

Supporting the Development of the Hand

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The hands of a musician gracefully flying across the piano keys, the fingers of a young student playing a recorder, or the hands of a sculptor molding clay into artistic forms—these are all situations which show the uniquely human quality of the hand. Observe the hands of a mother caressing her baby, an elderly couple holding hands, or a hand giving a friendly pat on a shoulder—the hands can freely offer solace, convey love, as well as give and receive gifts of service. Besides these heartfelt and creative pursuits, the human hand develops several practical capacities, mainly through the activities of childhood and youth. With precision and strength the hand can use a screwdriver, a saw, or a hammer; it can spin a top, sew on a button, paint a delicate picture, and write with a pen or pencil.

In today's push-button world the hand's marvelous capacity for skill has taken on a regimented and manipulative character rather than its birth right, a living, creative agility. Do the eyes lovingly follow what the hands are doing when the fingers are clicking away at a keyboard, moving a mouse, or pushing buttons on any other machine? This lack of connection between the eyes and the hands begins early these days as more and more young children stare at screens while their hands do nothing or move joy sticks or push buttons in automatic ways. Does the rise in carpal tunnel syndrome and other ailments due to muscle tension in the neck, shoulders, and arms have anything to do with the ways we use our hands? How our hands are used may not seem like an important issue in the education of the child; yet our human hands have a potential which no animal 'hand' has (Frank Wilson, *The Hand: How its use shapes the brain, language, and human culture*). The hands are the human being's most creative and selfless organs, in that our hands are free to offer service to others and to nourish and care for ourselves. (Rudolf Steiner, *Practical Advice to Teachers*; Lectures 4 & 7)

The development of the hand with its fine motor skills so necessary for managing the writing, drawing, and other artistic activities of school is an area often forgotten by today's parents and educators alike. Many teachers notice that children hold their pencils and crayons in awkward ways, but do not necessarily connect these tense pencil grips with the sensory and motor development of the hand and of the postural system.

The hand and arm are, of course, only a part of the whole. Yet the whole is present in the part. If we look at the hand we see the quiet center of the palm with the five delicate fingers raying out from it. The powerful heel of the palm can be seen as the will aspect of the hand, the center of the palm as the feeling aspect, and the fingers as the thinking part. The hand, arm, and shoulder are a trinity in themselves. The hand is related to the nerve-sense system, connected with thinking; the arm is the balancer in the center, related to our feeling life; while the shoulder carries the will. The eye, in the meantime, directs the fine and large movements of the hand, arm, and shoulder. Thus, the eye carries thinking, feeling, and willing (Susan Greenfield, *The Human Brain: A Guided Tour*); it registers vitality. The sense of life is connected to thinking (Rudolf Steiner, *Man as a Being of Sense and Perception*; Karl König, *A Living Physiology*; Albert Soesman, *Our Twelve Senses*). As the sense of life helps convey thought into deed, it balances (with the support of the sense of balance) what the arm does, and moves (the sense of self-movement) the shoulder into action—for example, when aiming an arrow or a spear at a goal. The eye movements in their sockets are very similar to shoulder movements (the upper arm in the ball-and-socket shoulder joint). The child's pointing at an object or person at 14 months is the precursor of the young person shaking hands while establishing eye contact. (F. Wilson, *The Hand*).

Hand Development in Infancy

The healthy newborn infant has such a strong hand grasp that her weight can be carried when she is lifted by the doctor whose fingers the baby's two hands are grasping in a reflexive manner. Gradually, over the first year of development the infant's hands become able to let go of the finger which has stimulated the grasp reflex, and can then purposefully grasp an object she wants. The process by which a child gains his abilities to use the hands in more and more controlled ways is universal—if the child has an intact nervous system and is given the right environmental opportunities, it will seek to use its hands in more and more complex ways. Of course, how the child deals with his environment depends a great deal upon the child himself; the human being is not solely determined by heredity and environment (Michaela Glöckler's article 'Human Biography and its Genetic Instrument' in Volume IV, number 2, June, 1999 of the *Research Bulletin of the Waldorf Education Research Institute*).

If the young infant's caregivers give her the opportunity to lie on her back during waking hours, you might observe how she rotates her hands in the air above her face, as if her hands were playing with the beams of light. The intent connecting of the eyes with what the hands are doing during this peaceful activity gives a wonderful foundation for future eye-hand connections. The infant feels her hands' movements through her sense of self-movement (proprioception); she sees the play of light and dark as her hands and fingers change position, she feels her hands meet—at the vertical midline, giving her a beginning awareness of the two sides of her body and leading over time to the development of bilateral integration. This seemingly simple activity of the infants' hands may be crucial to the development of manual dexterity. If the infant spends most of her waking hours carried around or propped in infant seats, strollers, swings, walkers, bouncers, or other contraptions, she misses the opportunity to lift her arms up in this way and gracefully move her hands and fingers while her eyes connect with their activity. It would be very challenging for a young infant who is propped up (as in an infant seat or stroller) to raise her hands up so she can 'finger the light beams' while she intently watches her hands move; she simply won't do this in a propped position. Another drawback with a propped-up position for the infant has been pointed out by Carla Hannaford in *Smart Moves: Why Learning is Not All in*

Your Head: "These seats keep the baby at a 45 degree angle that inhibits active muscular movements either of the neck or core muscles (of the abdomen and back). Even though the baby's eyes are forward, because movement is inhibited the baby is not actively developing vision."

Throughout the early months the grasp reflex continues to be elicited via the touch receptors (sense of touch) in the palm; gradually the grasp becomes more relaxed. The process which allows the hand to relax its reflexive grasping involves the baby's gross motor movements on the floor. Usually, by three to four months old, the baby has rolled over and finds herself on her stomach. Soon thereafter she starts to push on her hands to help raise her large and heavy head and shoulders up so she can look around from this new position. The pressure thus exerted onto her hands, as they gradually open up while she pushes down onto the floor, gives firm tactile input onto her palms. Because this tactile input happens while she carries weight on her palms she cannot easily respond by closing her fingers around this tactile sensation—her grasp response fades away naturally. This pressure on the palms continues as she creeps around on her hands and knees.

In the school-aged child who is asked to creep like a deer you often see that the fingers curl under as the child does not put his weight fully onto the palms of the hands. Sometimes a child places the knuckles of the fisted hands onto the floor while creeping, in a stronger avoidance of contacting the palms to the floor. In both of these situations the child has probably not spent enough time creeping on hands and knees nor pushing onto the floor while lying prone as an infant; a residual palmar reflex is still active. These are usually the children who hold a pencil, crayon, and eating utensils in tense, awkward ways. Some also avoid contacting the palms to the substance they are working with while doing craft activities or kneading dough, for instance; you can see how they use their finger tips while working with their hands, in avoidance of having the palms touch anything.

By about the fifth month the infant can consciously, though still with difficulty, let go of an object. As the infant learns to stretch his fingers, coordination between bending and stretching develops; by eight months he can freely let go of an object when the hand is resting on a surface and by one year the object can be released in the air. The grasp-release

function is now under control. Playing give and take games supports this development. When the infant, from eight months to a year, amuses himself by dropping everything onto the floor, he is practicing this capacity. He is also experiencing how long it takes for an object to hit the floor—subconsciously learning to gauge distances through his hearing, and what kind of sound the object makes against the floor—subconsciously learning the denseness of various substances. These 'applied physics' lessons are subtly absorbed by the child. (Stephen Edelglas, Meier, Davy, *The Marriage of Mind and Matter*)

Again, given well functioning senses and plenty of opportunities to manipulate differently shaped, weighted, and textured objects in the environment, the development of the grasp follows a certain sequence. Initially the infant only grasps an object if it touches his palm; the three ulnar fingers (little, fourth, and middle fingers) then flex against the palm ('ulnar-palmar grasp'). At first the index finger and the thumb do not fully take part in this action. When the infant grasps with one hand the other will simultaneously, reflexively, clench. After a few months the index finger and thumb become more involved and you see a 'radial-palmar grasp'. By about the fifth month both hands can be used to grasp objects simultaneously. Eventually the infant can use all finger tips (the pads of the fingers) against the pad of the thumb to grasp, without having to press the object against the palm. Finger coordination improves and gradually the infant can use one hand without a corresponding movement of the other, unless the movement involves new movement sequences or new objects. From using all finger pads the ability to use only the thumb and index finger pads develops through practice and exposure to a variety of objects to manipulate.

When the infant wants to grasp an object, the sequence of stretching-grasping development also follows a definite pattern. At first the arm, hand, and fingers are stretched to the maximum before the object is grasped, way over-stretching in relation to the size of the object. As the coordination improves, the stretching will occur at the last moment, and the hand opens just enough to grasp that particular object.

By the time the infant is one year old she can pick up a little green pea lying on the high chair tray by using a 'pincer grasp'—grasping the pea between the pads of the thumb and the index finger, then put it

into her mouth and let go of it. Not long thereafter the grasp is between the tip of the index finger and the tip of the thumb, a 'superior pincer grasp', and the tiny object can be picked up without the hand being supported by the surface of the table.

Another factor in the development of fine motor skills is the integration of early movement patterns. For instance, it is difficult for a child whose head movements are intimately connected to her or his hand movements to use scissors or to develop a relaxed pencil grip. For the head and trunk to act as centered, relaxed, and stable foundations which support the fine motor activities of the hand, the early movement patterns need to have matured. This maturation takes place naturally as the infant, toddler, and young child rolls, wiggles, crawls (on the stomach with the big toes providing the 'push-off'), creeps (on knees and flat hands), walks, climbs, and eventually runs through space which is safe and which gives plenty of opportunity for unhindered movements (except for 'obstacle courses' which children can squeeze, wiggle, inch-worm, climb, and roll their way through). This gross motor development is equally important as it provides the postural basis for the development of a relaxed, mature pencil grip. Similarly, the integration of the grasp reflex (mentioned above) takes place naturally as the infant and young child crawls and creeps around, and as she or he engages the hands in more and more complex activities.

Development of Postural Control in the First Year

When lying on her back the young baby does not have to engage her senses or muscles to control her posture; the surface she is lying on supports her completely. Therefore she can fully engage in what her hands are doing as they freely move above her face. Gradually, as the control of her postural muscles increases, from the head downwards, she gains the ability to move her body in large motor movements. First she raises her head against gravity, either from a supine or prone position. Eventually she rolls over from her back to her stomach, then from her stomach to her back—that is if she is given the opportunity to spend plenty of time lying flat on her back.

Later she can drag herself forward on her belly, using her hands and legs like a human lizard, to get a toy which attracts her attention. Somehow she figures out how to push herself into a sitting position; she gains more and more balance as she falls over,

pushes her trunk upright again, then just sits there flapping her arms up and down with delight. After her balance has improved in sitting she gains enough trunk stability to be able to reach out toward a toy, grasp it, and manipulate it without falling over any more. This trunk stability is essential as a foundation for the hands' ability to develop their fine motor skills.

As the months pass, the infant figures out how to get onto hands and knees from sitting or lying prone, then she rocks forward and back in this position. From this rocking forward and back, she develops the ability to creep backward and forward on her hands and knees. As we know, the ability to pull herself up into standing and thereafter to walk, first along furniture and then freely, is universally human. Through crawling, creeping, and walking, the child explores, gets to know, and makes an internal imprint, or map, of three-dimensional space. This connection with space is critical for developing future abilities in school, not just for games, gymnastics, dance, and sports, but, in order to orient to the page when writing, calculating, and reading.

In the gradual development of postural control the infant will initially be able to perform only one function at a time. At first the infant can lie on her back and grasp an object; when she has rolled over and can lie on her stomach, she works on lifting her head up and stabilizing its posture before she can grasp a toy. After she can sit up, she spends time stabilizing her posture in this position before she grasps one object; eventually she can grasp an object, drop it, and grasp another. Finally she can hold an object with one hand, while the other hand reaches for something else.

The stages of movement development which lead the infant into uprightiness and walking out of her own efforts are the signature of the ego helping the individual to find her way into her body and into three-dimensional space. If the infant has been allowed to accomplish these archetypal steps of maturing into her body out of her own efforts, without interference from her environment, the ego has been able to leave a deeper imprint than if she was continually 'aided' by those around her. (Audrey McAllen, *The Extra Lesson*; Joan Salter, *The Incarnating Child*; Magda Gerber, *Your Self-Confident Baby*.)

The steps involved in this archetypal movement development also lead to a gradual control of the postural system. When she struggles on her own, the in-

fant is gradually readied to take on each new ability. Her balance is steadier, her postural system is more controlled; it is not at the mercy of unnecessary tensions in compensation for her inability to perceive what each of her postural senses tell her.

How Children Draw and Write

An 18-month-old toddler 'drawing' (scribbling) with a stick crayon holds it in a fistful hand ('cross palmar grasp'), tip downward (on the little finger side), with the wrist slightly flexed and the forearm slightly supinated; the motion of the crayon across the paper (or wall?) is produced by shoulder or trunk movements.

A two- to three-year-old child holds the stick crayon with some differences: now the tip of the crayon is on the thumb side, the index finger begins to straighten and lie on top of the crayon, separating from the three other fingers which still grasp the crayon as a tight unit (partial cross palmar grasp); the forearm is pronated and the wrist is not flexed; the drawing motion is still guided by the movements of the shoulder and trunk. A block crayon is not held in this way; rather, the child grasps the block crayon with all fingers pressing against it in a full cross palmar grasp, much like the younger child's grasp on a stick crayon.

After four years of age most children can hold the stick crayon or pencil through thumb opposition to the index and long fingers with the ring and small fingers in flexion beginning to stabilize the hand. As the ring and little fingers take up the role of stabilizing the hand against the drawing or writing surface, a subtle 'arch' of the hand develops longitudinally from the wrist to the space between the base of the ring and long fingers. (Like the feet, the hand has two arches—a transverse and a longitudinal—which create a cross.) Gradually, small movements at the metacarpophalangeal and interphalangeal joints begin to control the movements of the crayon or pencil. The shoulder, elbow, forearm, and wrist act as stabilizing joints, along with the core muscles of abdomen and back, giving support and a firm foundation from which the finer movements of the hand and fingers can operate.

By the time the child is five to six years old, his or her hand development has matured to the point where he or she now can eat and draw with a mature, 'adult' grasp. When writing, the mature hand rests on its side, stabilized by the little and ring fingers. The stick crayon or pencil is grasped in a relaxed, graceful man-

ner with the ends of the curved thumb and index finger across from each other on top of the crayon, supported by the side of the long finger's distal phalange underneath the crayon. The upper end of the crayon or pencil rests against the base of the index finger. Intrinsic muscles of the hand cause motions in the small joints of the hand and fingers which create the writing motions, while wrist extension moves the pencil across the page to the right. Again, the shoulder, elbow, forearm, and wrist act as stabilizing joints. The trunk and head are kept in neutral position without leaning or twisting to the side, nor folding over the work at the table.

Activities Which Support Hand Development

In today's homes and classrooms one can see that many grade school children have not completed the normal movement development of the hand. Some children need much catch-up, while for others more opportunity for fine motor activity seems to suffice. It's a good idea to check visual acuity if the school-aged child is truly struggling with fine motor skills; far- or near-sightedness can affect the development of eye-hand coordination. When hands act more like paws, the child might benefit from regular hand massage and even passive finger movement with nursery rhymes or songs—while you're at it, massage and play with the feet, too!

The importance of engaging the children in fine motor activities to give them the opportunity for catching up on this development must be conveyed to teachers in training, as well as to parents. I suggest establishing a 'craft corner' at home where school-aged children have access to a variety of art and craft items with which to create any number of cards, gifts, works of art, and useful objects. Supply this corner with such items as beeswax, plasticine, clay, baker's clay, colored tissue paper, glue, scissors, colored construction paper, colored crayons and pencils, watercolor paint, plain white paper of differing thickness and size, wooden or bamboo skewers, origami paper, yarn of various thickness and colors, sewing needles, knitting needles, crochet hooks, colored fleece, carding tools, glitter, lace paper, rice and textured paper, beads of various sizes and shapes, leather thong and leather scraps, fabric scraps, string, and rope. For example, the children can 'finger knit' belts, felt wool fleece into flat pieces usable as potholders or trivets, sew a felt purse, fold origami figures, or tie ropes with dif-

ferent knots. Felting and modeling with large pieces of beeswax or clay is particularly helpful for children who tend to hold their hands fisted. Initially supervised access to pieces of wood, nails, screws, and a few good tools—hammer, saw, pliers, screwdriver—which they can learn to use is also important. Activities in the garden, such as digging, raking, planting, weeding, and harvesting are invaluable experiences, not only for sensory and motor development of the hands, fingers, arms, and the whole body, but also for learning about nature and our interdependence with it.

A fun and challenging way to support fine motor development is learning to eat with chopsticks. One can let a younger child try to eat with chopsticks any way she can, then show the five years and older child how chopsticks are held in the countries where people use them on a daily basis. Hold them so that the little and ring fingers stabilize the lower chopstick in the base of the 'valley' between the thumb and index finger, while the tip of the thumb together with the index and long fingers allow the upper chopstick to move against the stable lower one. The value of having the young and school-aged child participate in all the activities of the home, especially the kitchen, must not be forgotten. Of course, everything takes much longer when the little ones want to 'help out', but the opportunity for education of the sensory and motor systems cannot be duplicated. The child not only furthers the maturation of the hand, but develops many important faculties in the process of opening a jar or bottle, turning a tight faucet, beating an egg by hand while holding the bowl with the other hand, cracking (and eventually separating) an egg, wringing out a wet rag, washing a dirty pot, folding a T-shirt neatly, dusting under a vase which is lifted up by the other hand, sweeping the kitchen floor (using sweeping motions across the vertical midline), grating the carrot with one hand while the other firmly holds the grater, cutting apple and orange slices, measuring the flour, kneading the bread dough by hand, pressing the pastry dough into the pie pan, cracking nuts, or any of the activities of the home.

The development of the feet is even more forgotten in today's world; we take the feet quite for granted and are surprised when they ache, become flat, or develop hammer toes. Yet, the potential for the capacities of the foot is such that people who lose the use of their hands can perform most of the functions of the hands with their feet, such as brushing their

teeth, writing, drawing, and painting. Our traditional childhood culture has foot games such as "This Little Piggie Went to Market" as a reminder that the development of the feet is not to be taken for granted or neglected. Foot clapping games where the parent takes the child's feet and moves them up and down at the ankles, wiggles the toes, or claps the soles together, while saying a nursery rhyme, delight little children and help connect them to their feet. Eventually the child can pick up little objects, scarves or marbles with their toes and put them in a basket. Walking on the toes like fairies, on the heels or on the outside of the soles like gnomes, or bunching up a sock underneath the foot by pulling at it with toes curling and straightening are other ideas for supporting toe and foot development. Rudolf Steiner reminded the first Waldorf teachers that it is important to look at children's feet when their hands have difficulties with hand writing. He suggested that school-aged children be taught to write with their feet (the child uses the foot of the dominant side). Class teachers who have used this approach have noticed that children's hand writing indeed does improve and that their fingers and hands become less tense.

Today's children are allowed to spend too many hours in front of video game, computer, and television screens for the fine movements of the hands and postural control to develop fully. Many adults seem to feel that the interaction of computer games and other electronic activities where children use their fingers on buttons and sticks is good enough for the development of eye-hand coordination and fine motor skills. But compare these hand motions with the ones children use when engaged in some of the activities suggested above. Who wants to see the development of the hand go in the direction of being able to perform fewer skilled motions and possibly just turn into an extension of the machine? I strongly urge all adults who work with children to take up the task of supporting the proper development of the hand. The hand with its ability to create and to freely give is what makes us truly human.

Note: For those unfamiliar with anatomical terminology: phalanges are the bones of the fingers and the interphalangeal joints the joints between these bones. The metacarpophalangeal joints are between the bones of the hands (metacarpals) and the proximal (closest to the palms) phalanges. The distal phalanges are those of the ends of the fingers (furthest

away from the palms). The pronated forearm turns the palm down while the supinated forearm turns the palm upward.

About the fine motor movements of the hand and fingers, professor Matti Bergström, a Finnish neurophysiologist and author, says: "The brain discovers what the fingers explore. The density of nerve endings in our finger-tips 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 form-building capacity of their hand muscles, then we neglect to develop their understanding of the unity of things; we thwart their esthetic 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."

A Note on Block and Stick Crayons

Try drawing with a block crayon, then with a stick crayon, and notice the difference in your own posture and in the drawing. Which seems to create more tension in shoulders, neck, and hand? What is the history of the block crayon? There were no block crayons during Rudolf Steiner's time; they were not 'invented' until the 1950s. I have heard from retired Waldorf teachers that two art teachers in a northern German Waldorf school designed the block crayons for artistic use in the upper grades. They were intended to be used as a means of extending artistic techniques after the shaded drawing technique had been mastered in the first three grades. These types of drawings could not yet be made by kindergarten and lower grade school children whose hand, wrist, and arm development is still maturing. The typical forms drawn by

young children are lines: at first scribbly lines, then 'wooly balls', circles, spirals, triangles, squares—which are all more readily drawn with stick crayons than with blocks. The block crayon delays the fine motor development of the hand, discourages the drawing of these archetypal forms of early childhood drawings, and causes many children to hurriedly complete a picture as they cover the paper with quick, broad strokes. When holding a block crayon the five- to six-year-old's hand is mostly pronated. There is little stabilizing effect of the flexed ring and little fingers, so the hand lacks full support and the motion of the crayon across the paper is mostly guided by the arm moving at the elbow and shoulder and/or the trunk leaning or twisting to the sides. This is quite a different picture from the hand holding a stick crayon or pencil, more reminiscent of a younger child who directs the crayon across the page with the help of the whole arm and/or trunk.

Many of today's kindergarten teachers who have stick crayons in their classrooms have noticed that the children draw more universal and age-typical pictures with more of the mentioned archetypes. In my work with second graders I have noticed how much longer they spend on drawing person-house-tree pictures when they use stick crayons and no block crayons. In my observation, they work with greater care and draw more archetypal forms.

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