordinates of the self come into being. For humans, the hand has a special role and status in the organization of movement and in the evolution of human cognition.¹⁴

As far as we know, or can imagine, thought and intellect are the sum total of the organizing tendency of the child's entire, rapidly expanding collection of passive and active interactions with the world via touch, smell, sight, hearing and kinesthesia. It is probably not possible to be more specific than this. . .¹⁵

Whatever precise sequence [children] follow discloses the influence of an abstract, hierarchically organized (learning) process. . .The seven- year -old, manifesting maturational changes in her brain, approaches the problem (of forming stick patterns) as an architectural one. [In comparison the eleven year old's] performance is not orderly. She has become an improviser. Her use of hierarchical pattern thinking is now so secure, so integral to her technique, that she has been set free. . .She is now unequivocally behaving with intelligence!¹⁶

I think working with children has given me this idea, which isn't often discussed in medicine: a lot of disease—medical disease and emotional "dis-ease"—is an outcome of a lack of full development. It's not something we can get to just by removing a psychological block. There actually are no blocks in that respect, but there is the block caused by lack of learning and development. In that sense, healing is a process of continuing development and learning. It's not a single, miraculous event that people imagine, a catharsis or something like that. So when I look at people with problems, more and more I ask: "What have they not learned? What in their development have they missed?"¹⁷

If the hand and brain learn to speak to each other intimately and harmoniously, something that humans seem to prize greatly, which we call autonomy, begins to take shape.¹⁸

In comparison with animal appendages, our hands have remained curiously unspecialized and almost embryonic, yet therein lies their great flexibility and freedom of movement. They are able to learn to execute an infinite number of tasks. The human hands have emancipated themselves from being environmentally fixed for specific purposes and become primary organs of freedom and the basis for mobile, creative thinking and communicating.

Speech and Language

Wilson devotes considerable attention to the intimate relationship between what he calls the articulate hand, its gestures, and the development of speech. He explores the possibility that the hand may very well have been the instigator of human language. To this end, he brings into his study the insights and conclusions of several other researchers.

For [Russian psychologist] Vygotsky, "well-developed thought" arises as the verbal behavior of the child undergoes a long metamorphosis during which words that were originally object attributes come increasingly to be manipulated and combined, just as *real* objects are manipulated and combined by the child.¹⁹

Linguists Armstrong, Stokoe and Wilcox in their 1995 book *The Nature of Language*:]conclude: “With their hands and developed brain and greatly increased eye-brain -hand neural circuitry, hominids may well have invented language---not just expanding the naming function that some animals possess but finding true language, with syntax as well as vocabulary, gestural activity.”²⁰

We can now say with considerable coincidence that almost the entire set of distinctive human motor and cognitive skill, including language and our remarkable ability to design, build, and use tools, began as nothing more than an enhanced capacity to control the timing of sequential arm and hand movements used in throwing.²¹

Such research correlates in part with the language investigations of Johannes Kiersch: “[Early language] achieves its individual form not through participatory imitation, but through the type of motor activity peculiar to early infancy. In several lectures of 1923 and 1924, Rudolf Steiner describes in what subtle ways the human capacity for speech is predisposed by the occurrence of certain leg, arm and finger movements. Thus he maintains that the structuring of language in sentences is anticipated through vigorous, regular movements of the legs, good pronunciation through harmonious arm movements, and the sense for the modulation of speech through the child’s experiencing the life in its fingers.”²²

Education of Head, Heart, and Hands

The implications of recent brain research and Wilson’s work for education and basic educational arts such as modeling are immense. Wilson believes that we ignore at great risk the necessary role of real hands-on, experiential learning in human life.

The young of our species will respond to their environment and will advance their own skills and understanding according to the same basic plan provided to every new Homo sapiens for at least 100,000 years.²³

The hand enjoys a privileged status in the learning process, being not only a catalyst but an experiential focal point for the young child’s perceptual, motor cognitive and creative world.²⁴

In the formative years of each human being, the hands need to recapitulate and play their crucial evolutionary role designing and building significant elements of our neural circuitry and capacities.²⁵

It may be that the most powerful tactic available to any parent or teacher who hopes to awaken the curiosity of a child, and who seeks to join the child who is ready to learn, is simply to head for the hands.²⁶

Wilson ultimately includes the role of feeling and the heart with those of hand and head. A delightful part of his research involves qualitative case studies of individuals who use their hands in a variety of special ways: jugglers, surgeons, musicians, puppeteers, car mechanics, engineers, rock climbers and so on. Through interviews he encounters successful lives and minds that have been incredibly enriched and enhanced by hand creativity. In connection with his study of a surgeon’s hands, for example, Wilson experiences that there is knowledge that can “be obtained only by acting on the object being held in the hands and then written in the brain in the tactile and kinesthetic language of manipulation.”

In evaluating this more personalized aspect of his research, Wilson comes to one of the most striking observations of his entire book:

When personal discovery and desire prompt anyone to learn to do something well with the hands, an extremely complicated process is initiated that endows work with a powerful emotional charge. People are changed, significantly and irreversibly it seems, when movement, thought and feeling fuse during the active, long term pursuit of goals. . .²⁷

For me as a teacher, this special fusion of willed movement, thinking and feeling is also very applicable to the quality and level of experiential learning we should be aiming for in the education of children. Such fusion means that the whole child and human being is addressed and engaged. It integrates head, heart, and hands in full, unified experiences.

In the Prologue to his book, Wilson posed a provocative question to society and educators: “How does, or should the education system accommodate the fact that the hand is not merely a metaphor or icon for our humanness, but often the real life focal point — the lever or launching pad — of a successful and fulfilling life?”²⁸

To this, I would respond as a teacher and say that I have found education is profoundly enhanced when it uses an artistic-experiential method to achieve lasting and integrated capacities of intelligence — intellectual, emotional and volitional (will). Such an education is not intended to train or produce artists, but uses the experiential methodology of the arts to gain knowledge, values in life, and a healthy practical sense among other things. Herbert Read called this “*Education as an Art*,” an expression also used by Waldorf schools. The arts are not frills but rather the great, largely untapped fountain of educational renewal. This was recognized in the November, 1998 issue of *Educational Leadership* devoted to “How the Brain Works”:

Because our visual, auditory and motor systems are essential to cognition, it’s probable that the arts emerged to help develop and maintain them. . . Evidence from the brain sciences and evolutionary psychology increasingly suggests that the arts (along with such functions as language and math) play an important role in brain development and maintenance—so it’s a serious matter for schools to deny children direct curricular access to the arts. The arts are highly integrative involving many elements of human life. . . (especially) on two key elements: (1) heightened motor skills that we call performance (2) the heightened appreciation of our sensory-motor capabilities that we call aesthetics. . . Movement is central to Life and to the Arts. Why do we have a brain? Plants seem to do fine without one; many trees far outlive us. We have a brain because we have muscle systems that allow us to move toward opportunities and away from dangers.²⁹

For me, the very form and function of the instrument of the human hand and its fine motor muscle systems is a key to education. It curiously holds within its configuration an imaginative miniature of our human wholeness and nature. The tips of our fingers are like little sensing heads with their incredible concentration of nerves and “seeing” ability. The interior hollow is an inner heart space of feeling in which we can hold, weigh, and judge things. The lower part of the hand and the strong opposing thumb have the most developed musculature and embody the hand’s will power. Let our children work with their hands and imbue life with creative form, beauty, and wisdom!

After working for many years as a class teacher at the Pine Hill Waldorf School, Arthur Auer is now the Coordinator of the Year Round Waldorf Training Program in the Education Department of Antioch New England Graduate School. As a classroom teacher and someone not professionally trained in modeling or the arts, he perceived the need for a sourcebook to aid others in similar situations.

Endnotes:

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- ¹ Mackaye Ege, "The Human Hand," p. 47
 - ² Mitchell, *Will-Developed Intelligence*, 1999, p. 9
 - ³ Wilson, *The Hand: How it Shapes the Brain, Language and Culture*, 1998, p. 295
 - ⁴ *Ibid.*, p. 59
 - ⁵ *Ibid.*
 - ⁶ *Ibid.* p. 290
 - ⁷ Wilson, "Hands-On Education", p. 6
 - ⁸ Wilson, *The Hand*, 1998, p. 6
 - ⁹ *Ibid.* p. 28
 - ¹⁰ *Ibid.*, p. 120
 - ¹¹ "Hands-On Education", p. 6
 - ¹² Wilson, *The Hand*, 1998, p. 307
 - ¹³ *Ibid.*, p. 307
 - ¹⁴ *Ibid.*, p. 291
 - ¹⁵ *Ibid.*, p. 195
 - ¹⁶ *Ibid.*, 1998, p. 167
 - ¹⁷ *Ibid.*, p. 252
 - ¹⁸ Wilson, "Hands-On Education", 1999," p. 9
 - ¹⁹ Wilson, *The Hand*, 1998, p. 193
 - ²⁰ *Ibid.*, p. 204
 - ²¹ Wilson, "Hands-On Education", 1999," p. 6
 - ²² Kiersch. *Language Teaching in Steiner Waldorf Schools*, 1997, pp. 34-35
 - ²³ Wilson, "Hands-On Education", 1999," p. 4
 - ²⁴ *Ibid.*, p.14
 - ²⁵ Wilson, *The Hand*, 1998, p. 296
 - ²⁶ *Ibid.*, p. 276
 - ²⁷ *Ibid.*, pp. 5-6
 - ²⁸ *Ibid.*, p.14
 - ²⁹ "Educational Leadership", November 1998, pp. 31-32