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STANDING YOUR GROUND

By Arthur Kilmurray

We walk on our feet; we run on our feet. We dance on our feet; we do yoga on our feet. But how often do we really consider the creative potential of our feet? Those of us with the urge to refine our practice of Hatha Yoga must sooner or later address the action of the feet — how do they work, and what is the effect of asana on the feet and vice versa. This article will examine how the feet can be explored through asana.

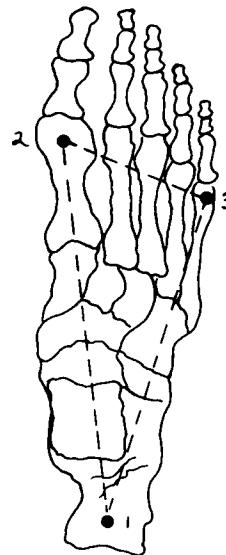
Direct perception of the nerve signals coming from muscles and bones is the definitive source from which the awakening of the intelligence of the body comes. It takes time and commitment to practice to tap that source. In the meantime, anatomical and kinesiological information can be useful to awaken understanding. Precise details of the structure and function of the feet, for example, can provide a framework from which the student can visualize just how they work. Note that this process is very different from just accumulating facts. Two suggestions are offered to the reader. First, refer to a good anatomy book to obtain more precise information and visual input than can be included in this article. The book should serve as a topographical map of the body. Second, play with your feet as you go over the various points — connect the words and pictures with kinesi-
thetic experience.

The opening and expanding action of the arches is the key to awakening the intelligence of the feet. In all standing poses the arches are the connecting link between the downward pull of gravity and the upward lift of postural action. B. K. S. Iyengar, author of Light on Yoga, frequently refers to the arches, emphasizing the importance of maintaining their intelligence in all poses. The inability to work the arches correctly can lead to long-term degenerative problems throughout the body. But "happy feet" lead to a happy spine and a happy mind. We will begin our exploration of

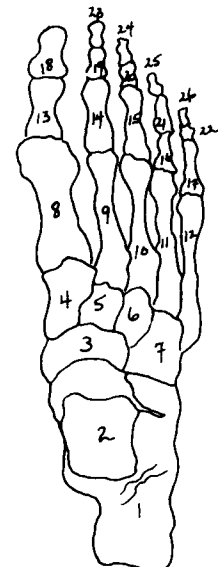
the arches by examining the structure of and movement available to the foot. We will look at the arches in general to see the main contact points of the weight-bearing foot, followed by a closer look at the specific bones that compose the foot and how they are aligned along the arches and the muscles that act on them. An examination of the basic movements of the foot will give us clues to the dynamic action needed to awaken the arches, as well as some of the possible problems that can occur from incorrect actions and how they might be corrected. Finally, some simple exercises will be suggested to help bring intelligence to these movements.

The bony contact points of the arches define the ideal distribution of gravitational stress through the foot. (See drawing #1.) The plantar arch (the singular term for the three-dimensional structure of the foot) can be seen as two crossing arches — the longitudinal arch running from the heel to the toes, and the transverse arch running from the inner to the outer foot. The longitudinal arch can be further divided into the medial arch (from the heel to the ball

(Continued on page 4)



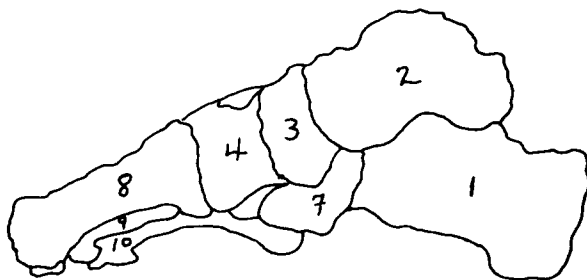
Drawing 1



Drawing 2

point of the big toe) and the lateral arch (heel to the ball of the little toe). The medial arch is much more pronounced than the lateral arch. The contact points of the transverse arch are the ball points of the first and fifth metatarsals, although the arch itself spans the mid foot as well as the toes. Correct action through these contact points will create a lift at the center of the plantar arch.

The weight of the body enters the foot at the ankle joint. From the tibia-fibula lower leg, the weight is transferred into the talus bone (see drawings #2 and #3, bone #2) from which it fans out in all directions. Part of the weight is transferred through the subtalar joint into the calcaneus bone (heel, bone #1). These two bones comprise the back of the foot and sit in an almost vertical relationship. From the front of the talus at the talocalcaneonavicular joint the medial arch extends outward through the navicular bone (bone #3), the three cuneiform bones (bones #4, #5, #6) and the first three metatarsal bones (bones #8, #9, #10) and their associated phalanges (toe bones). The lateral arch extends through the calcaneus into the cuboid bone (bone #7) and through the fourth and fifth metatarsals (bones #11, #12) and their associated phalanges. (The five metatarsal-phalangeal units can be referred to as digits.) The lateral fanning of the transverse arch begins at the mid foot as navicular, cuneiform, and cuboid bones sit in a diagonal relationship to each other. This arch is most pronounced here, sloping from the higher medial to the lower lateral side. By the front foot the metatarsal and phalangeal bones sit essentially in a horizontal plane (see drawing #3).

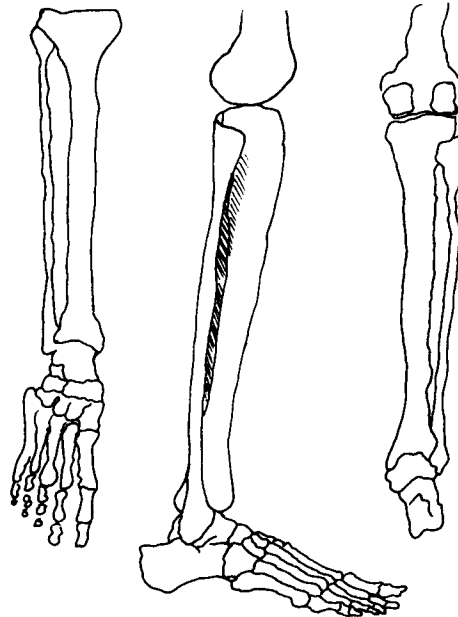


Drawing 3

The integrity of these bony arches should be maintained at all times, even in nonweight-bearing asanas. Consciously connecting with the bones and floating them in the colloidal intelligence of the muscles will create this action (a colloidal, a state somewhat between a solid and a liquid, approximate to the state of intelligent muscle tissue). All the joints in the feet open and expand evenly. To understand the precise forms this in-

telligence can take, we must first look at the four primary movements of the foot (see drawing #5, box 2).

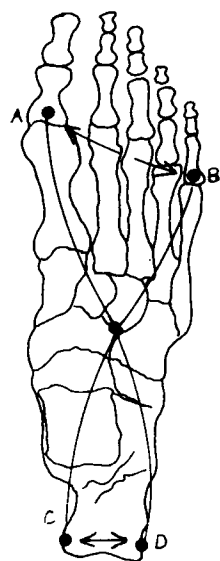
The first two movements occur at the ankle joint and involve the longitudinal axes of the plantar arch. Dorsiflexion moves the top of the foot towards the shin and extends the heel bone. This action grounds the back of the foot. Plantar flexion moves the top of the foot away from the shin and grounds the front of the foot. This is a common movement in ballet.



Drawing 4
Left to right:
4a, 4b, 4c

The second two movements occur at the sub talar and talocalcaneonavicular joint and involve the transverse axes of the plantar arch. Pronation or eversion grounds the medial foot and elevates the lateral foot. Supination or inversion grounds the lateral foot and elevates the medial foot. Three specialized muscle groups, each lying in a distinct region of the lower leg, refine each of these actions.

The major dorsiflexors of the foot lie on the front of the leg between the tibia and fibula and are referred to as the extensor group (see drawing #4a). The largest and outermost of these is the tibiales anterior. It begins at the top of the lateral surface of the tibia and attaches to the medial cuneiform (bone #4) and first metatarsal bones (bone #8). It also acts on the medial mid foot. The extensor digitorum longus originates on the lateral condyle of the tibia and the head of the fibula and runs down to the ankle, where it splits into four tendons which extend to the phalangeal bones of the second through fifth digits. The extensor hallucis longus originates on the fibula partway down from the knee and extends to the end of the first digit (big toe). The latter two muscles act primarily on the front foot. The action of this group as a whole strongly extends or



Drawing 5

BOX 1

5a and 5b: widening and pressing down.

5c and 5d: extending out.

BOX 2

5b and 5d: supination

5a and 5c: pronation

5a and 5b: dorsiflexion

5c and 5d: plantar flexion

grounds the heel bone.

The peroneals, major pronators, lie on the lateral side of the lower leg (see drawing #4b). The peroneus longus arises from the head of the fibula and runs down the outer leg, behind the outer ankle bone, under the calcaneus and along the sole of the foot to attach to the medial cuneiform and first metatarsal bones. This last section supports the transverse arch. The peroneus brevis begins at the side of the fibula, partway down from the knee, follows the peroneus longus around the ankle bone, and attaches to the fifth metatarsal. The extensor digitorum longus also aids in pronation.

The principal plantar flexors are located on the outer posterior of the lower leg (see drawing #4c) and are known as the triceps surae group. The soleus arises from the back of the fibula and tibia below the knee joint and ends in a large terminal tendon. This tendon is joined by the terminal tendon of the gastrocnemius muscle and together form the achilles tendon, attaching to the back of the calcaneus bone. The gastroc originates at the back of the femur (thigh) with two sections or heads (medial and lateral). These heads cross the knee joint and begin superficial to the soleus and then merge at the achilles tendon. The third muscle in this group, the plantaris, is long and thin, originating near the lateral head of the gastroc and also merging with the achilles tendon. This powerful muscle group firmly grounds the front of the foot, especially the metatarsal bones, balancing against the dorsiflexors.

This group also serves as the primary supinators, balancing against the pronating peroneals. Thus the muscle compartment at the back leg is longer and more complicated than the other two. Deep to the triceps

surae lie three more muscles that aid in supination and further plantar flexion. The tibiales posterior arises from the tibia, fibula, and the membrane connecting these two bones just below the knee. The muscle tendon begins two-thirds of the way down the tibia and runs behind the medial ankle to the underside of the foot. Here it divides into two parts. The thicker medial branch attaches to the navicular bone, while the weaker lateral branch is inserted onto the three cuneiform bones. The flexor hallucis longus originates on the fibula, one-third of the way down from the head of that bone. The muscle extends downward almost to the ankle, where the tendon runs behind and under the medial ankle to the underside of the foot where it attaches to the terminal phalanx of the first digit. This muscle strongly supports the medial arch. The flexor digitorum longus arises from the tibia, medial to the tibiales posterior. Its tendon crosses posteriorly over the tibiales posterior tendon at the back of the ankle. On the sole of the foot, the tendon branches into four segments which extend to the terminal phalanges of the second through fourth digits. This muscle supports the lateral arch.

There are also numerous smaller muscles that originate in the feet themselves which will not be discussed here, but it should be stated that there are two secondary movements created by these muscles that are important to understand. Adduction is the movement of the digits toward the midline of the foot, and abduction is a movement of the digits away from the midline.

The fundamental pose for the exploration of the flow patterns of the feet is Tadasana, Mountain Pose. The integration and harmonization of all the possible movements of the feet will create a dynamic sense of the precise flow patterns that both open and stabilize all the joints of the feet. The ball points of the big and little toe are anchored to the floor by the strong lift of the calf muscle group. The toes, when fully extended, are further pressed into the floor by the action of the deeper muscles of the back leg. Normally, this action would elevate the heel, so the front shin dorsiflexors must also lift to anchor the heel. The deep muscles here keep the toes extending and also prevent the tips of the toes from gripping the floor, an action that curls the energy back into the feet. (Energy must flow out through the extending toes as they press down — much like the action of a wind sock moving with the breeze.) These actions stabilize the longitudinal arches. Because the activation of the muscles at the back of the leg will also supinate the feet, the peroneals must also be lifting to balance the transverse arch. The digits are spread away from each other (abduction) to broaden the base of support,

while tone is maintained in the adductors to augment the lift of the arches.

Perhaps all this can be seen more simply as a diagonal cross-stabilization (see drawing #5). Here, the brain or central distribution point is seen to be the center of the plantar arch, balancing two diagonal extensions. The energy flowing out through the inner and outer heel and ball points of the first and fifth toes is balanced by the lift moving back up the arch and into the leg.

In Tadasana, the action of the feet grounds one to the earth. This pattern should be maintained in all asanas. Various standing poses will change the angle of the legs, but the feet should adjust to recreate Tadasana. Seated poses will take the soles of the feet away from the floor, but the flowing extension of the arches remains. The source of the energy that activates the arches is always the center of the pelvis or hara. In inversions the arches and feet direct the extension of energy upward. The relationship to gravity may change, but the flow pattern is always the same.

Imbalances in these flow patterns can lead to long-term problems. The most obvious is a structural collapse in the plantar arch, commonly referred to as fallen arches. An over pronation at the talo-calcaneonavicular joint pushes the bones of the arch medially whereupon they sink. Here the ligaments are usually overstretched and their intrinsic stability is lost. However, correct action in the muscles can restabilize the arch to a certain extent. The first action to work on is supination, rolling from the medial foot to the lateral foot (see drawing 5, box 1, b & d). This will bring the center arch back into alignment. Then the ball points of the toes must press down to create more lift. The best way to accomplish this is to lift the toes away from the floor. With steady practice good results will be seen in the arch, but the muscles must be vigilant to make up for the overstretched ligaments. This corrective action will lead to a secondary imbalance, the shortening of the medial arch muscles. After the lift of the arch is learned, the ballpoint of the big toe must lengthen away from the center (see drawing #5a). Also, the toes eventually return to the floor, but not at the expense of the lift.

Most other imbalances are not quite so obvious. Because the muscles at the back of the leg (plantar flexors and supinators) are generally quite strong, they usually overpower the other two regions — the anterior shin and lateral shin muscles (dorsiflexors and pronators). Strong tight plantar flexors and weak dorsiflexors make it difficult to extend through the heel. Extension through the heel is part of a larger flow pattern involving the coccyx (tailbone) and lumbar spine. The compression that can happen

in the lower back during backbending asanas can be alleviated by lengthening through the tailbone and out the heel. If the heels cannot extend, the action is lost and the lumbar pays the price. To prevent this, work on strengthening the dorsiflexors and stretching the plantar flexors. This action can also be seen in squatting positions such as Pasasana.

Strong and tight supinators and weak pronators create a lateral imbalance whereby the weight falls onto the outer heel and outer foot. Thus the inner calf is shorter than the outer calf muscle and the whole midline of the body, including the spine, contracts. Strengthening the peroneals will help. Extend the inner ankle, heel, and big toe to open up and elongate the midline from the center of the pelvis on down. This will have a direct effect on releasing the whole spinal column.

Unusual leg positions can also create imbalances that must be adjusted for. In standing poses where the feet are wider apart than hip distance, over supination or sickling of the foot can become a problem. Here, the outer arch of the back leg is overstretched and the grounding of the ball point of the big toe is lost. The challenge in these positions is to firmly anchor the outer edge of the foot without creating this sickling effect. This is accomplished much more from the hip joint than the foot. To correct sickling, rebalance the foot and press from the outer arch through the ball of the big toe. Then anchor the outer edge of the foot by lifting the whole leg, including the thigh bone, as a unit up from the floor, extending down through the inner heel, but lifting the inner ankle bone. Trying to correct only from the ankle will create the sickling.

Here are some simple exercises to get you in touch with some of these movements and areas. Use them to discover your weaknesses, strengths, and imbalances, and then devise your own methods to restore harmony to your feet. Your spine will be glad that you did!

These exercises are done from a right angle stretch at the wall: legs are perpendicular to the floor; upper body is parallel to the floor (as the hamstrings allow); feet are hip distance apart; arms are shoulder distance apart.

Exercise 1. Lift the heels away from the floor, bringing weight onto the toes. Notice how this weight will tend to roll to the outer (little toe) side (plantar flexion and supination accompany each other). Go up and down several times, noticing movement and observing the feeling.

Exercise 2. Keeping the heels away from the floor, balance the feeling in the center arch. Because the foot is not symmetrical, there will be more weight on the big toe than the little toe.

From this position, lift the toes strongly away from the floor. Feel the action. Try to form a right angle between the toes and metatarsal bones. Then press the whole of the toes firmly into the floor. Feel the action. Notice where it originates. Go up and down with the toes, actively lifting, actively pressing, keeping the heels up.

Exercise 3. Again with the heels off the floor, lift the whole outer foot towards the outer knee. Hold, release, and repeat several times. Notice the action; feel the movement.

Exercise 4. This time anchor the heels to the floor. Lift the front foot to meet the front shin. See if the inner and outer foot lift evenly and if they do not, balance them by lifting the lower edge more. Go up and down several times.

Exercise 5. Maintaining the lift of the front foot and anchoring of the heel, lift the toes even further towards the front shin and then press the toes down — without losing the lift of the front foot. Repeat several times, just working the toes.

Exercise 6. From the same position as in #4, further lift the outer foot to reach the outer knee and release. Repeat several times.

Those with an urge to further explore these movements can begin to trace the flow patterns of the feet into the spinal column. Observe, for example, how extension through the big toe effects the spine in one way, extension through the little toe has yet a different effect, etc. Observe how working at the inner heel effects the spine, as well as working from the outer heel, center arch. Play with it! ●

Arthur Kilmurray teaches yoga classes in San Francisco and Oakland, California.

Drawings by Linda Cogozzo, adapted from Color Atlas and Textbook of Human Anatomy by Werner Platzer. Volume 1: Locomotor System. Year Book Medical Publishers, Chicago, 1978.

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Get-Aways

MAY 17-19: Yoga retreat sponsored by the Marin School of Yoga at the Vedanta Meditation Retreat Center in Olema, California. Write/call: Richard Miller, 15 Dorset Lane, Mill Valley, CA 94941; (415)381-3324.

MAY 24-27: Memorial Day yoga retreat with Margaret and Martin Pierce at Gwynn Valley, Brevard, North Carolina. Write/call: The Pierce Program, 1258 Mansfield Avenue, NE, Atlanta, GA 30307; (404) 524-7225.

MAY 31-JUNE 2: Inner Awakening, a yoga workshop with Jearl Couch at Westerbeke Ranch, Sonoma, California. Write/call: 26790 St. Francis, Los Altos Hills, CA; (415)941-6087.

MAY 31-JUNE 5: Iyengar-style yoga with Maureen Caruthers at Hollyhock Farm, Box 127, Manson's Landing, Cortes Island, BC, Canada VOP 1K0; (604)935-6465.

JUNE 5-14: Yoga on Maui with Bob and Linda Smith, authors of Yoga for a New Age. Write/call: 4450 - 11th Ave., NE, Seattle, WA 98105; (206)632-1706.

JUNE 13-23: The Ultimate Four-Day Fitness Forum with Kathy Hunter. This get-away promises to focus on fitness from the inside out! To be held at Wilmington College near Cincinnati, OH. Write/call: P.O. Box 37332, Cincinnati, OH 45222; (513)948-1321.

JUNE 21-23: Summer solstice, an Integral Yoga weekend with Swami Satchidananda at the Joy Lake Community, P.O. Box 1328, Reno, NV 89504; (702)323-0378.

JUN 28-30: Iyengar-style yoga retreat with Susan Voorhees at Ocamora Foundation, Ocate, NM. Write/call: Route 7, Box 129-Z, Santa Fe, NM 87501; (505) 982-5031.

JUL 2-AUG 1: Yoga in Salzburg, Austria with Bobbi Holliday Thompson. Includes classes in art, history, German, music, and a daily yoga class. Optional trips to Switzerland, Vienna, Budapest, and Italy. Write/call: 26101 Country Club Blvd., #1926, North Olmsted, OH 44070; (216)779-4166.

JUL 21-AUG 13: Join Sam Dworkis of the Yoga Institute of Miami and Himalayan Fantasies for THE GREAT HIMALAYAN YOGA TREK, approximately 25 days of trekking, touring, and yoga. Write: 5793 Commerce Lane, Miami, FL 33143.

AUG 1-9: No frills Iyengar-style yoga vacation with Ramanand Patel at Hampshire College, Amherst, MA. This get-away includes twice-daily classes, lodging, meals (vegetarian available) and college recreational facilities. Write/call: Jyoti Hansa, RR 1, Box 132A, Taylor Rd., Shelburne, MA 01370; (413)625-9329.

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