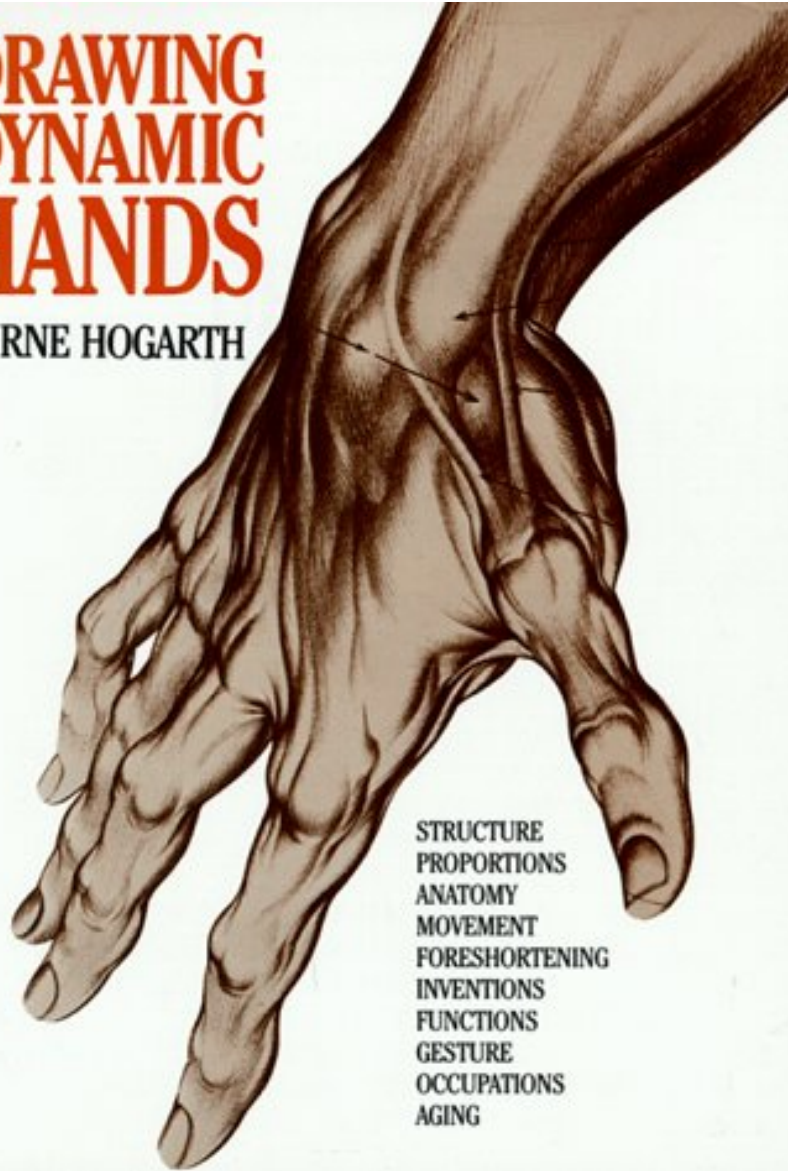


DRAWING DYNAMIC HANDS

BURNE HOGARTH



STRUCTURE
PROPORTIONS
ANATOMY
MOVEMENT
FORESHORTENING
INVENTIONS
FUNCTIONS
GESTURE
OCCUPATIONS
AGING

**DRAWING
DYNAMIC
HANDS**

BY BURNE HOGARTH

back Edition

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RODUCTION

ancient precept that the person who
e an artist must first learn to *draw*.
who has ever wished to become
—who has taken those first falter-
s down the road to art—has begun
desire to draw. It was the love of
that confirmed all those initial
And through all the later aspira-
s long as the creative drive
ed, the urge to draw never died.
of us who are committed to
in the visual arts can remember
formal training. When we first
in a studio art class—whether our
s painting or sculpture, illustration
n—we knew that *drawing* had to
st. Our first adventure in art began
wing class. Drawing, we knew
doubt, was the root of the visual
nd the core of all art experience.
afe to say that there is no system
ation for the artist that does not

offer drawing—indeed would not *d*
offer a curriculum without drawing.
visualizing capability would be crippled.
And if we have reason to examine a
student's portfolio to assess perform-
and potential talent, there is no firm
touchstone than the quality of the dra-

Learning to draw means, a priori,
drawing. If we say, “Here is an artist
can draw,” we mean that this artist
draw the *figure*. But now a subtle d-
tion emerges. Among the world's ar-
schooled in the figure, who are the
noteworthy, who are those of the hi-
rank—and how do we know them?
transcendent artists were those who
draw the most difficult of all figural
ments, the *human hand*, with author-
and authenticity. And these tended to
come the luminary creators.

Consider the poignant hands and
in the *Expulsion* by Masaccio; the a-

hands of Grünewald's *Crucifixion*;
consciousness of Botticelli's *Adoration*;
infallible simplicity of Dürer's
My Hands.

Can anyone doubt the harmony, the per-
fection of forms in the figures and hands
of the works of Leonardo, Michelangelo,
Caravaggio, Rubens, Velasquez, Caravag-
gio, Rembrandt. . . .

Can we in our time support the canon of
art and the criterion of the human
form? Does anyone doubt the competence
of Rodin, Matisse, Rouault, Braque, or Picasso to
lead us away from the springboard of the fig-
ure and how shall we understand Rodin's
tormented *Burghers of Calais* or the
contemplating *Thinker* if not by their hands?
In this venture, speculatively, one last
attempt. In all the world's art, the highest
achievements, the most lofty visual expres-
sions center around the hand. From the

earliest hands of the Aurignacian hu-
man to the majestic God-king of Egypt, the
hand speaks to us. The hand spells resis-
tance to tyranny and proclaims victory in the
hands of *Harmodius and Aristogeiton*, the
founders of the world's first democracy. The
hand of Adam receives the spark of life
from God in Michelangelo's Sistine ceiling. The
hand holds aloft the chilling form of Me-
dusa's head in Cellini's *Perseus*. The hand
of Bologna's *Mercury* leads our thought
skyward.

The hand, as Rodin showed us, is the
alter ego of mankind, *The Hand of*

But it is also the hand of that other
creator, the artist, who, shaping the
world, creates himself.

BURNE HOGARTH
Pleasantville, New York
December 1976

1. FORMS AND STRUCTURES

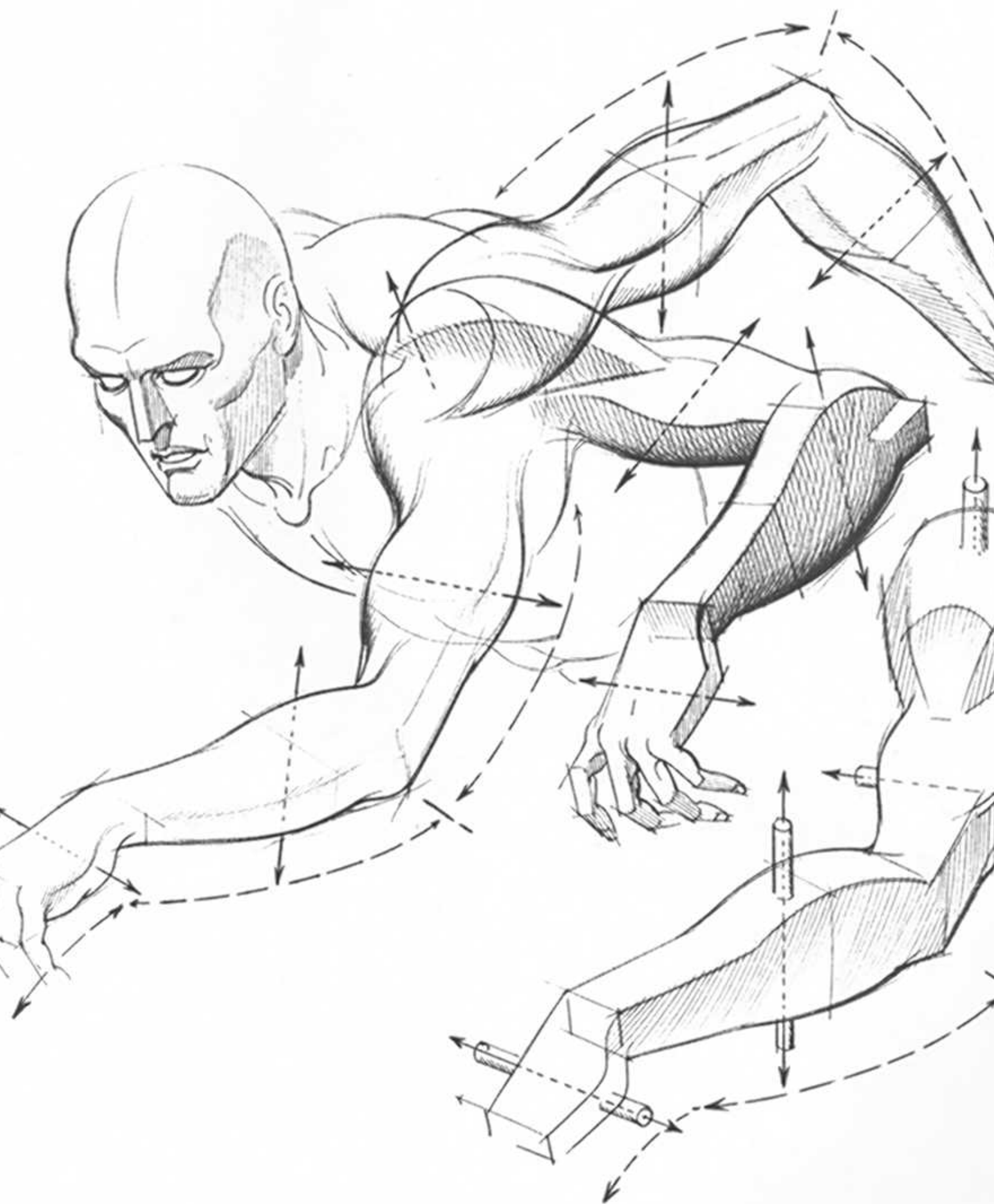
The hand is not a flat, two-dimensional shape without volume. It is a dynamic, three-dimensional body form, energetic and complex, each of its forms and structures interrelated. In this chapter we will look at it from various angles in space and depth, noting its curves and rhythms and examining the bulk, sizes, shapes, and masses of its individual parts and their relation to the whole.

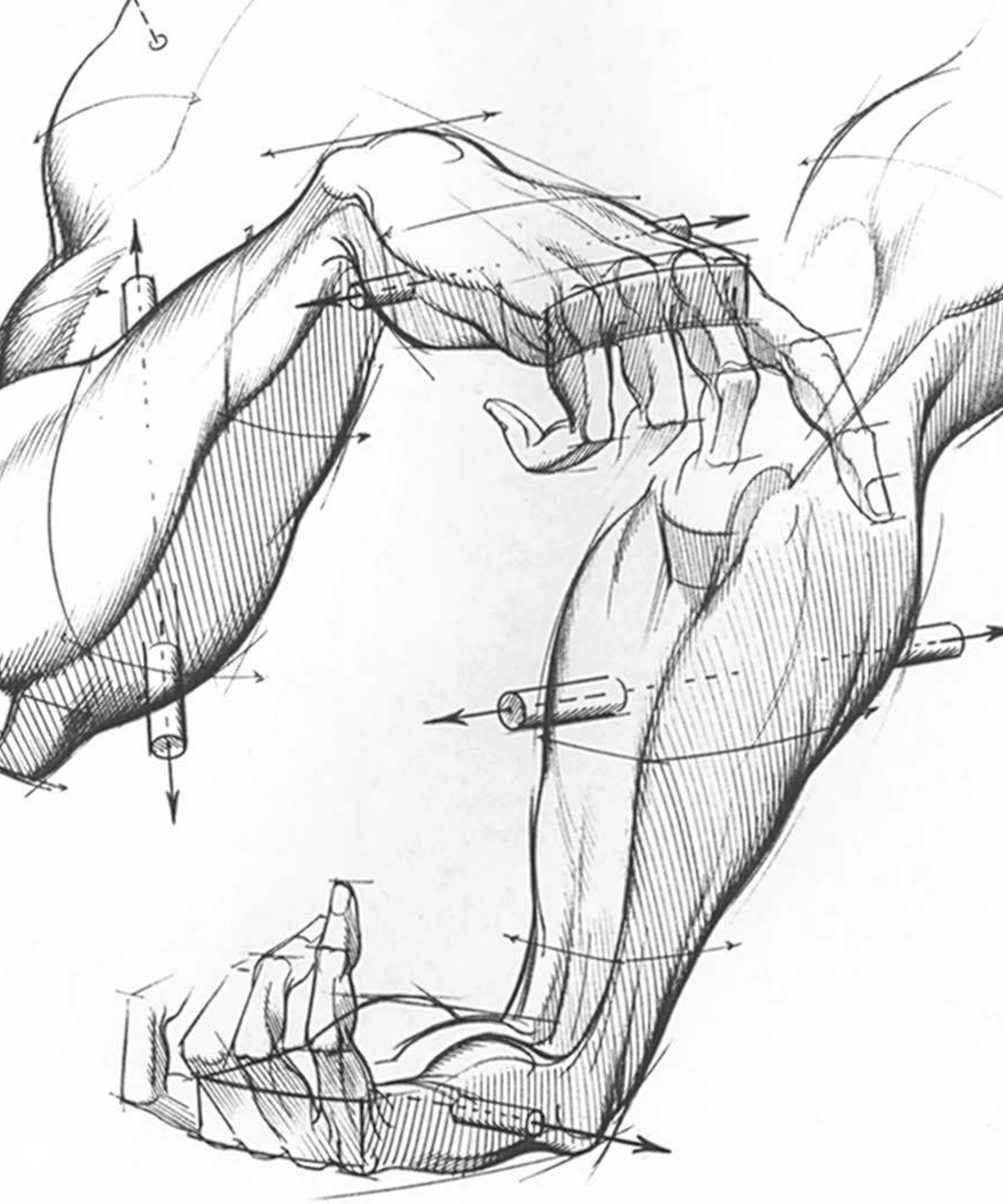


AND LOWER ARM

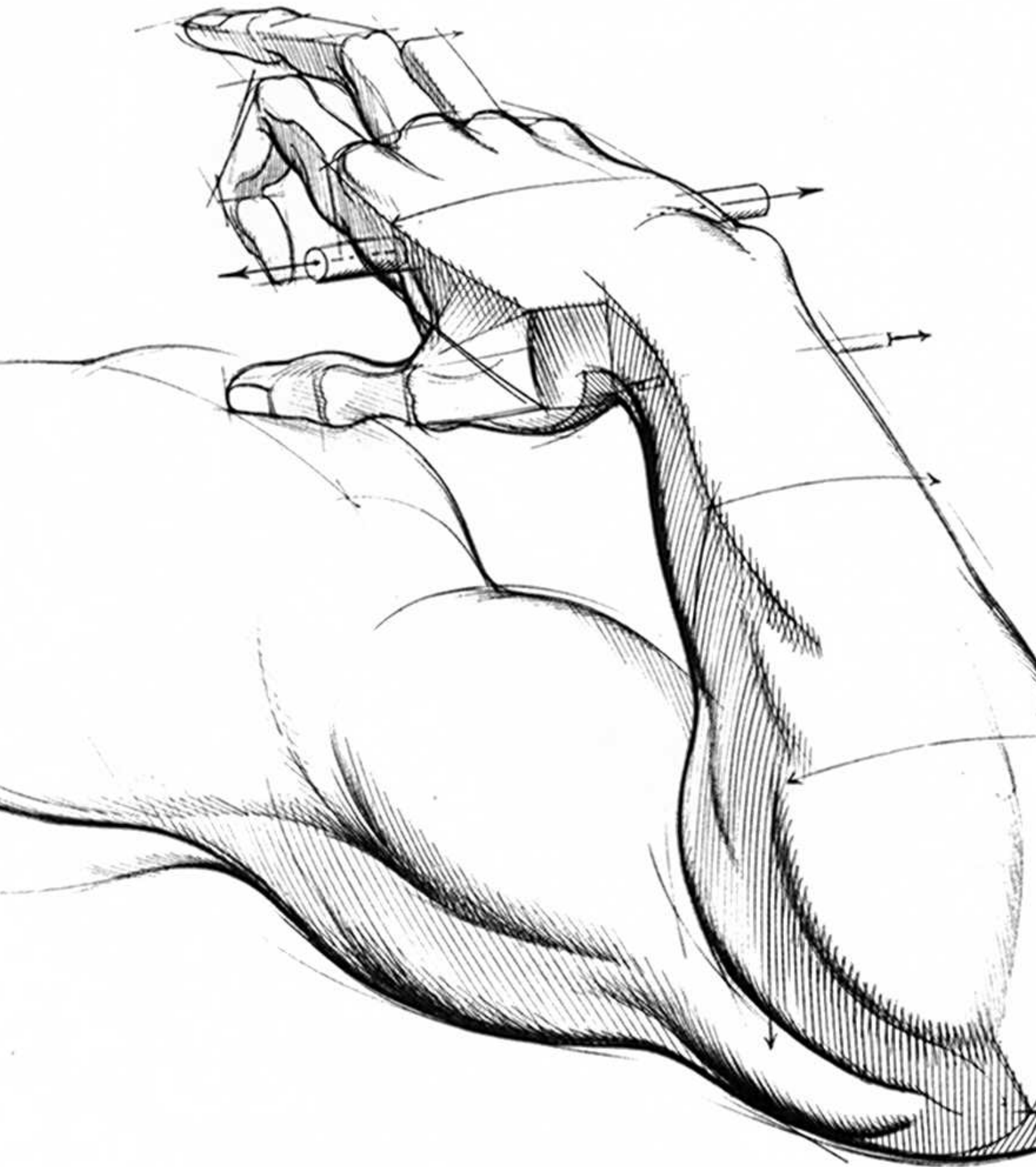
Masses of the upper and lower arm are good examples of the principle of *contraposition*—one form in opposition to, or moving in a different direction from the other. For example, the shoulder mass thrusts upward and backward; the direction of the biceps and triceps is forward and backward; the forearm repeats the up-and-down motion of the shoulder and is opposed by the hori-



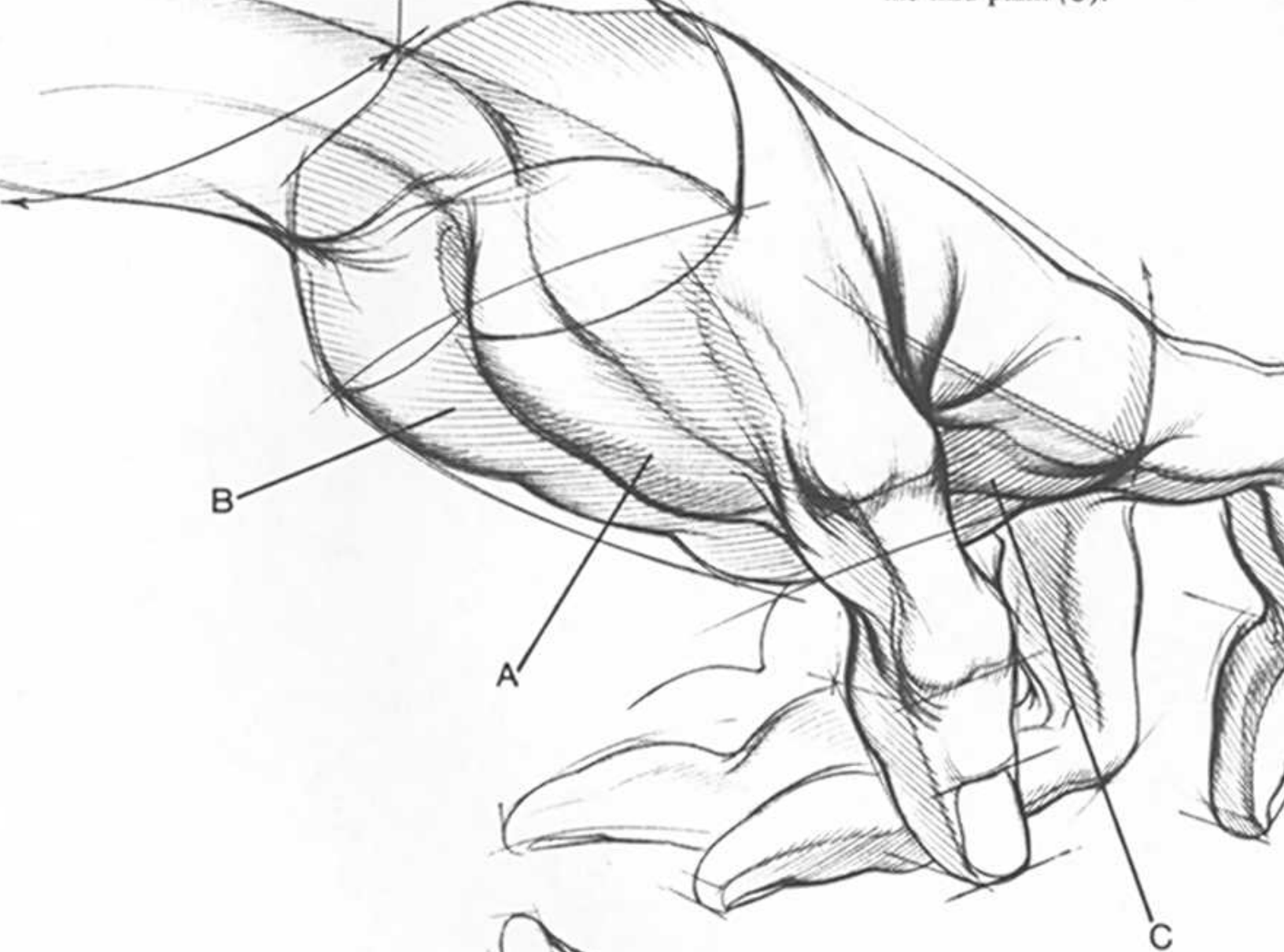


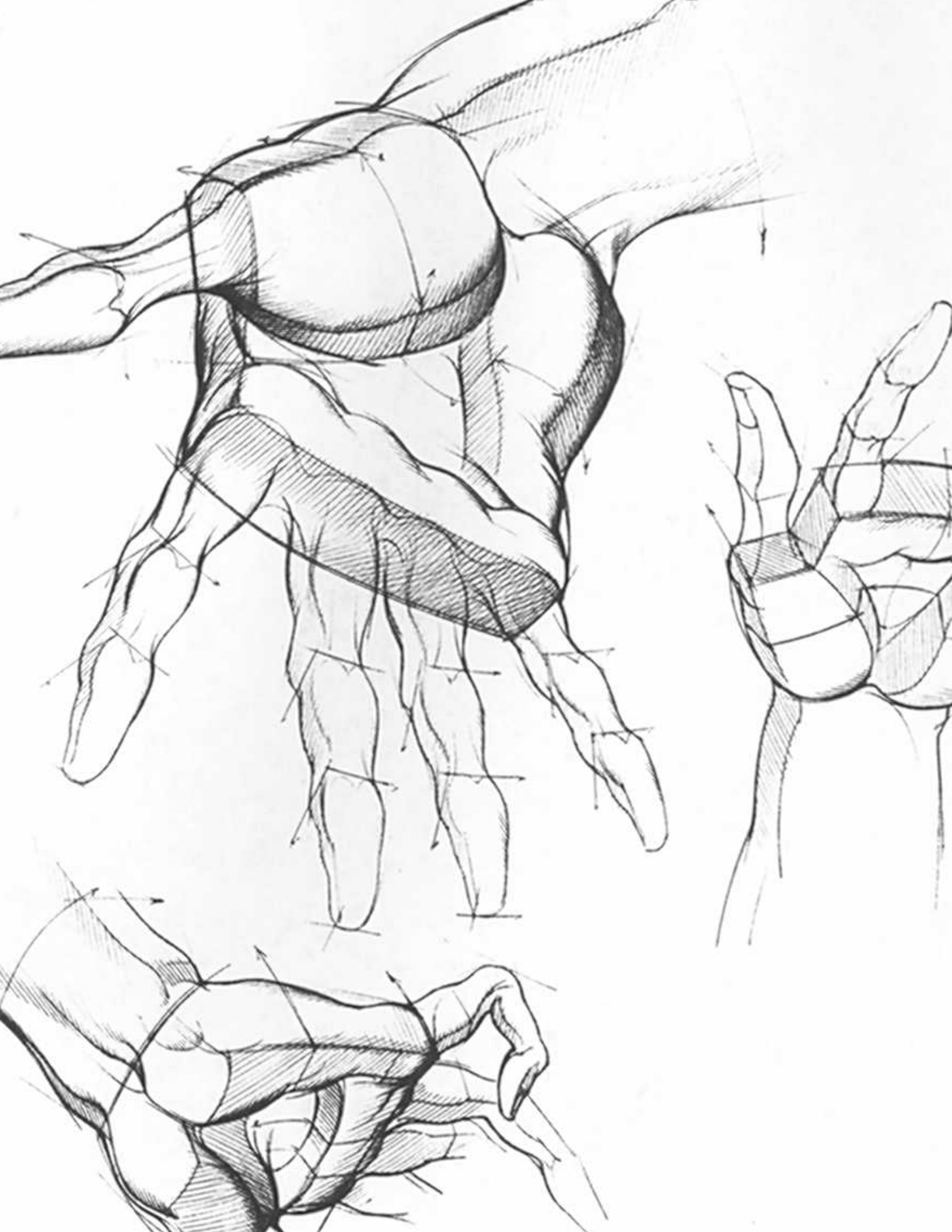


muscle about midpoint on its upper edge. Should
arm be raised vertically, the thumb would reach into
pit of the deltoid.











wise from wrist to fingers.





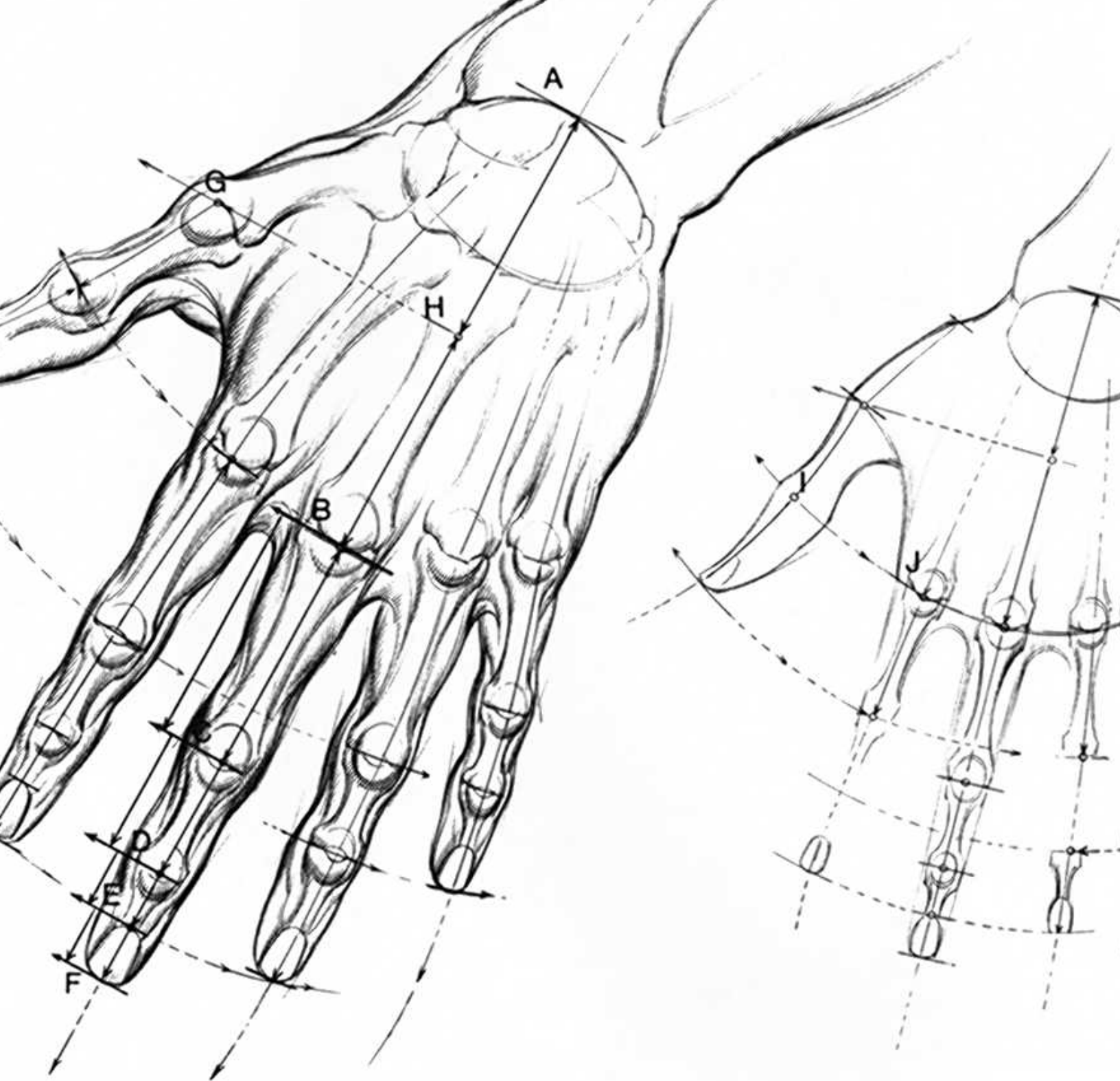
ROD AND BALL FORMS





2. PROPORTIONS AND MEASUREMENTS

Anyone who has tried to draw the human figure has quickly learned that the hand is among the most complex of the body forms. To draw the hand accurately and with precision, you must know how to relate the individual parts to each other and how to unify the separate elements. A knowledge of proportions is necessary in art and should be used as a learning stage to new expressive adventures. This chapter will introduce essential measuring cues and their use in drawing the hand in correct proportion. Once the interrelated measurements are understood, you can create dynamic and alive hands without needing a model. You will also see the underlying symmetry and unity of the structures of the hand.

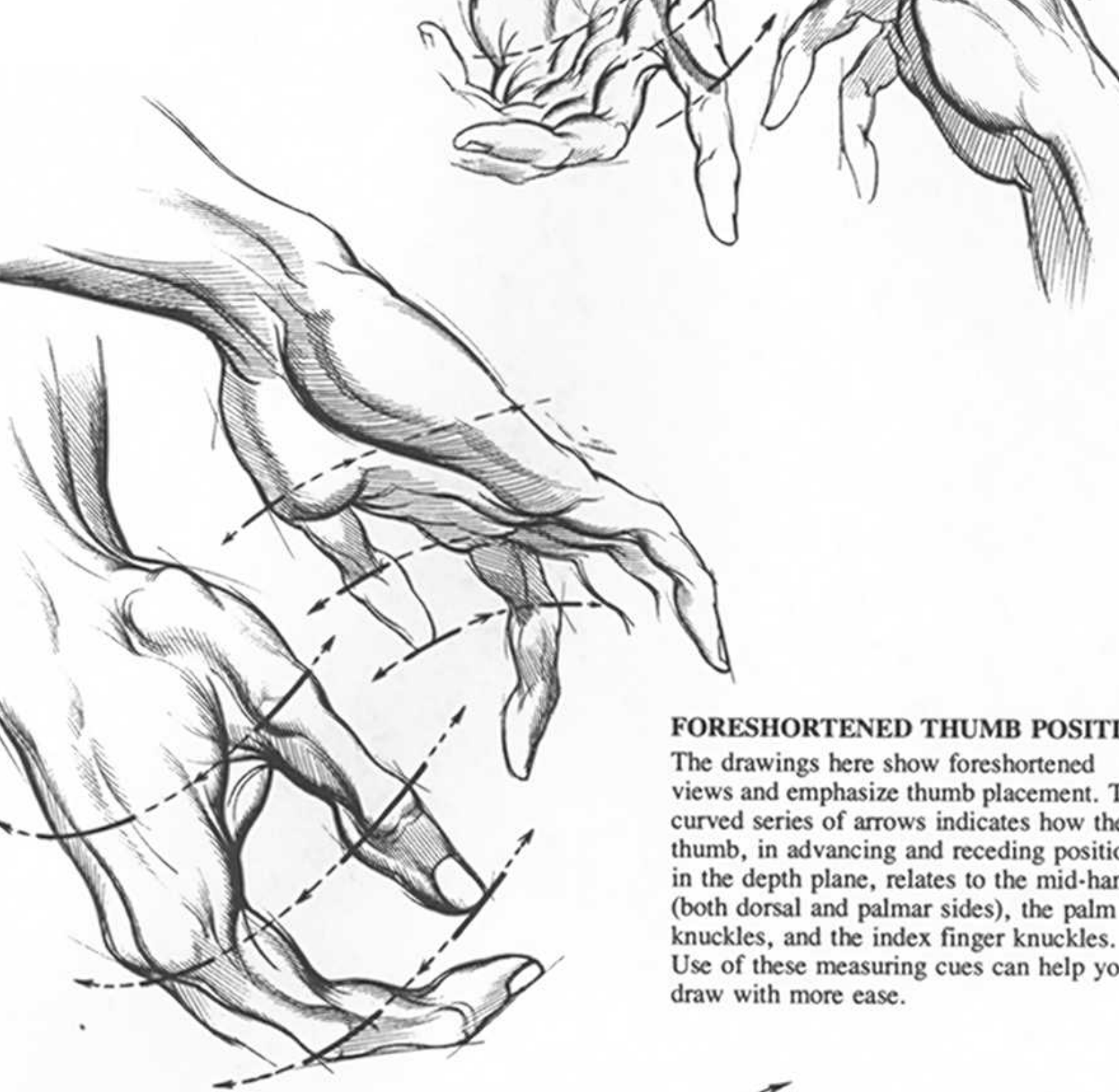


D FINGER MEASURES

is the governing form of the hand, and it varies in rectangular to square. From it, proportions and points of the entire hand can be determined. Note two measuring cues shown here. First, the palm begins at the wrist (*A*) and extends to the base of the thumb (*B*), which forms part of the palm knuckle. Second, the thumb emerges from the palm as a narrow wedge extending at about a 25- to 30-degree angle. The line (*G*) aligns with the vertical midpoint (*H*).

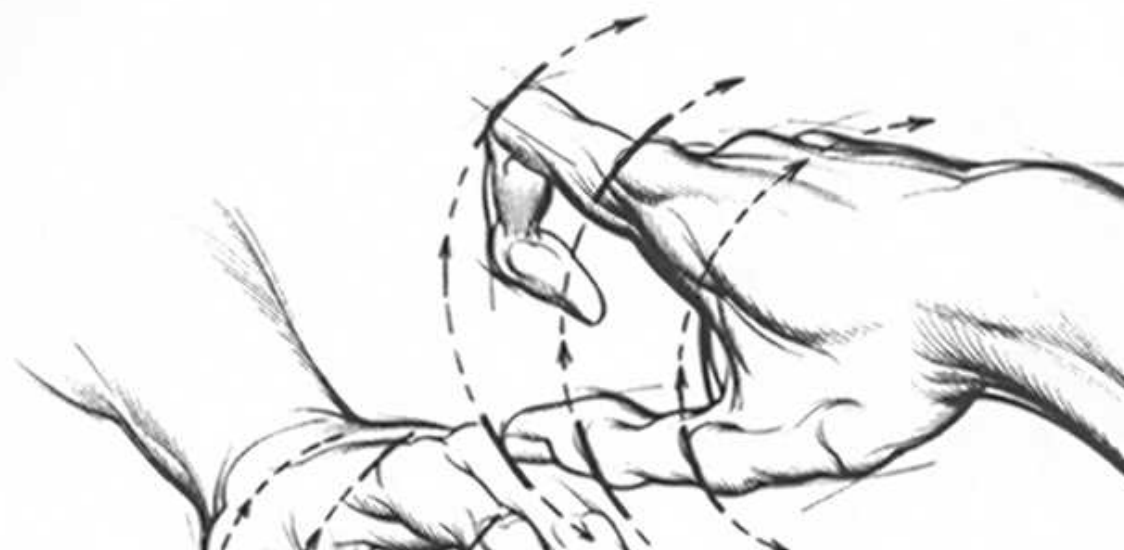
half the length of the first phalanx; and if the terminal phalanx (*D* to *F*) is divided, we have the length of the nail (*E* to *F*).

Other symmetries also exist. The schematic drawing shows the index and fourth fingers to be equal in length. Check this in both drawings and on your own hand. The tips of the index and fourth fingers terminate at the same level as the tip of the middle finger. Not all people show these equalities exactly, but a large enough majority have them to



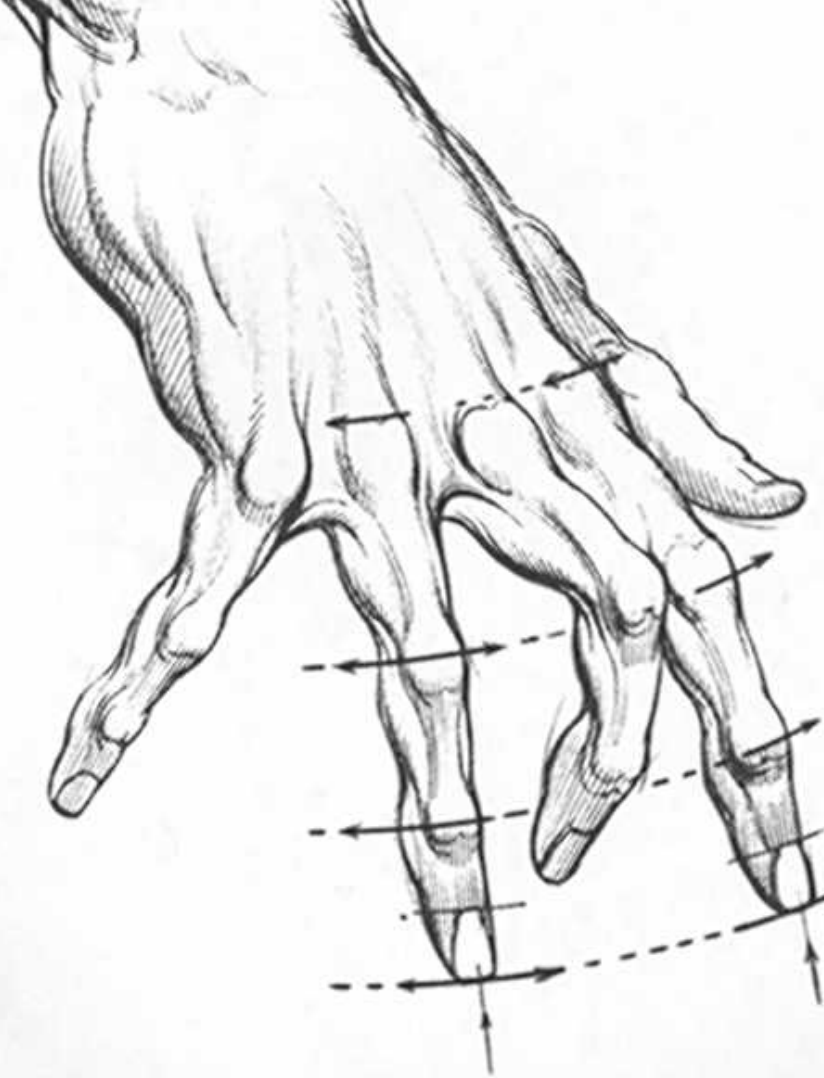
FORESHORTENED THUMB POSITION

The drawings here show foreshortened views and emphasize thumb placement. The curved series of arrows indicates how the thumb, in advancing and receding positions in the depth plane, relates to the mid-hand (both dorsal and palmar sides), the palm knuckles, and the index finger knuckles. Use of these measuring cues can help you draw with more ease.



FINGER MEASURES

Shown by the arrows here point out the relationship of the three long fingers of the hoof. The index and ring finger lengths can be measured from the nail bed of the middle finger. Since these fingers are usually about equal length, arcs from one to the other can be used to determine correct placement of the hoof wall and finger ends when viewed in the vertical plane. Note that this works consistently in the variety of actions shown here.





FINGER MEASUREMENTS

of the little finger lines up with the last knuckle of the
on the finger above the last knuckle of the

tween top and side planes of the *out*.
both hand and arm. This alignment is
apparent in the side view shown at left,
left, but correct placement of these po
less obvious, though essential, when
hand is drawn from angles, as shown
in the drawings at upper left and below



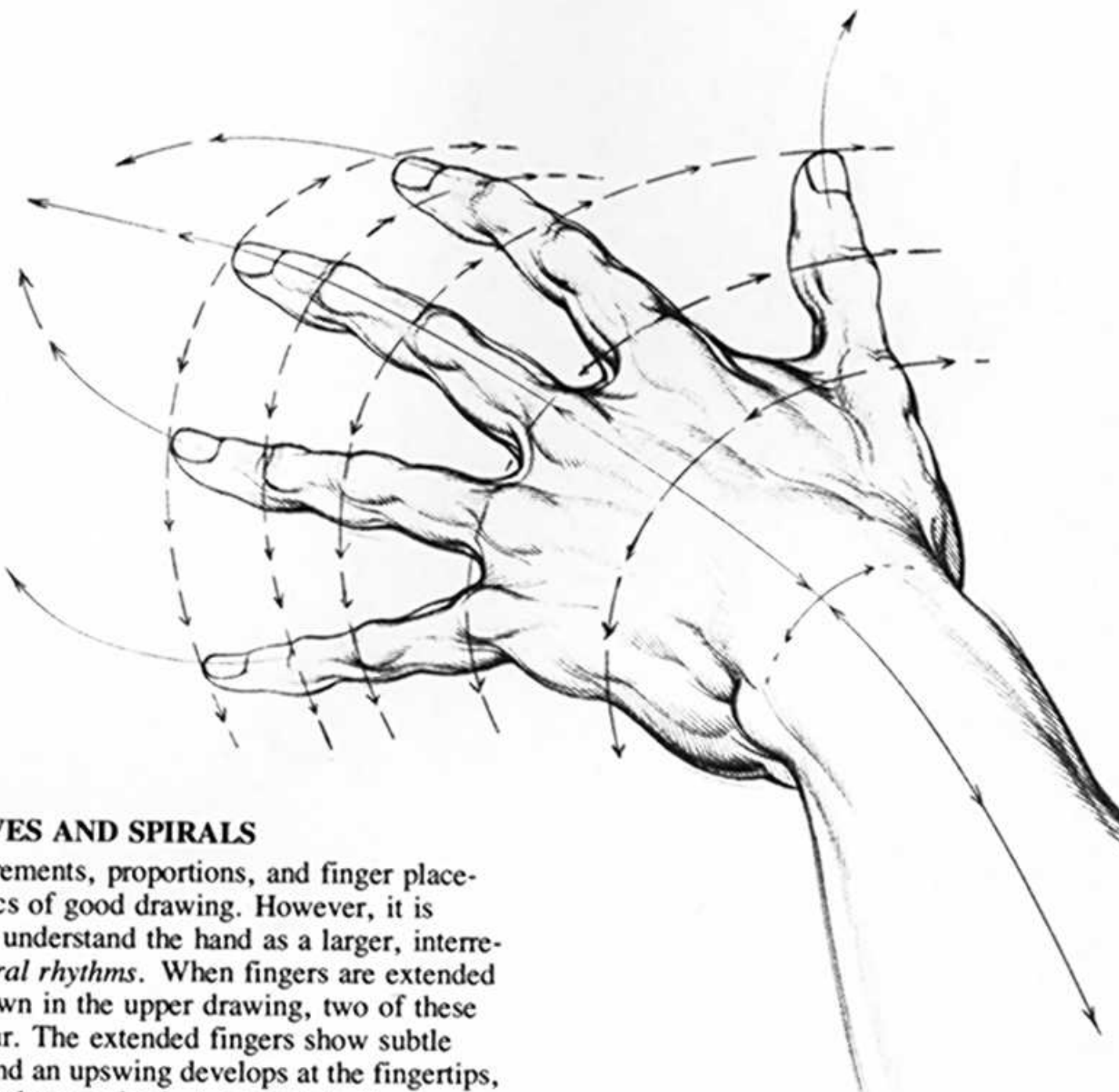
section is consistent even in different hand positions and different views.





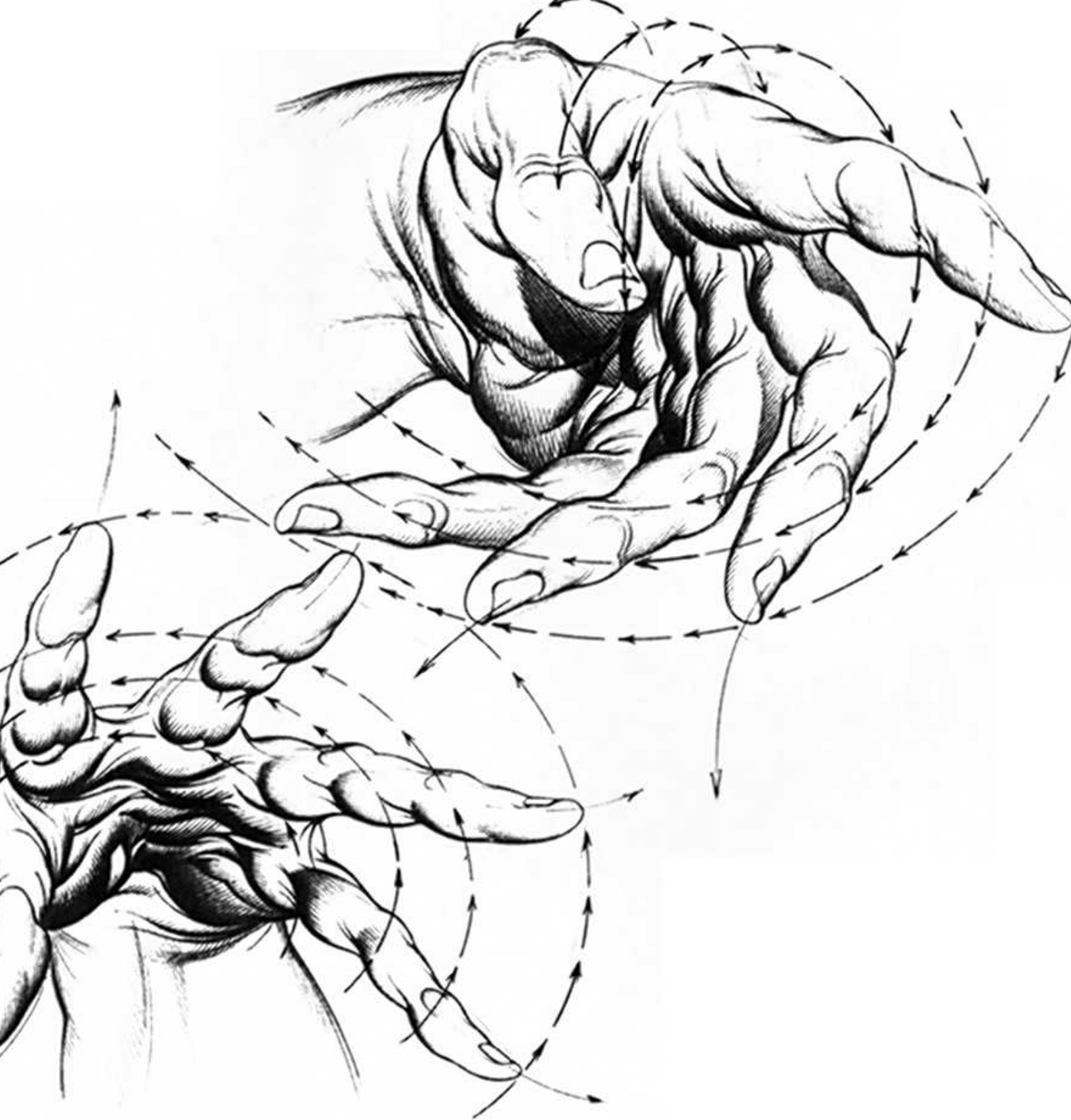
VIEWS IN DEPTH

Some of the most difficult views of the hand are those seen from the side, especially if the palm and fingertips are in some extended action. The thumb placement then becomes most difficult. In the upper drawing, the thumb has been put in *last*, after the finger and rear arm lines have been set. Note the relationship of the index finger and little finger palm lines relative to the thumb.



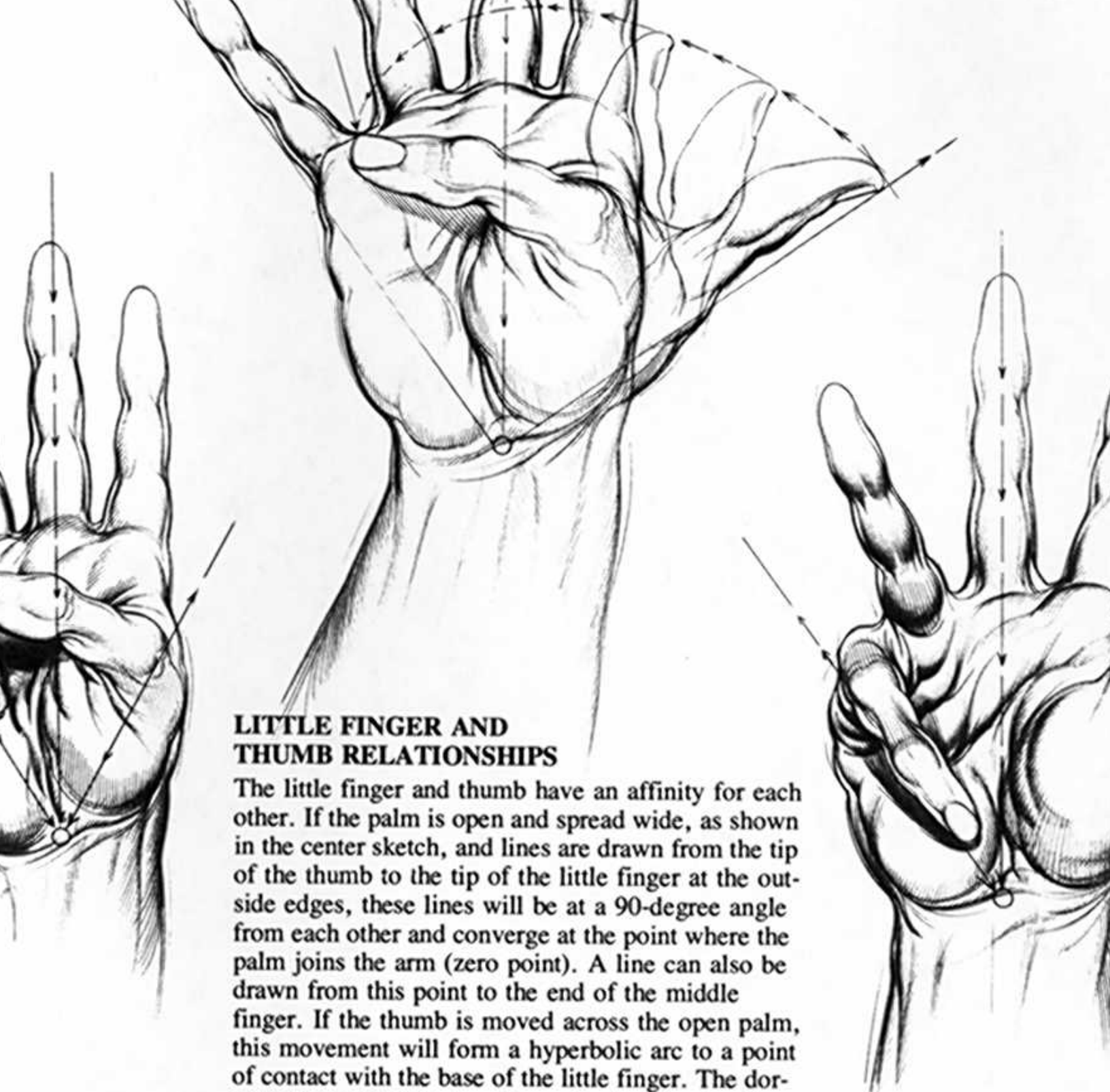
PARALLEL CURVES AND SPIRALS

with measurements, proportions, and finger placement, are the mechanics of good drawing. However, it is also important to understand the hand as a larger, interconnected system of *natural rhythms*. When fingers are extended to their limit, as shown in the upper drawing, two of these rhythms occur. The extended fingers show subtle curves and troughs, and an upswing develops at the fingertips,



SPIRAL AND ARC RHYTHMS

Awareness of the elliptical spirals of the hand may
spontaneous insight into form and can help you org

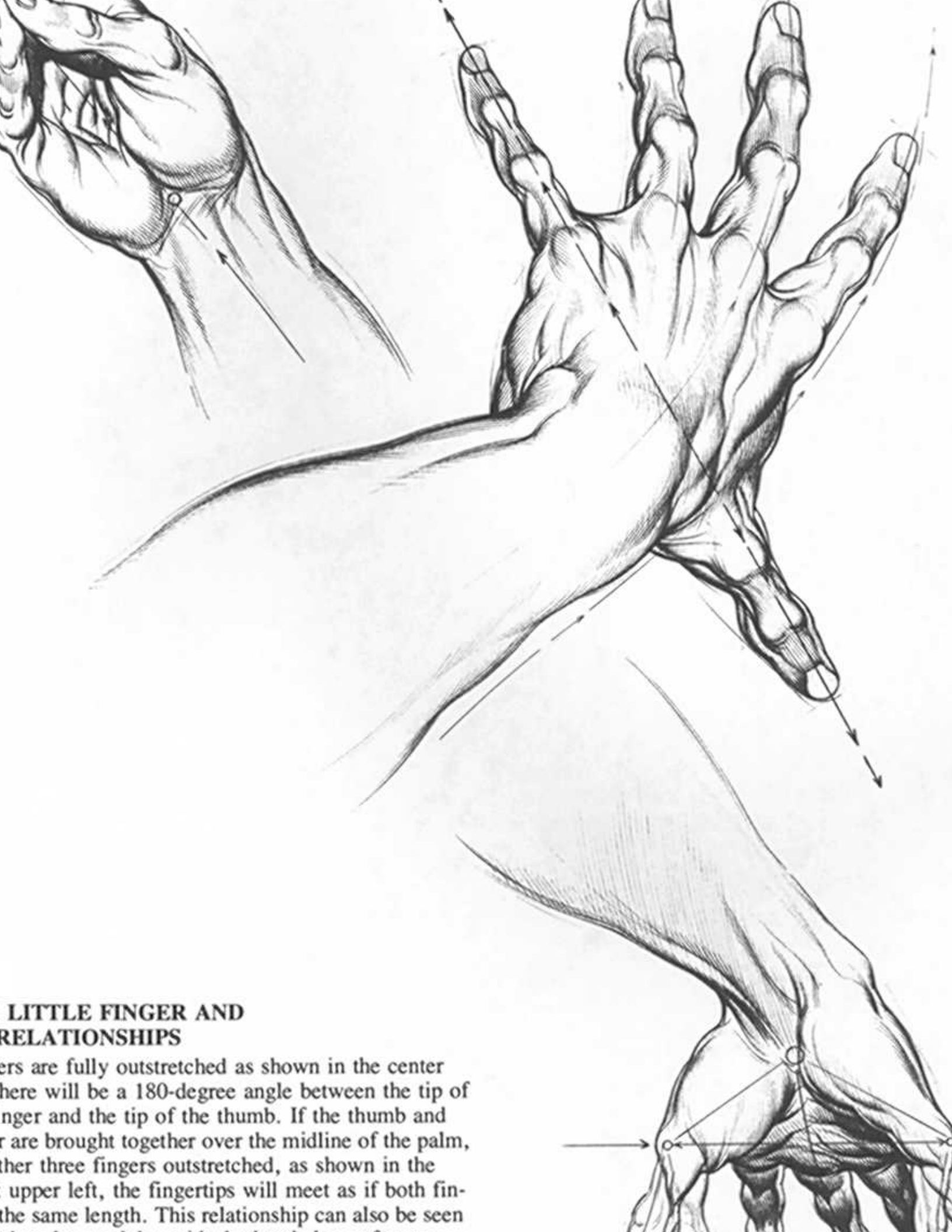


LITTLE FINGER AND THUMB RELATIONSHIPS

The little finger and thumb have an affinity for each other. If the palm is open and spread wide, as shown in the center sketch, and lines are drawn from the tip of the thumb to the tip of the little finger at the outside edges, these lines will be at a 90-degree angle from each other and converge at the point where the palm joins the arm (zero point). A line can also be drawn from this point to the end of the middle finger. If the thumb is moved across the open palm, this movement will form a hyperbolic arc to a point of contact with the base of the little finger. The dorsal palm knuckle is directly under the thumbnail on the dorsal side of the hand.

The sketch at left illustrates that when the fingers are expressing number three, the thumb crosses and rests on the second knuckle of the little finger, actually lining up with the palm knuckle beneath it, as if the little finger were not in the way. Note that the vector lines from the outside of the little finger and from the outside of the thumb converge at zero point and are perfectly equal in distance from each other.

Awareness of this relationship will help you in drawing various hand positions in which the thumb is



LITTLE FINGER AND RELATIONSHIPS

When the fingers are fully outstretched as shown in the center, there will be a 180-degree angle between the tip of the little finger and the tip of the thumb. If the thumb and index finger are brought together over the midline of the palm, with the other three fingers outstretched, as shown in the upper left, the fingertips will meet as if both fingers were the same length. This relationship can also be seen

ing toward each other but still maintain-
the wavelike form.

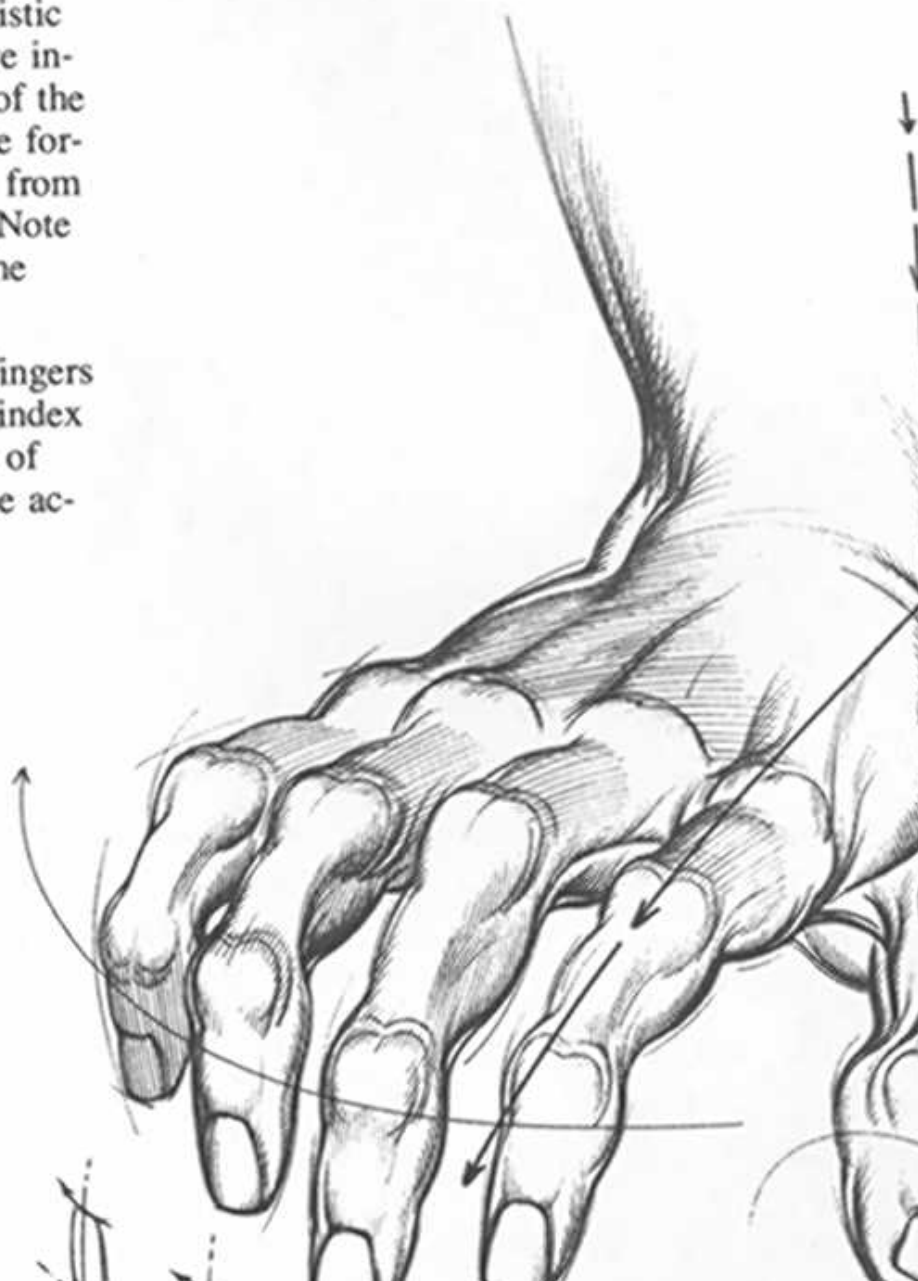


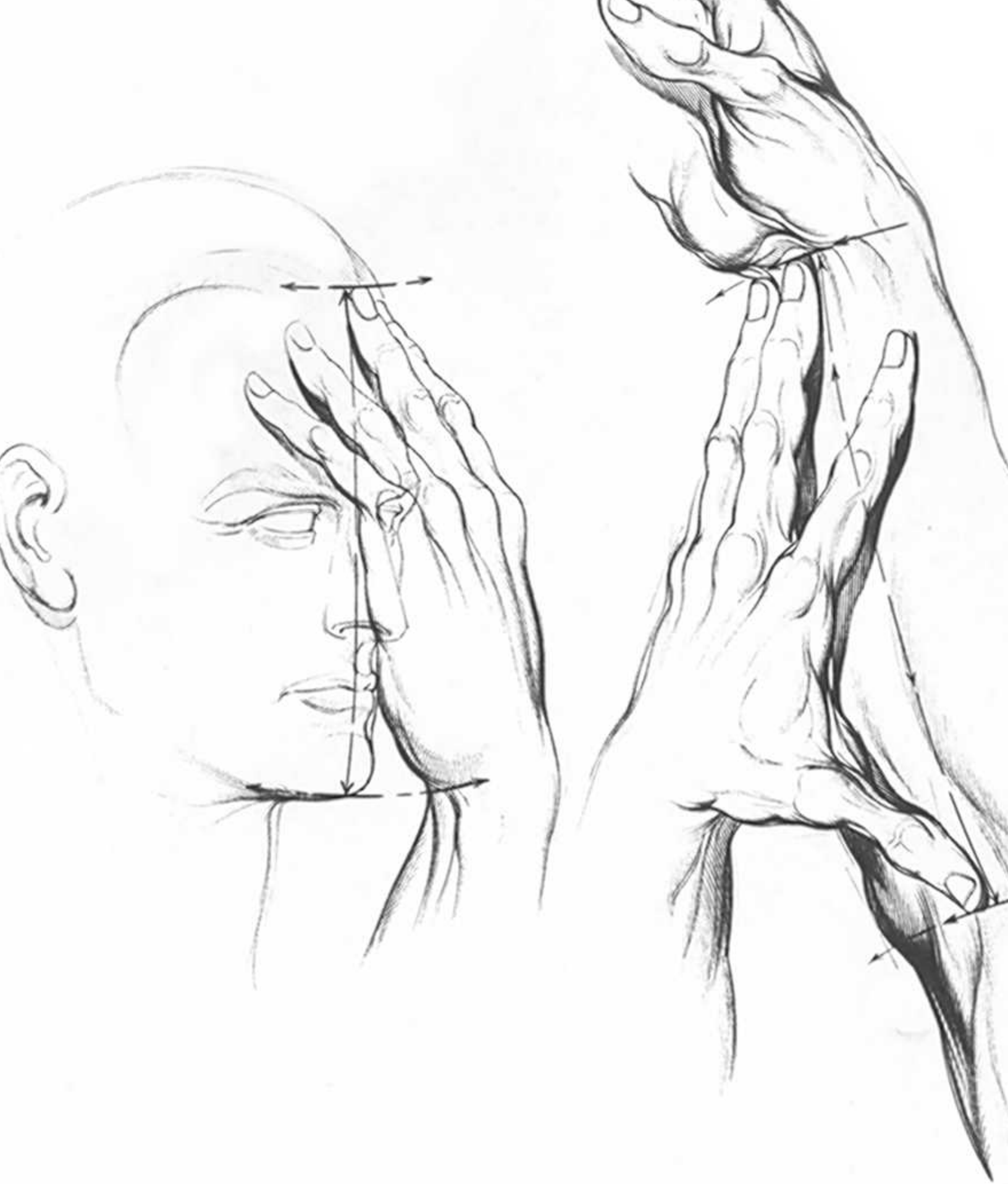


CHARACTERISTICS

Hands and arms have a special behavioral characteristic they also share with the legs—they tend to curve inward. This may account for the consistent undercurve of the hands mentioned earlier in Chapter 1. As the arms move forward, the tension projects the hands *outward* from the center of the arms, as shown in the drawing above. Note the directional arrows on the forearms and the index finger thrusts.

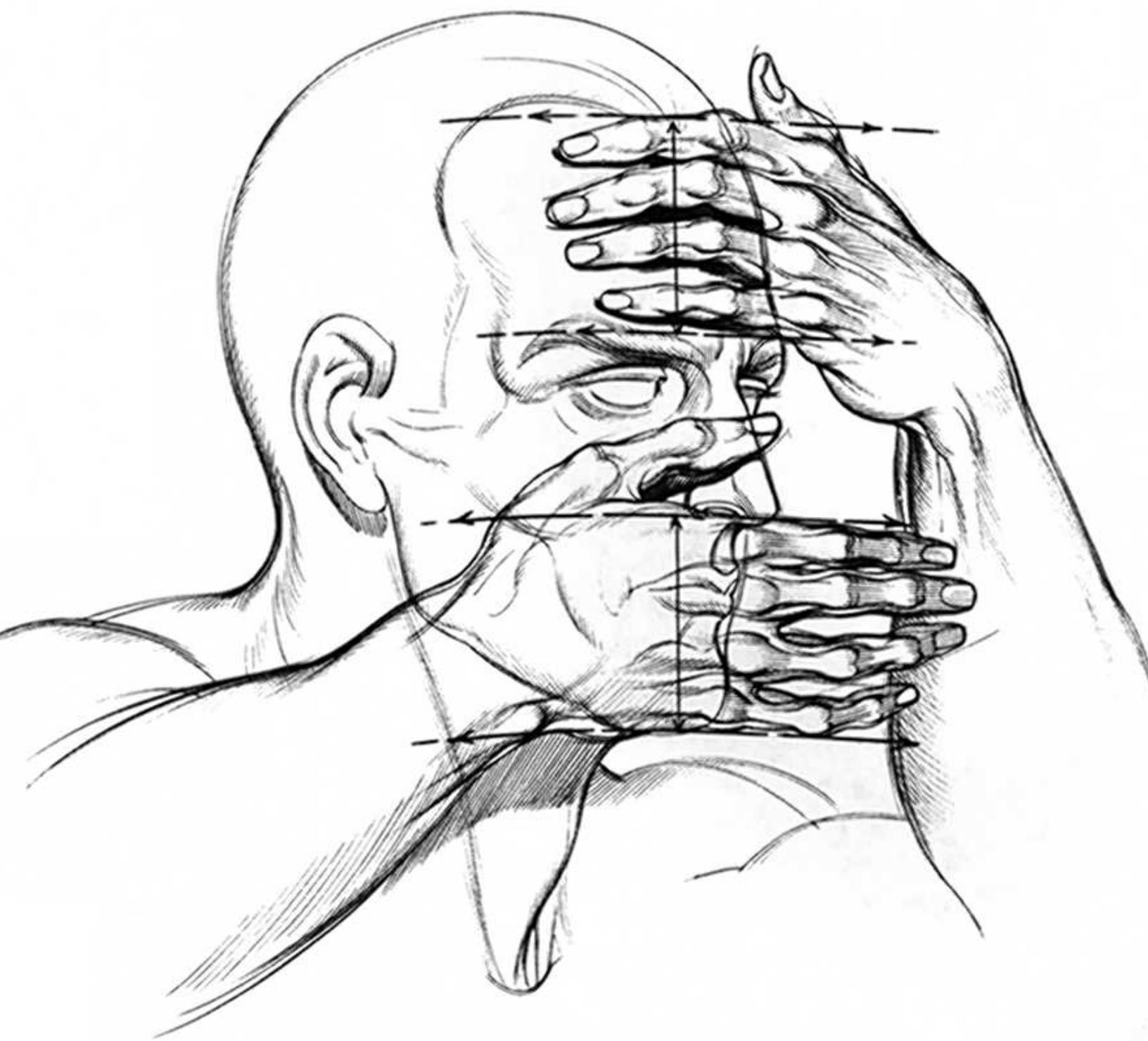
In the drawing below that fingernails of receding fingers are shown in an almost straight-on view, shown by the index finger. The little finger has a curve on the little finger that is almost out of the frame. The thumbnail, however, rotates according to the action of the hand or the action of the thumb.





**RELATIONSHIP OF HAND MEASURES
TO FACE AND ARM**

The base of the palm is level with the chin base, as shown



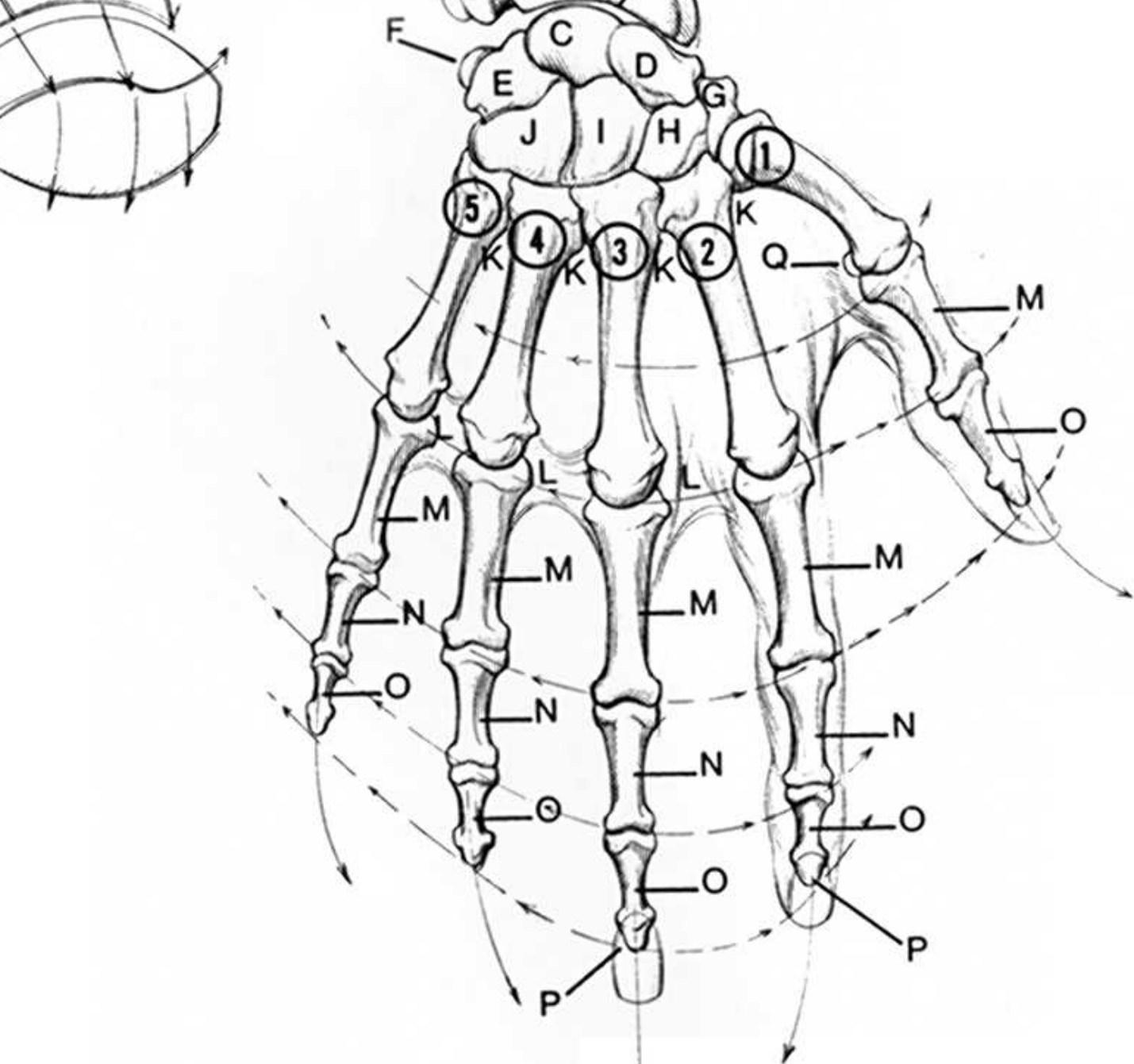
HEAD AND FACE MEASUREMENTS

final note on measured relationships, if the hand is held in side position and laid on the brow, it will fit almost

3.

ANATOMY AND STRUCTURE

When the artist studies human anatomy, he is not usually pursuing the same goals as the medical doctor or the scientist. He is searching for visual form which can be translated aesthetically and augmented imaginatively. However, knowledge of anatomy is essential for an understanding of various attitudes, postures, and movements. It allows the artist to truly understand the surface contours of the body because he knows the forms and structures underneath. It also teaches him why the surface forms appear as they do. Hopefully you will not be so caught in the study of the parts that you forget the rhythmic and unified whole. As you go through this chapter, you'll see the efficiency, order, and symmetry of the forms of the hand and the integrated way in which all work together to give the hand its wide variety of movement and response.



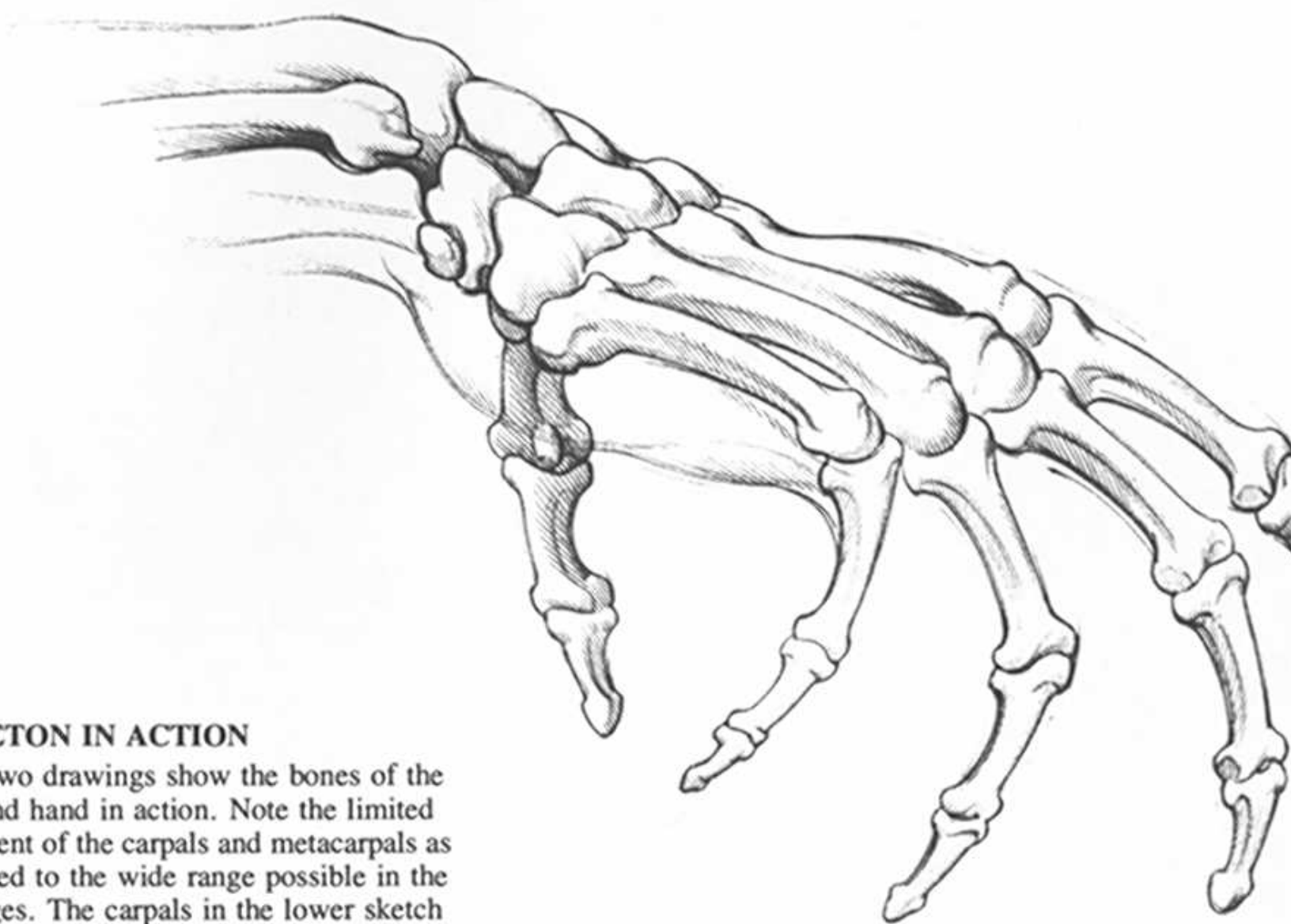
HAND BONES

side of the hand, including the wrist, has a particular surface, with many protrusions lying just under the hand begins above the wrist at the point where the radius and ulna (B) form the pivotal *radio-ulnar joint*. Only the radius articulates with the three top wrist bones to form the *radio-carpal joint* (X).

Just above the radio-carpal joint, the eight compact wrist bones as a whole make up the *carpus*, formed in a close-set ellipse, as shown in the schematic at right. Individually, they are known as the *trapezium* (A) and each has a separate name. The central *lunate* bone tends to elevate the upper tier composed of the *scaphoid* bone (D), a boat-shaped form on the inside; the *trapezoid* bone (E); the wedge-shaped *triquetrum* bone (F) on the outside (E); and the pea-shaped *pisiform* bone (F). The four carpal bones make up the lower tier. Articulating directly with the thumb is the saddle-shaped *trapezium* bone

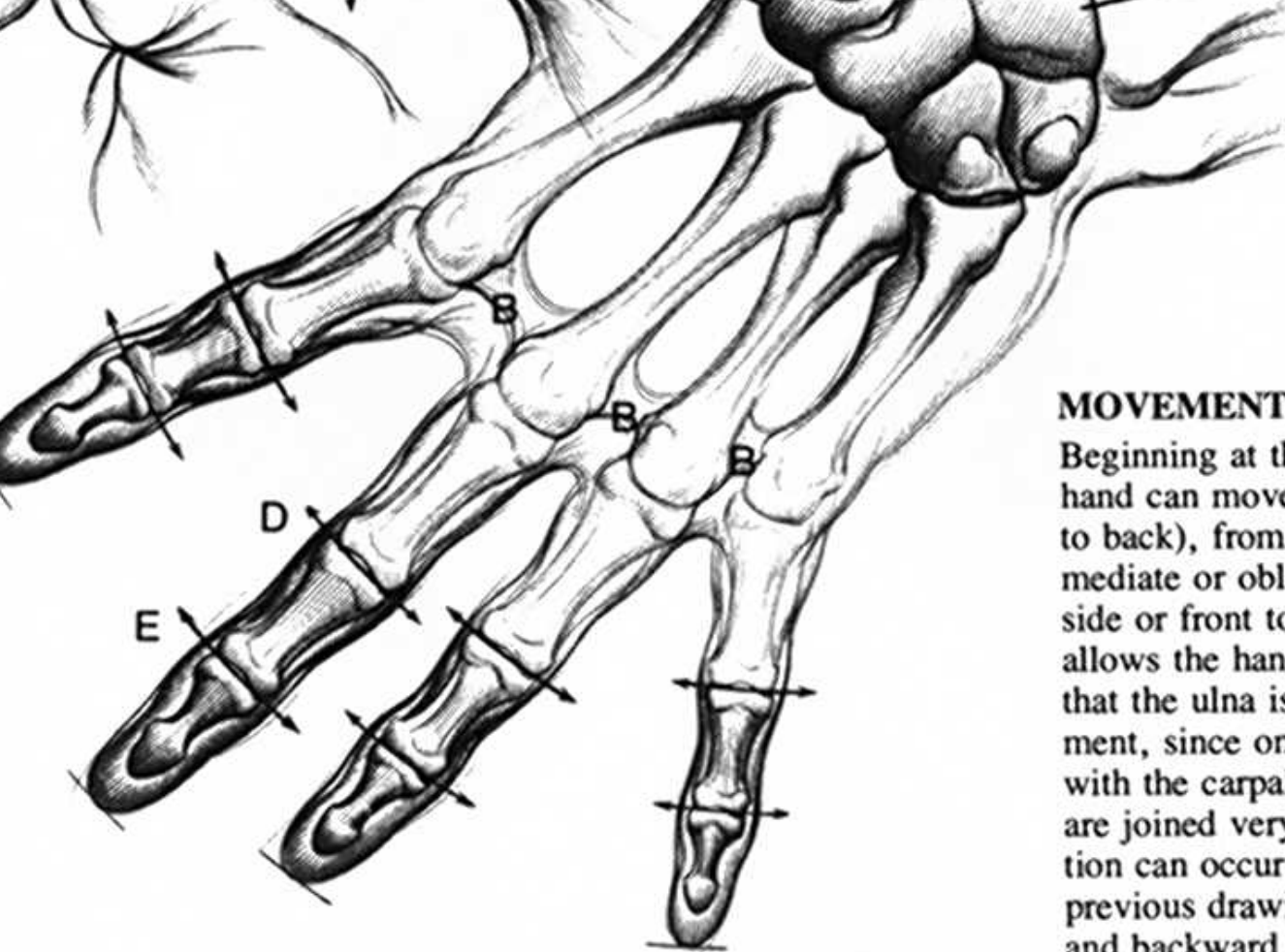
of the wrist. The individual names but are simply identified by number. The thumb is the *first metacarpal*, the index finger, the *second metacarpal*, and so on. They have characteristic shapes, with a shaft and two ends, the upper end articulating with the carpals and the lower end attaching to the phalanges or finger bones. The carpals and metacarpals form a firm arch and are greatly limited in movement, since they are held together closely at their bases by the *metacarpal ligaments* (M) and at their heads by the *intermetacarpal ligaments* (L). In addition to this is the *first metacarpal* of the thumb. It is attached to the trapezium by a capsular ligament only, which allows it much wider activity than the other four.

Attached to the metacarpal bones are the *phalanges* of the hand. Each finger is called a *phalanx*, and each has three units—the *proximal phalanx* (M), the *middle phalanx* (N), and the *terminal phalanx* (O). The thumb again



ACTION IN ACTION

Two drawings show the bones of the hand in action. Note the limited movement of the carpals and metacarpals as compared to the wide range possible in the fingers. The carpals in the lower sketch are capable of only a slight rocking motion. As you sketch the information here,



MOVEMENT POSSIBLE

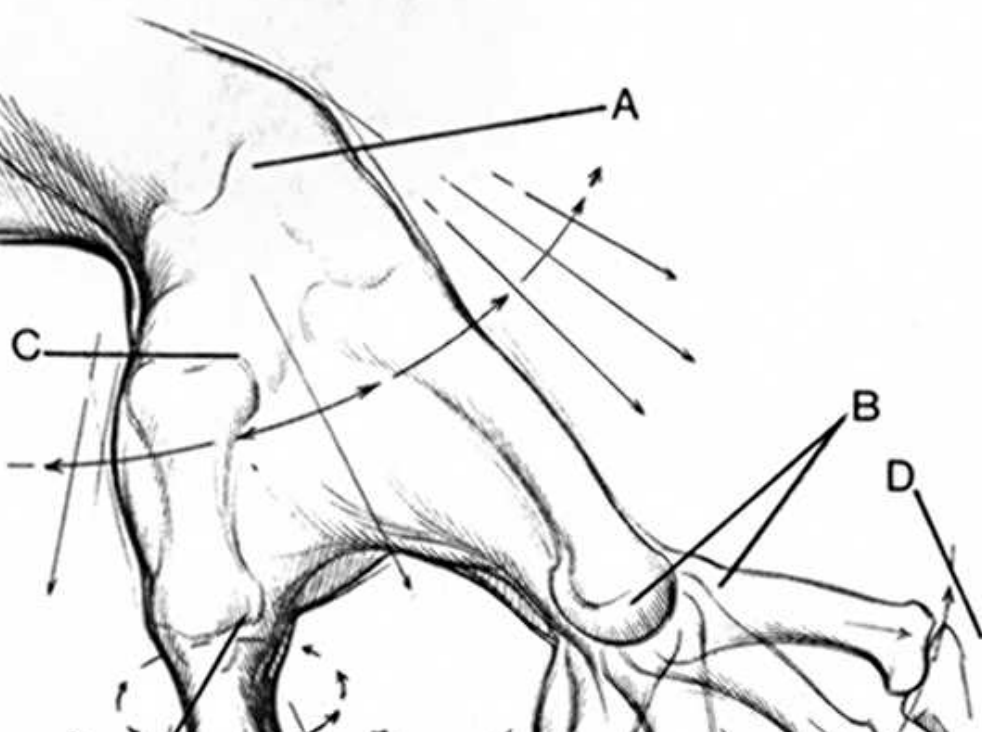
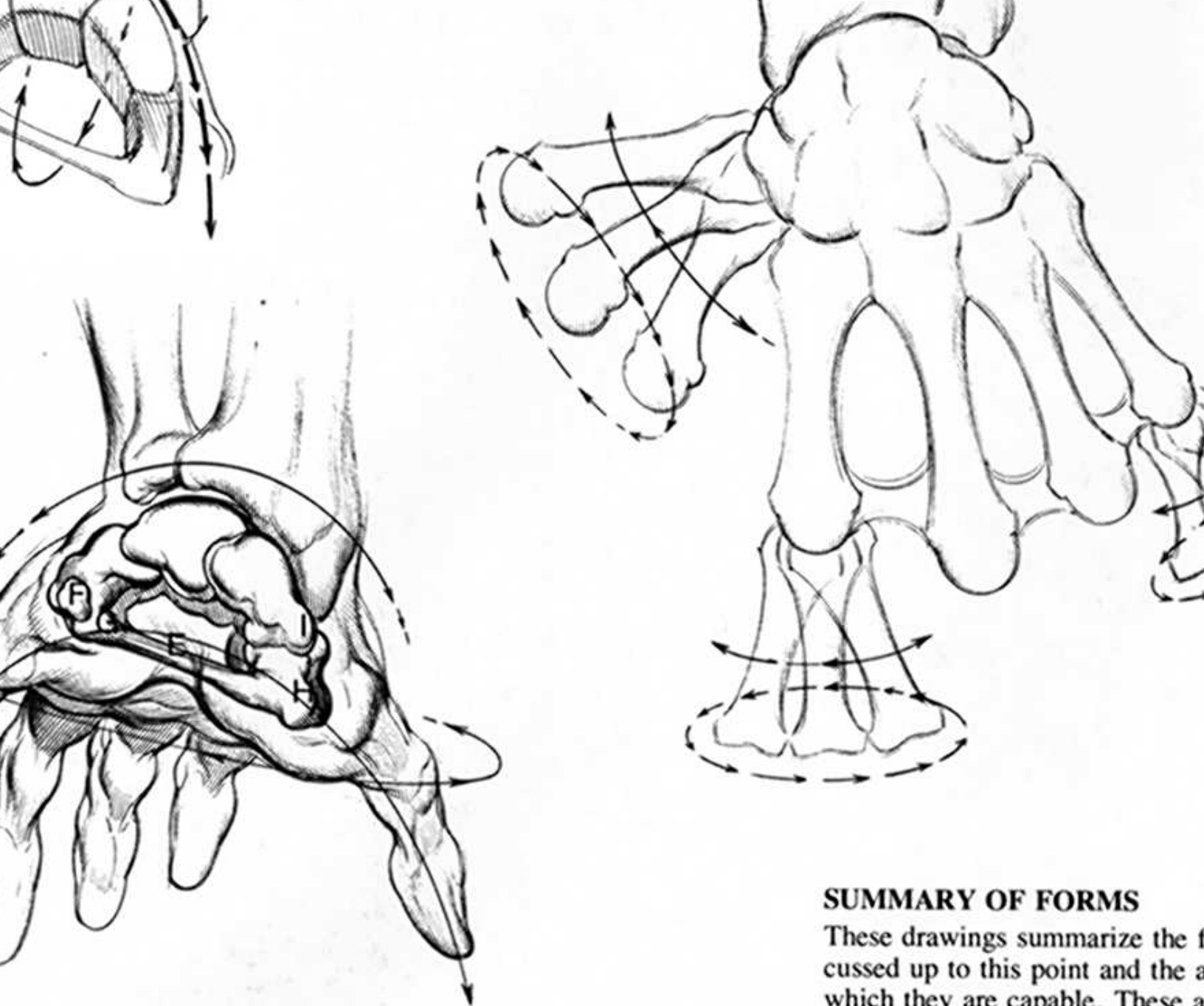
Beginning at the radiocarpal joint the hand can move back and forth (front to back), from side to side, and at mediate or oblique angles, either from side or front to back. This last position allows the hand to swivel or rotate about that the ulna is not involved in the movement, since only the radius is in contact with the carpals. Because the carpals are joined very closely, only a gliding motion can occur; however, as noted in the previous drawing, a slight rocking forward and backward is possible because of the curve of the two tiers.

The large hand shown here is drawn with light and dark areas. The wrist bones, the finger bones from the second joint, and the base joints of the four metacarpal (palm) bones. *All these areas are kept light.* The darker areas are the forms and joints which perform limited movement; the lighter areas are the forms which have freer movement.

The four long metacarpal bones and both wrist bones and intermetacarpal joints are constrained by the intermetacarpal ligaments (B) that movement between them is negligible. The exception is the base joint at the trapezium wrist bone (C) which is capable of much more freedom of movement. A ligament controls it. The interphalangeal joints (D, E) on the middle and ring fingers, darkened with cross-hatching, are capable of only forward and backward movement.

Note in the action sketch of the upper left that the characteristic





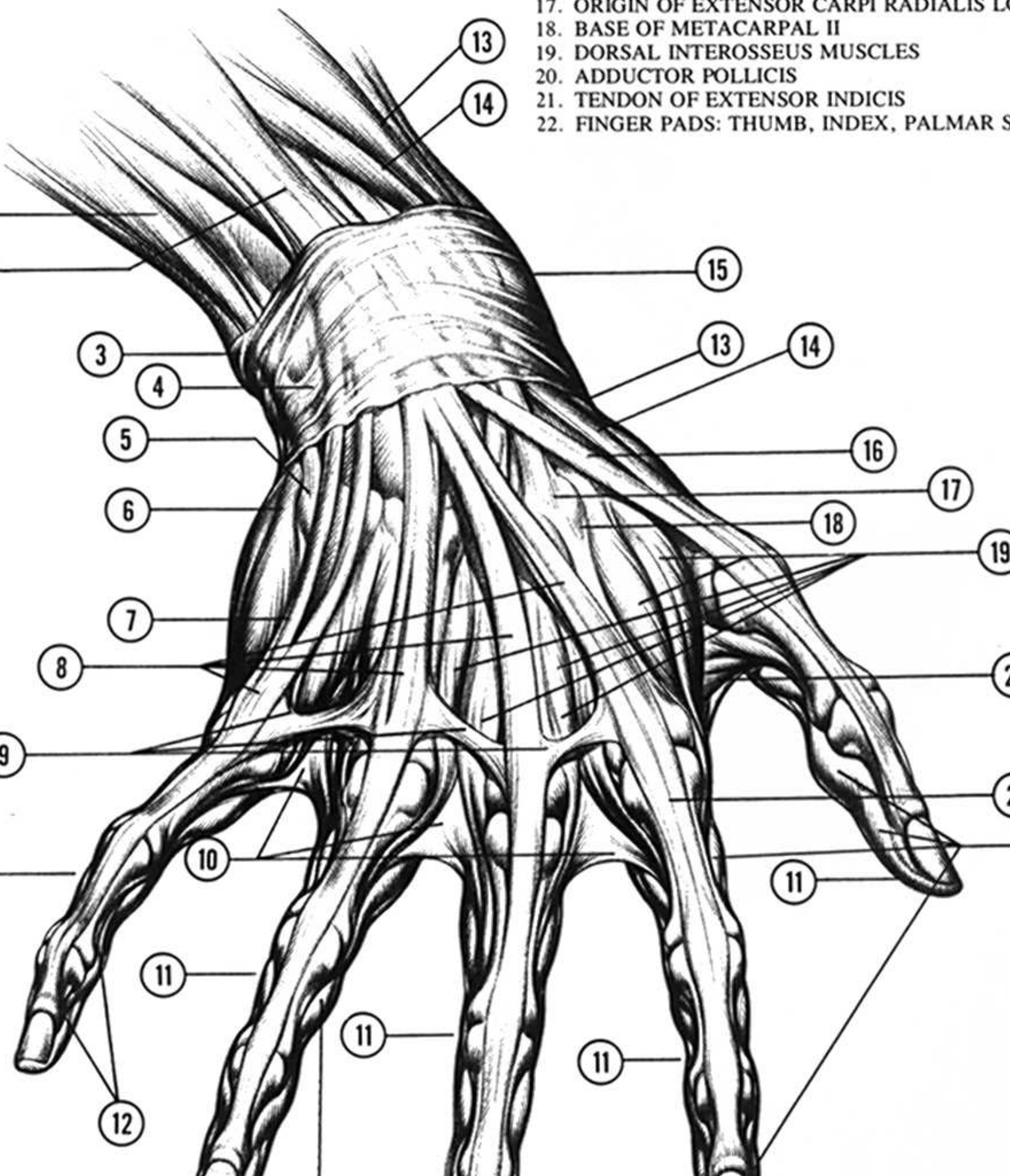
SUMMARY OF FORMS

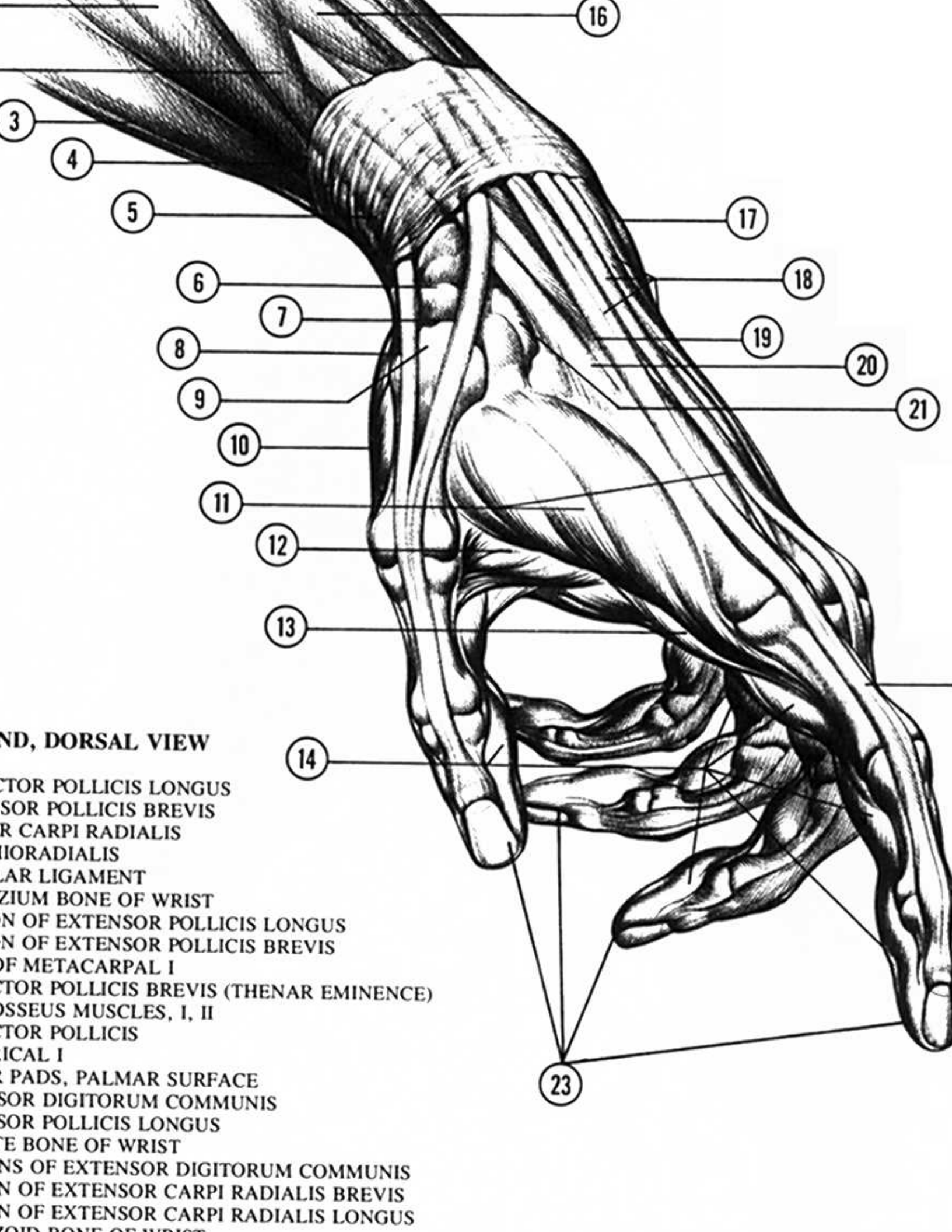
These drawings summarize the forms discussed up to this point and the actions which they are capable of. These are the *radiocarpal joint (A)*, the *metacarpophalangeal joints* from palm to thumb, the *wrist-thumb connection*, the *metacarpal joint (C)*, and the *interphalangeal digit-to-digit joints (D)*. Each is capable of performing to a greater or lesser degree circular gyration, flexion and extension backward and forward, and swinging or rocking from side to side. Study the drawings and use your imagination to discover the possibilities.

Note the arched arrangement of the metacarpals shown in the rear views. This is formed by a transverse ligament attached to the pisiform (*F*) and the hamate (*G*) at the outside and to the base of the trapezium (*H*) and the scaphoid

...IONS OF EXTENSOR DIGITORUM COMMUNIS
...NDINOUS INTERJUNCTURES

12. FINGER PADS, PALMAR SURFACE
13. ABDUCTOR POLLICIS LONGUS
14. EXTENSOR POLLICIS BREVIS
15. STYLOID PROCESS OF RADIUS
16. TENDON OF EXTENSOR POLLICIS LONGUS
17. ORIGIN OF EXTENSOR CARPI RADIALIS LONGUS
18. BASE OF METACARPAL II
19. DORSAL INTEROSSEUS MUSCLES
20. ADDUCTOR POLLICIS
21. TENDON OF EXTENSOR INDICIS
22. FINGER PADS: THUMB, INDEX, PALMAR SURFACE

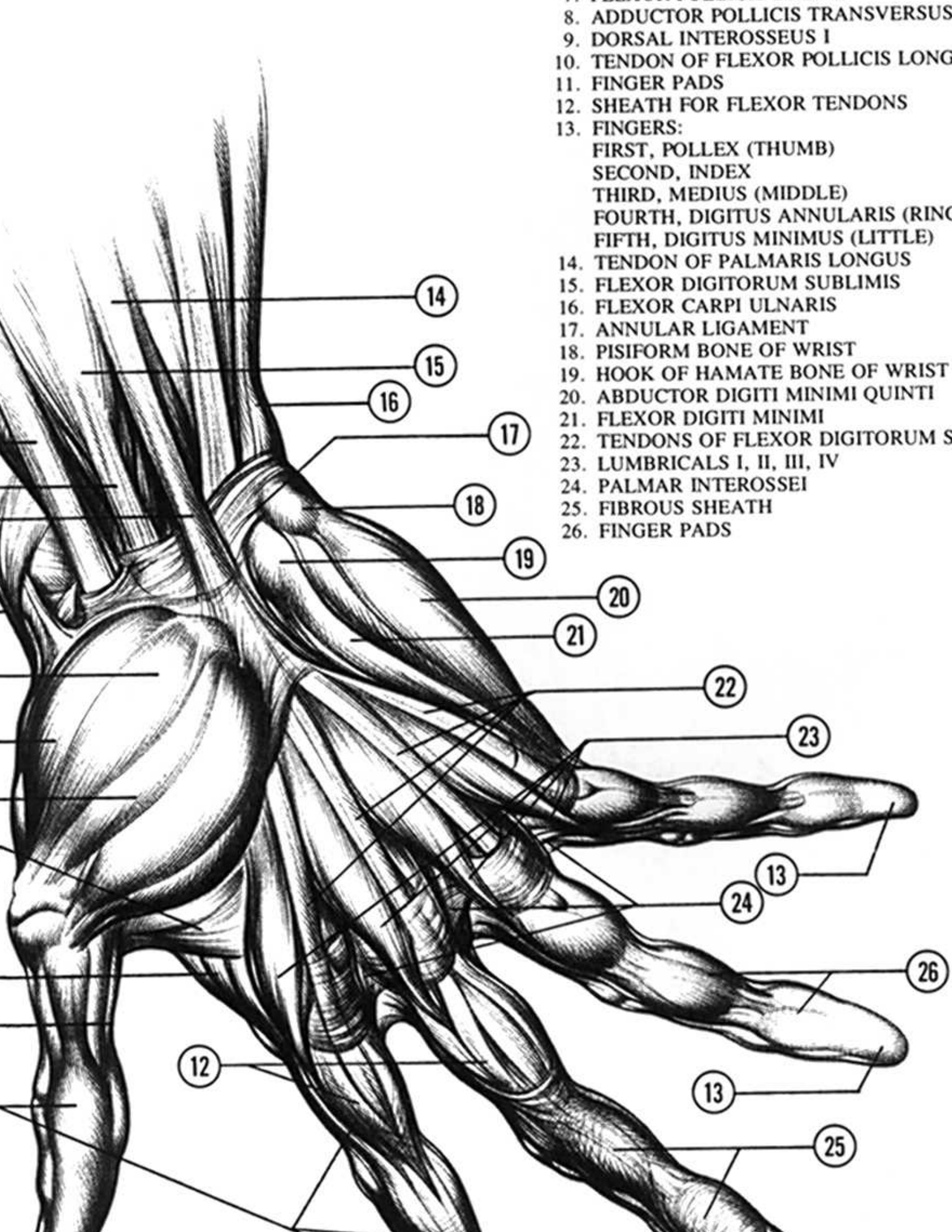




AND, DORSAL VIEW

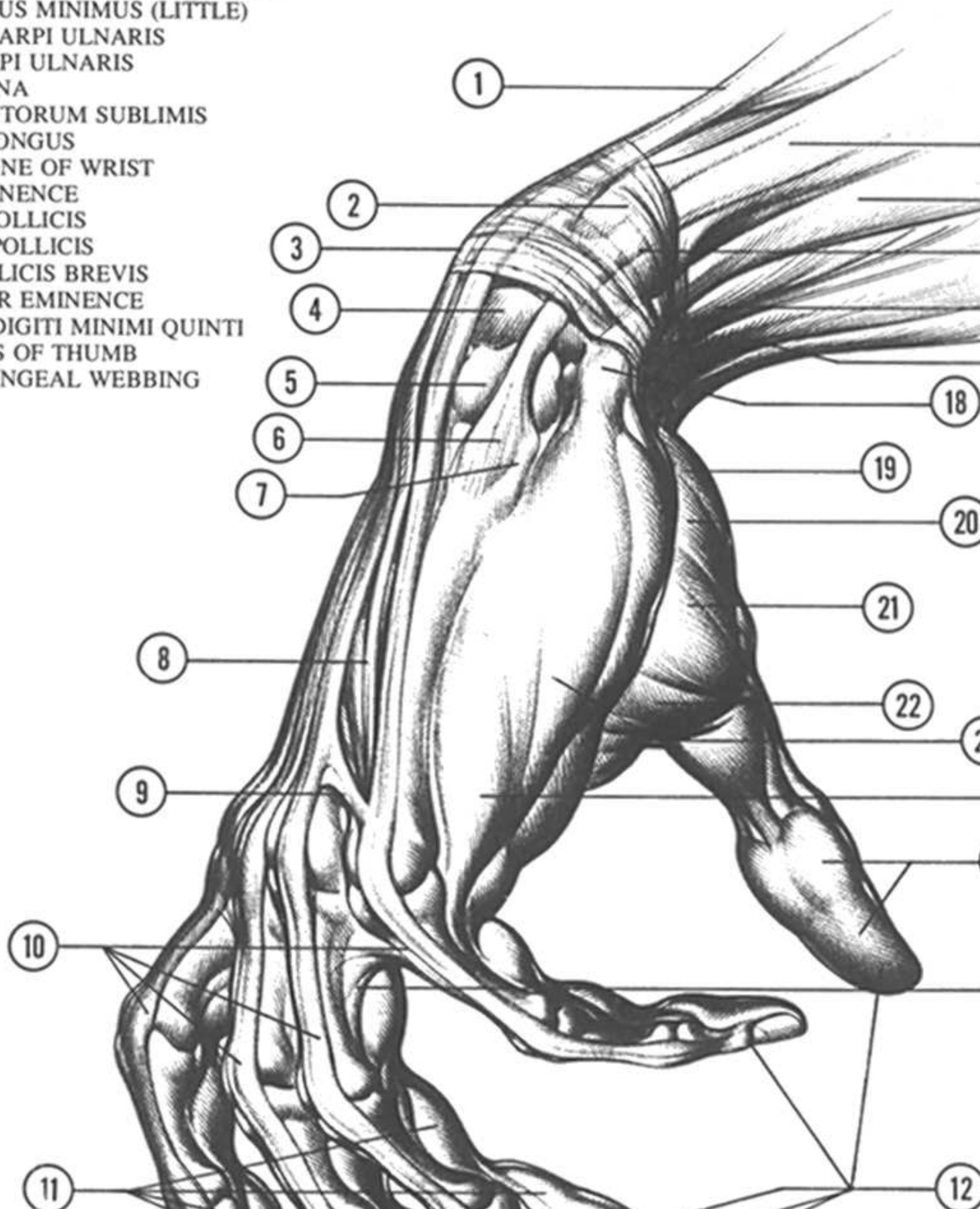
EXTENSOR POLLICIS LONGUS
 EXTENSOR POLLICIS BREVIS
 EXTENSOR CARPI RADIALIS
 SUPRADIAPYCNALIS
 CARPIAL LIGAMENT
 TRAPEZIUM BONE OF WRIST
 TENDON OF EXTENSOR POLLICIS LONGUS
 TENDON OF EXTENSOR POLLICIS BREVIS
 METACARPAL I
 EXTENSOR POLLICIS BREVIS (THENAR EMINENCE)
 OSSEOUS MUSCLES, I, II
 EXTENSOR POLLICIS
 METACARPAL I
 TENDON PADS, PALMAR SURFACE
 EXTENSOR DIGITORUM COMMUNIS
 EXTENSOR POLLICIS LONGUS
 TRAPEZOID BONE OF WRIST
 TENDONS OF EXTENSOR DIGITORUM COMMUNIS
 TENDON OF EXTENSOR CARPI RADIALIS BREVIS
 TENDON OF EXTENSOR CARPI RADIALIS LONGUS
 TRAPEZOID BONE OF WRIST

23



8. ADDUCTOR POLLICIS TRANSVERSUS
9. DORSAL INTEROSSEUS I
10. TENDON OF FLEXOR POLLICIS LONGUS
11. FINGER PADS
12. SHEATH FOR FLEXOR TENDONS
13. FINGERS:
FIRST, POLLEX (THUMB)
SECOND, INDEX
THIRD, MEDIUS (MIDDLE)
FOURTH, DIGITUS ANNULARIS (RING)
FIFTH, DIGITUS MINIMUS (LITTLE)
14. TENDON OF PALMARIS LONGUS
15. FLEXOR DIGITORUM SUBLIMIS
16. FLEXOR CARPI ULNARIS
17. ANNULAR LIGAMENT
18. PISIFORM BONE OF WRIST
19. HOOK OF HAMATE BONE OF WRIST
20. ABDUCTOR DIGITI MINIMI QUINTI
21. FLEXOR DIGITI MINIMI
22. TENDONS OF FLEXOR DIGITORUM SUPERFICIALIS
23. LUMBRICALS I, II, III, IV
24. PALMAR INTEROSSEI
25. FIBROUS SHEATH
26. FINGER PADS

DORSAL INTEROSSEUS
 TENDINOUS INTERJUNCTURE
 TENDONS OF EXTENSOR DIGITORUM COMMUNIS
 FINGER PADS
 FINGERS:
 FIRST, POLLEX (THUMB)
 SECOND, INDEX
 THIRD, MEDIUS (MIDDLE)
 FOURTH, DIGITUS ANNULARIS (RING)
 FIFTH, DIGITUS MINIMUS (LITTLE)
 EXTENSOR CARPI ULNARIS
 FLEXOR CARPI ULNARIS
 HEAD OF ULNA
 FLEXOR DIGITORUM SUBLIMIS
 PALMARIS LONGUS
 PISIFORM BONE OF WRIST
 THENAR EMINENCE
 OPPOSITION POLLICIS
 ABDUCTOR POLLICIS
 FLEXOR POLLICIS BREVIS
 HYPOTHENAR EMINENCE
 ABDUCTOR DIGITI MINIMI QUINTI
 FINGER PADS OF THUMB
 INTERPHALANGEAL WEBBING

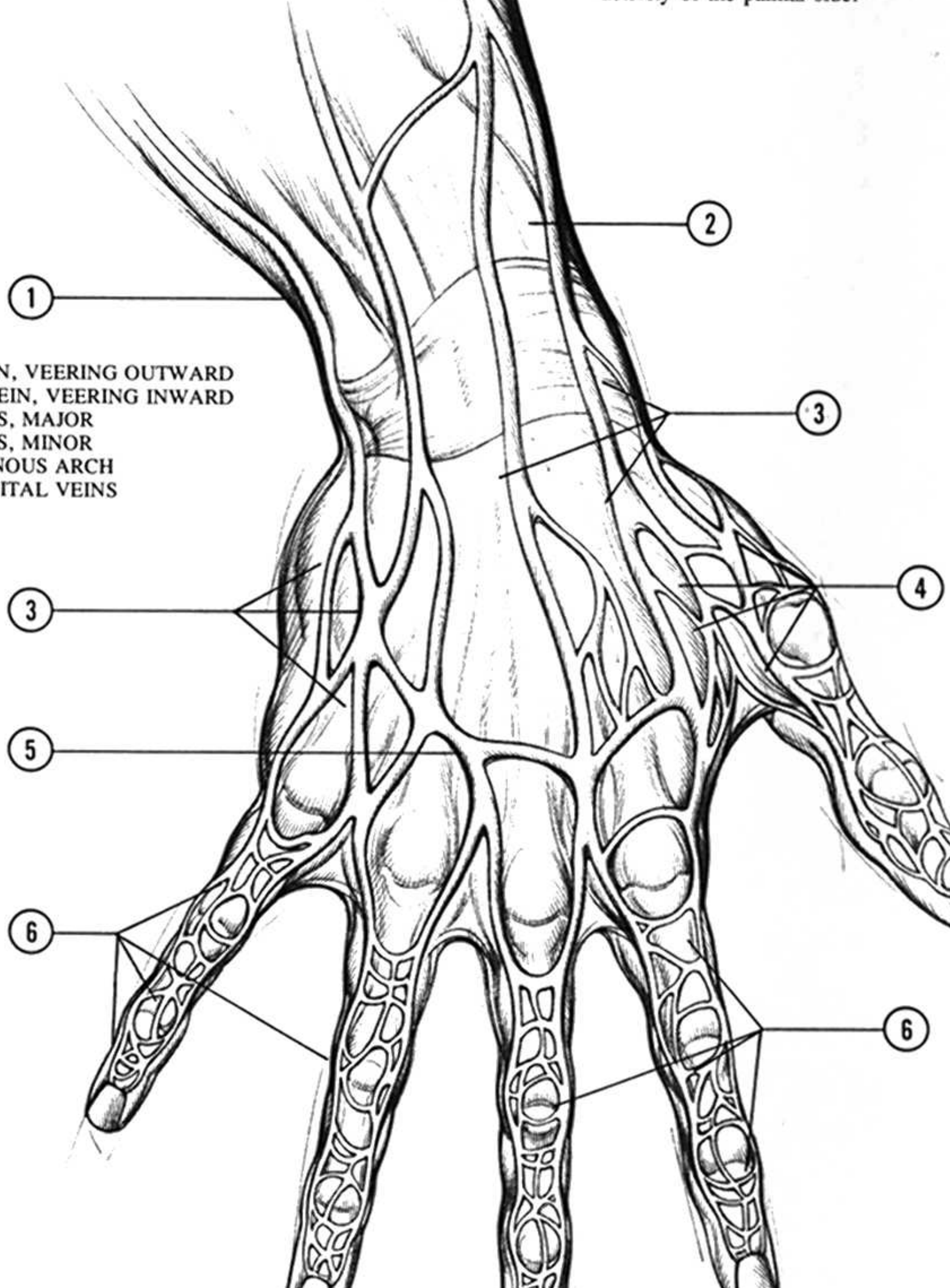




OF THE HAND

vessels through the body tend to lie in depressions,
 in hollows between elevated forms. They are thus
 in a position of safety, out of the way of impact or injury.
 This is particularly true of the hand, where no veins protrude
 on the ulnar side and where they tend to lie between forms
 on the dorsal side. The drawing at left shows the venous net-
 work circling around the elevated knuckles, circling and
 running along the side planes of the finger shanks, and rising along the side planes of
 the fingers. Higher up, the venous system branches off into

VEIN, VEERING OUTWARD
IC VEIN, VEERING INWARD
ARIES, MAJOR
ARIES, MINOR
VENOUS ARCH
DIGITAL VEINS



1

2

3

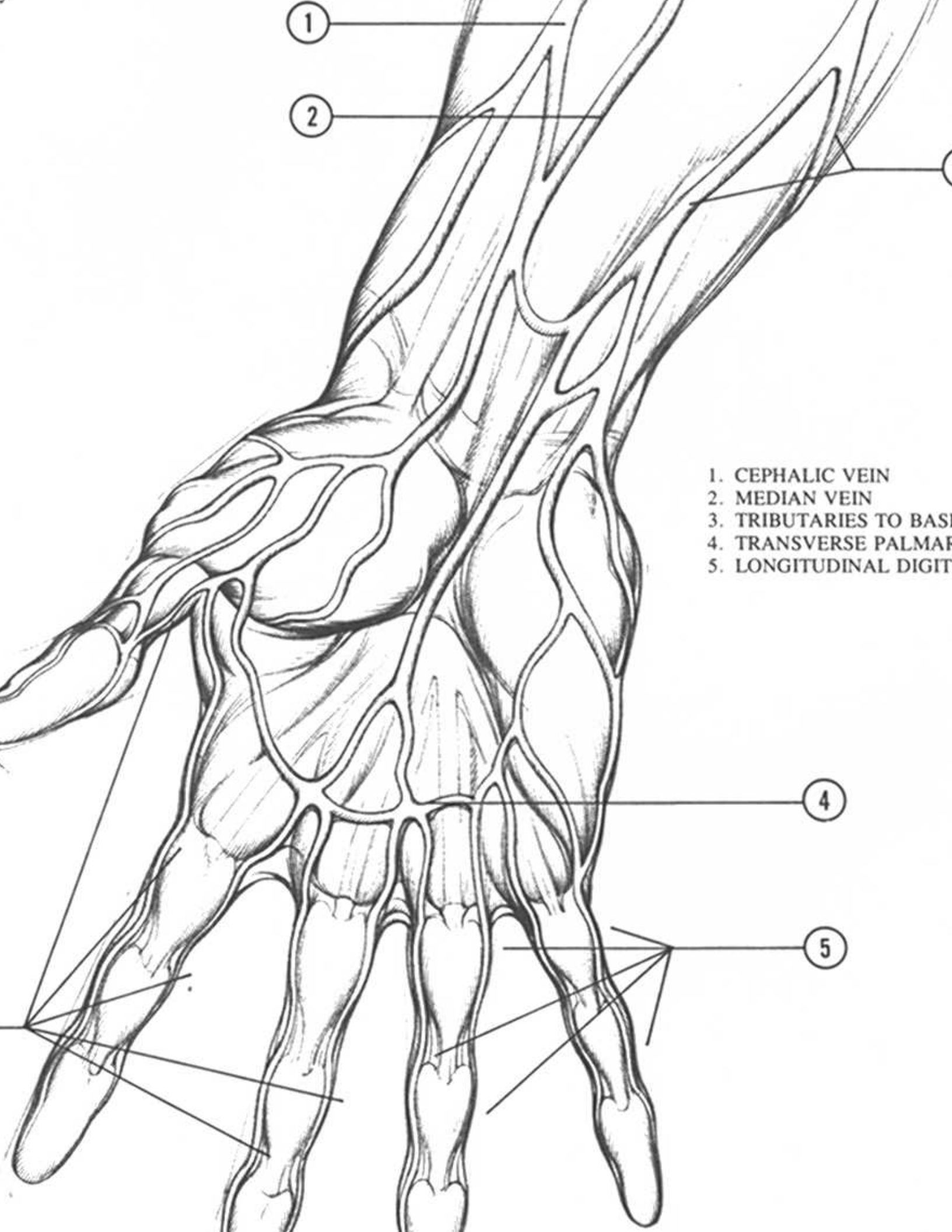
4

3

5

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6



1

2

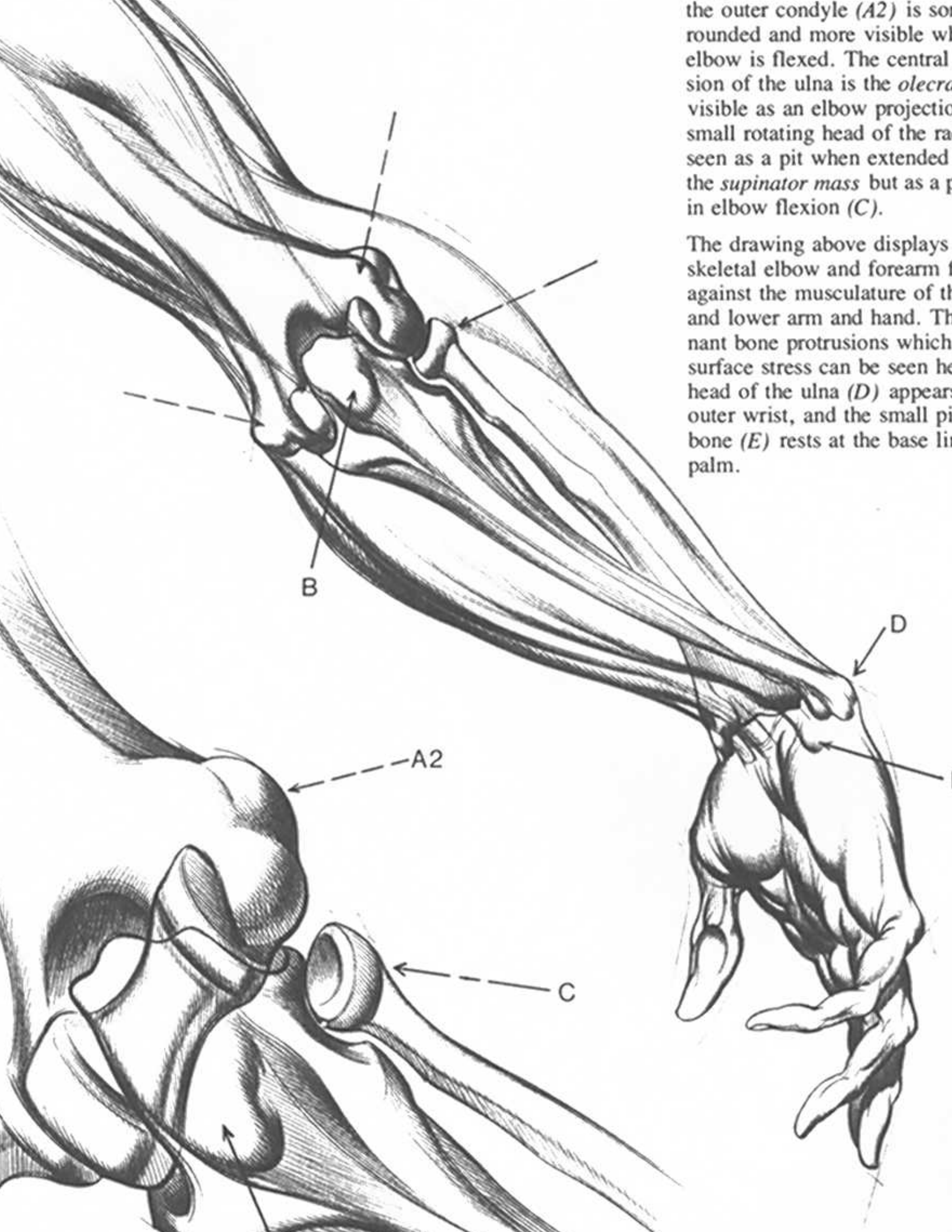
- 1. CEPHALIC VEIN
- 2. MEDIAN VEIN
- 3. TRIBUTARIES TO BAS
- 4. TRANSVERSE PALMAR
- 5. LONGITUDINAL DIGIT

4

5

4. ANATOMICAL LANDMARKS AND SURFACE STRESS

The artist can truly understand surface forms only by knowing their underlying structures and their form and behavior under tension, stress, and activity. We are still dealing with anatomy in this chapter, but from the viewpoint of dominant surface stress.

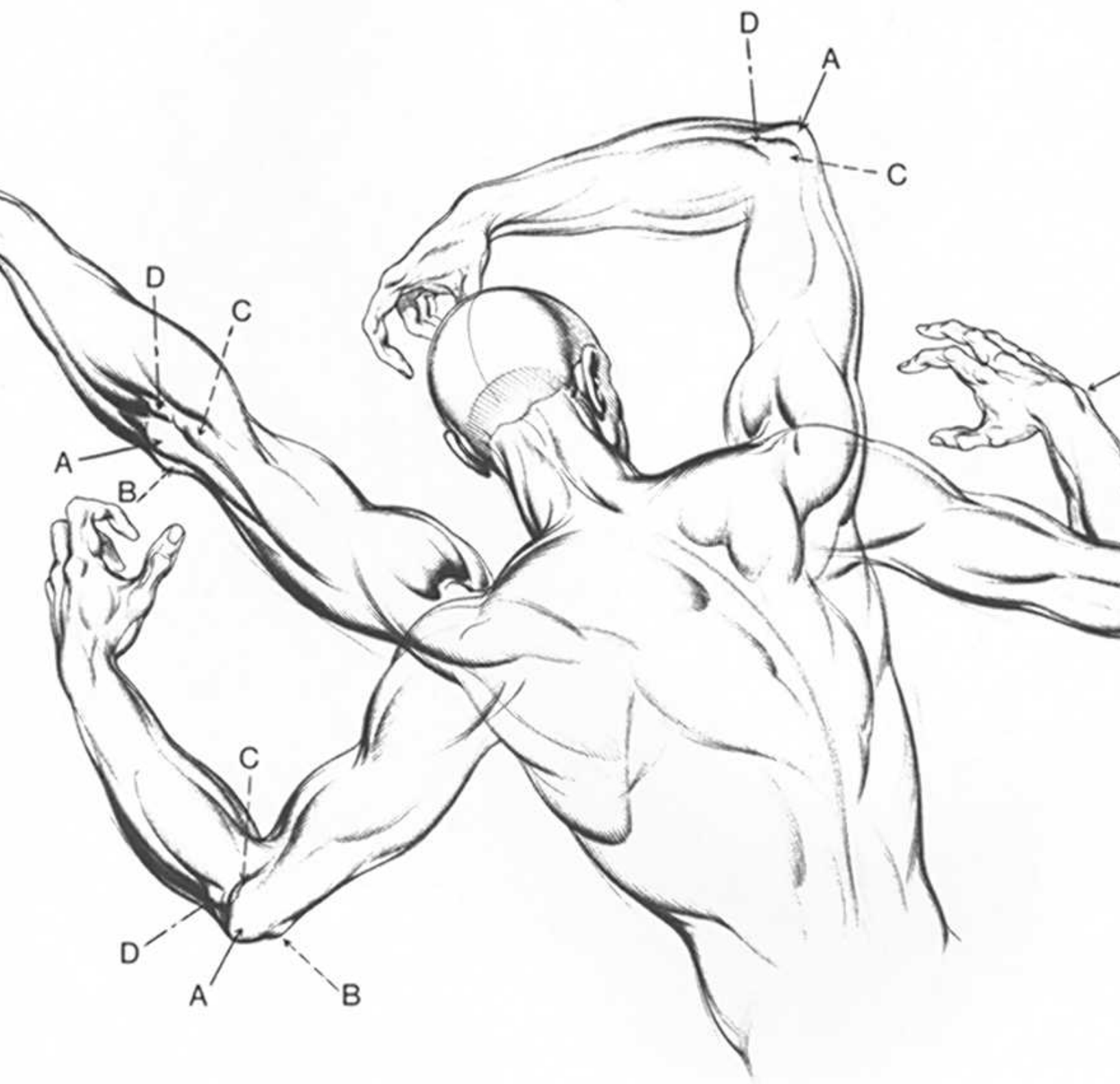


the outer condyle (A2) is somewhat rounded and more visible when the elbow is flexed. The central projection of the ulna is the *olecranon*, visible as an elbow projection. The small rotating head of the radius is seen as a pit when extended, the *supinator mass* but as a pit in elbow flexion (C).

The drawing above displays the skeletal elbow and forearm together against the musculature of the upper and lower arm and hand. The most prominent bone protrusions which bear surface stress can be seen here: the head of the ulna (D) appears at the outer wrist, and the small pisiform bone (E) rests at the base of the palm.

s known, all other knuckles on the dorsal side of
an also be determined correctly.





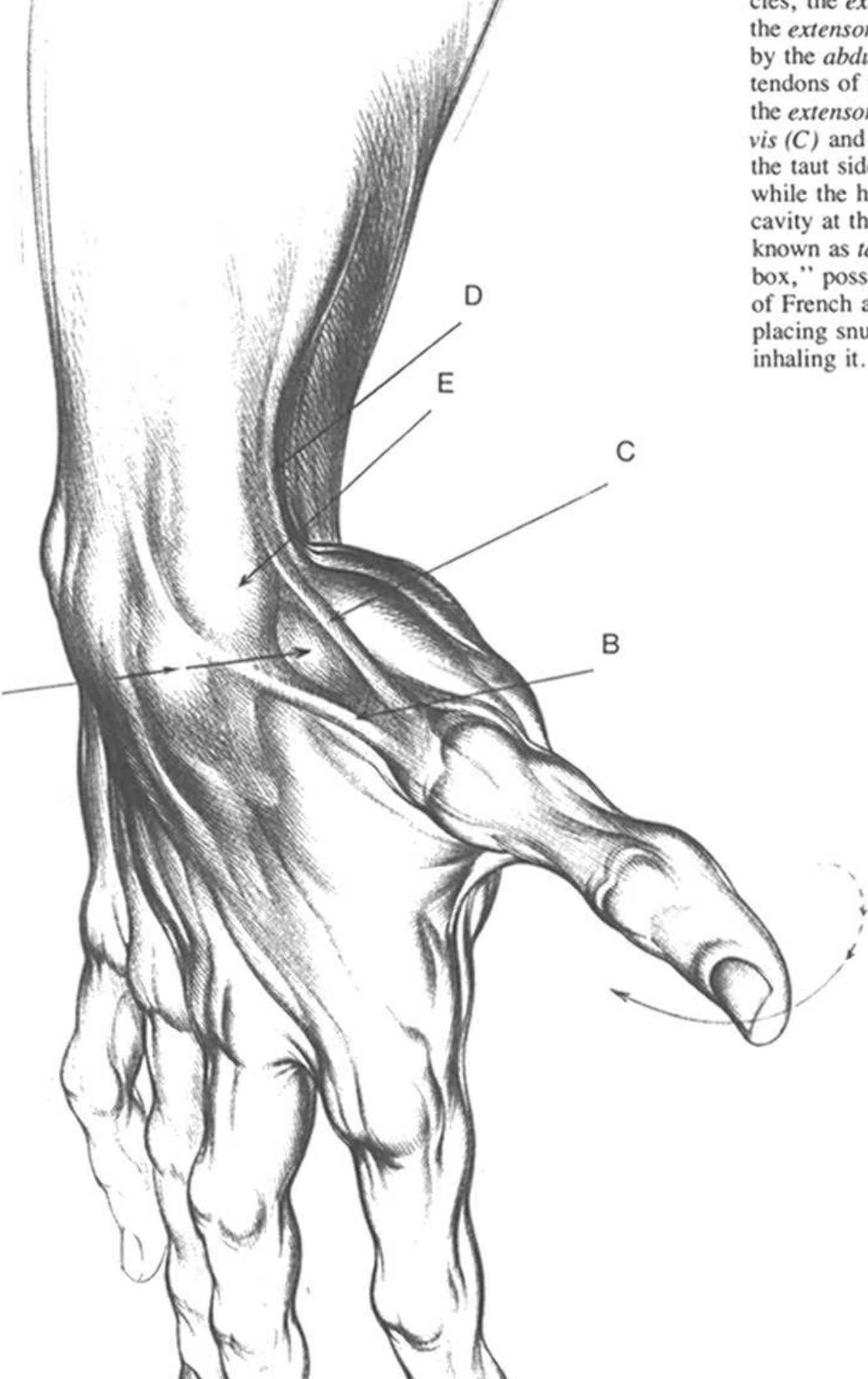
SKELETAL ELBOW AND WRIST PROJECT

This multiple action drawing illustrates the necessity of showing underlying structure and surface stress. Note the



**RADIAL EMINENCE
AND STYLOID PROCE**

On the *inner* wristline lie the radial eminence and the styloid process of the radius, which correspond to the ulnar styloid on the *outer* wristline. The sketch at the top shows how the radius is positioned in a marked extended mound



cles, the *extensor pollicis longus*,
the *extensor pollicis brevis*, and
by the *abductor pollicis longus*.
tendons of these muscles noted
the *extensor longus* (B), *extensor*
pollicis (C) and *abductor longus* (D)
the taut side walls of this depr
while the high radius (E) clos
cavity at the top. This depress
known as *tabatière*, meaning
"box," possibly derived from th
of French and English gentlem
placing snuff in this hollow an
inhaling it.



UNDER STRESS

and is flexed downward, and the

become explicitly visible, especially under stress and
below the palm knuckles. This is shown in the middle
drawing by arrows pointing down. Also note how the knuckle
becomes markedly triangular above and below the
capsules as the tendons ride over the knuckles.

When the fingers close in tight compression, as shown
in the lower drawing, the outer appearance of the taut tendons
of the finger shank appears somewhat like a miniature flexor
and lower leg.

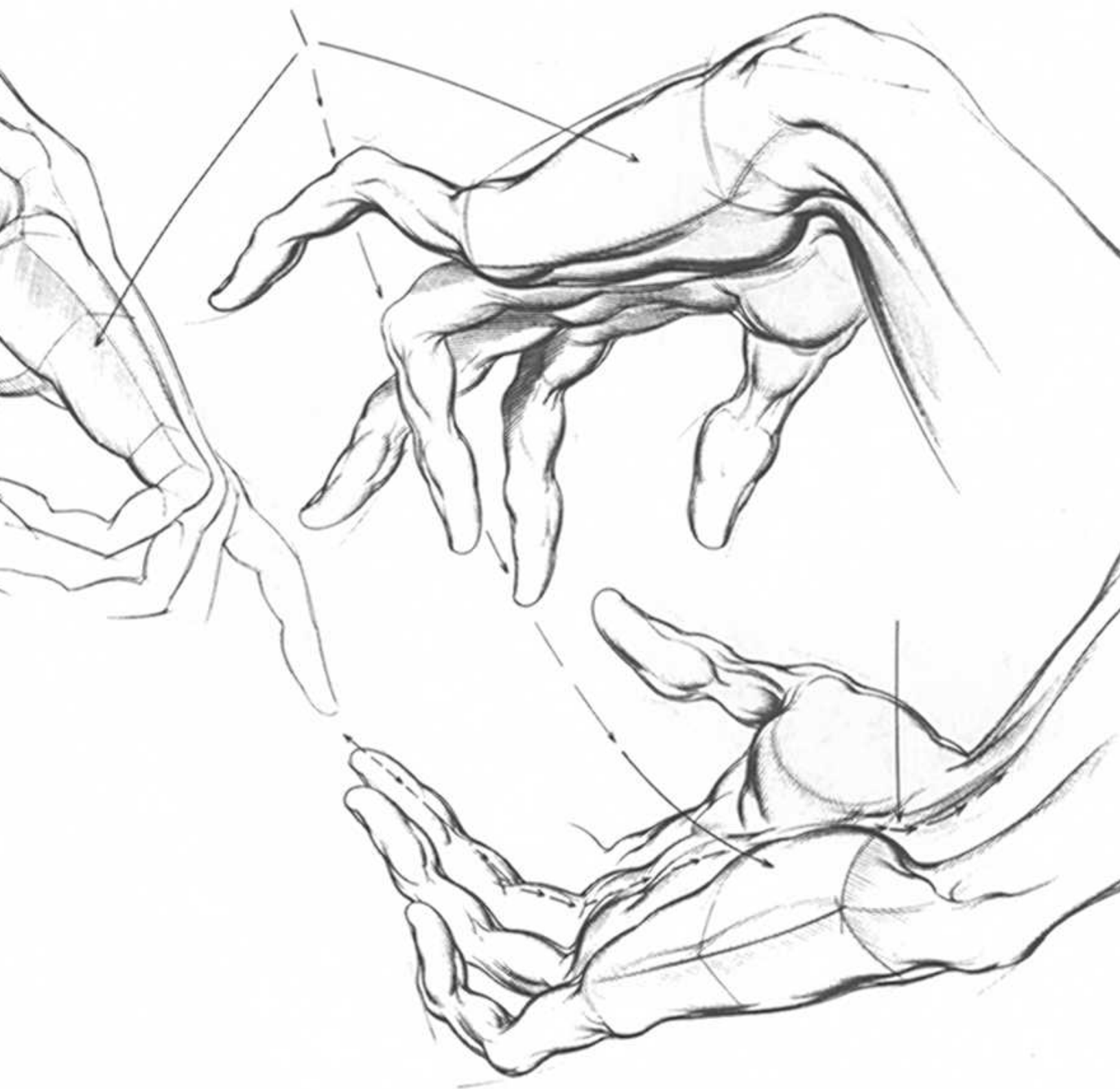




THUMBER EMINENCE

The thenar eminence of the thumb (thenar eminence) is the largest form on the underside of the palm. Shaped like an egg (as shown

menar eminence on the other side of the deep trench
palm. This mid-palm trench (marked by broken arrows)
unique landmark in the hand, for it centrally divides
palm, running from the tip of the longest finger to the
the palm at the wrist. Even beyond, it ascends the
the midline tendon of *palmaris longus*.





FINGER TIP AND FINGER SHANK PADS

With the wedge shape of all fingertip forms, the pads, marked by arrows in the large drawing at left, are isosceles triangles. This is true for all other fingertips.

In the finger shanks, seen in the drawings of the hand, the pads are somewhat lozenge shaped, yet are lightly indented in the center because of the deep flexor tendons running the length of the fingers. Note the variations of fingertip and finger shank pads seen from these two different views.



MUSCLES AND ENERGY FLOWS

When the hand is in motion or performing an activity, the skin is stressed in the direction of the action, responding to the forces in the same way that clothing responds to the action of the body. Note the arrows expressing the spiraling swings of the fingers in the drawing at upper left. Follow the back-sweep as the thumb surges forward and note the creases across the wrist.

The arrows in the drawing at lower left express the skin tension across the curved knuckle capsules and illustrate the concentration of energy flows and the direction of movement of the hand.

5. ACTIONS, FUNCTIONS, LIMITS OF MOVEMENT

The hand is the most complex and variable form in the human body. No other form can respond with such extraordinary range and functional capability and with such ease and grace. For example, the separate fingers can perform an immense variety of actions, and the thumb, obliquely opposing the four long fingers and palm wedge, aids in actions such as grasping, prying, and supporting. However, not all the forms of the hand are as free to move as the fingers. Some forms are bound tightly by ligaments and have a very limited range of movement. In this chapter we will look at the hand in terms of some of the many maneuvers of which it is capable.

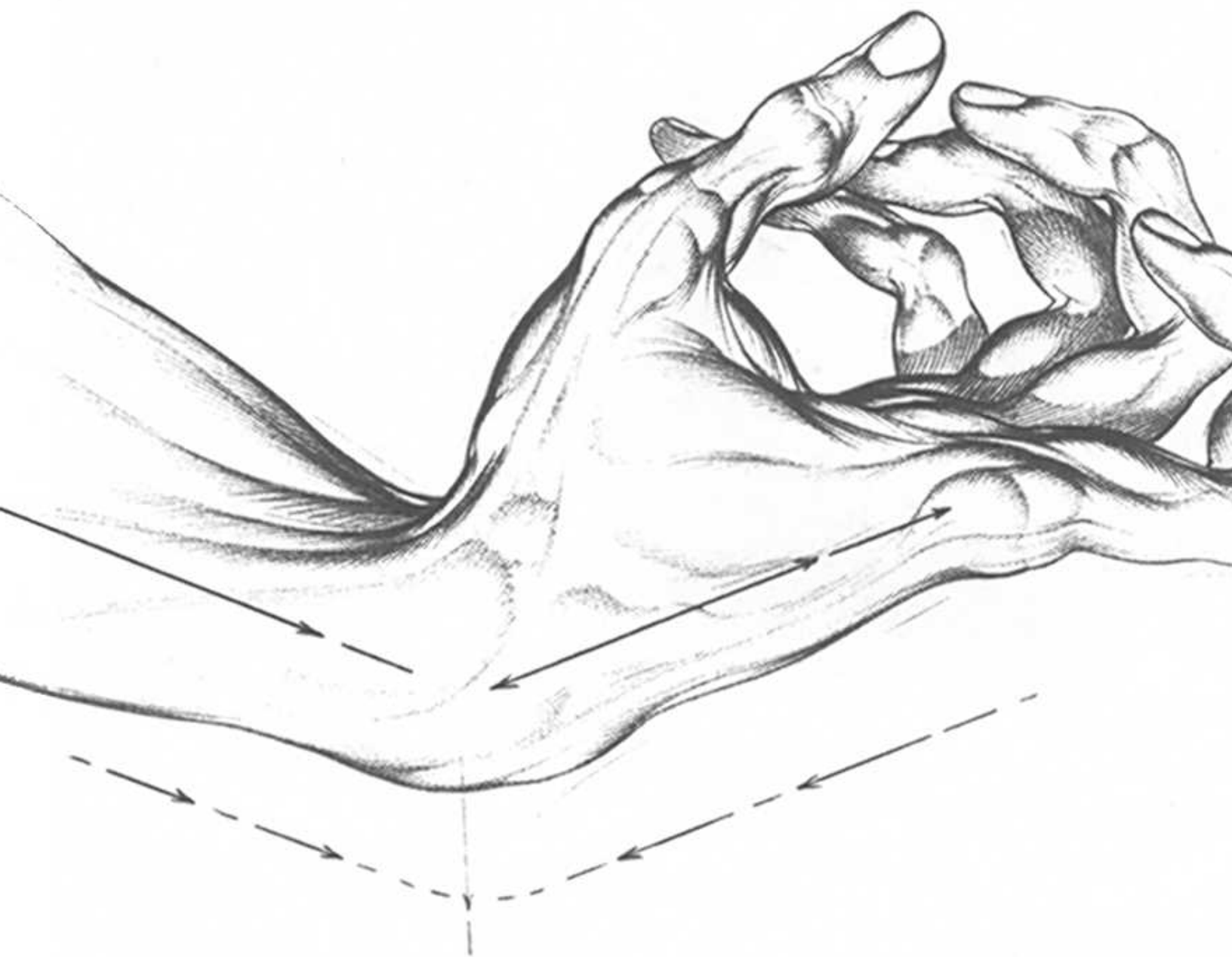


PALM ROTATION

One of the hand's unique actions is palm rotation.

of the arm, *not* the carpal
of the hand.



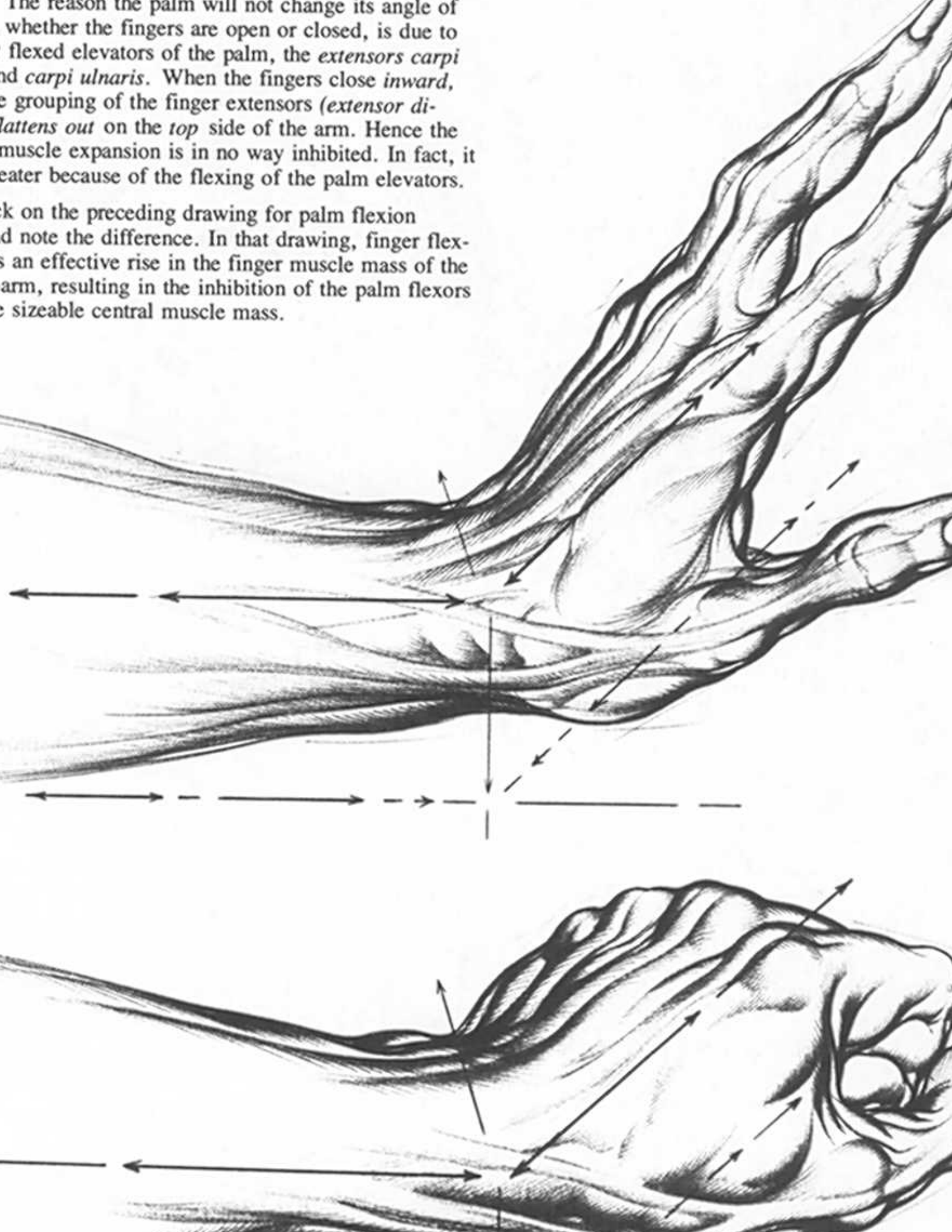


UPWARD PALM BEND

When the fingers flex and bend inward to the palm, the angle of palm-to-forearm is only 45 degrees. The juncture is shown by the vertical arrow.

The reason the palm will not change its angle of whether the fingers are open or closed, is due to flexed elevators of the palm, the *extensors carpi* and *carpi ulnaris*. When the fingers close inward, the grouping of the finger extensors (*extensor digitorum*) flattens out on the top side of the arm. Hence the muscle expansion is in no way inhibited. In fact, it is greater because of the flexing of the palm elevators.

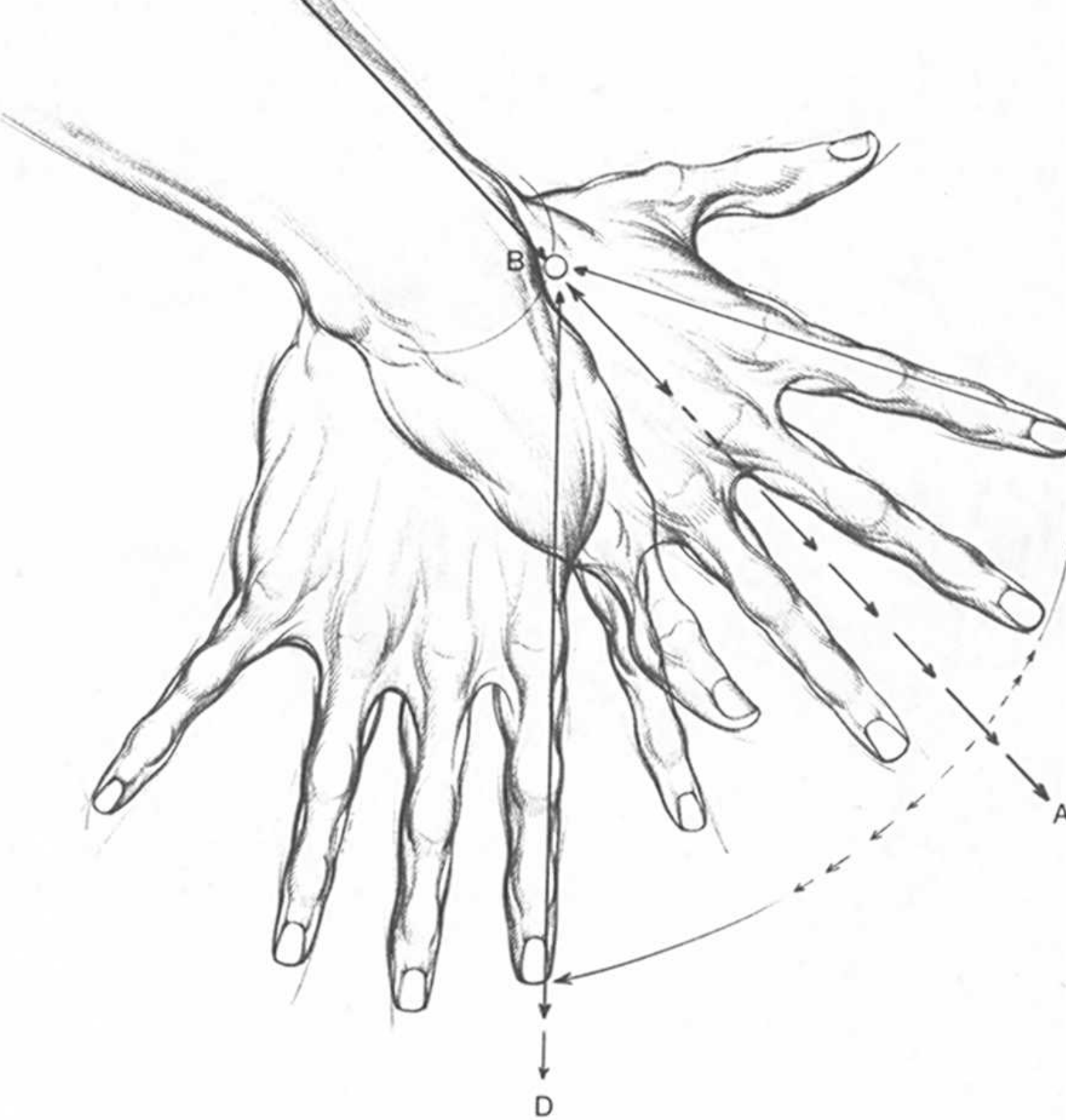
Look on the preceding drawing for palm flexion and note the difference. In that drawing, finger flexion causes an effective rise in the finger muscle mass of the arm, resulting in the inhibition of the palm flexors and the sizeable central muscle mass.





FIST CLOSURE

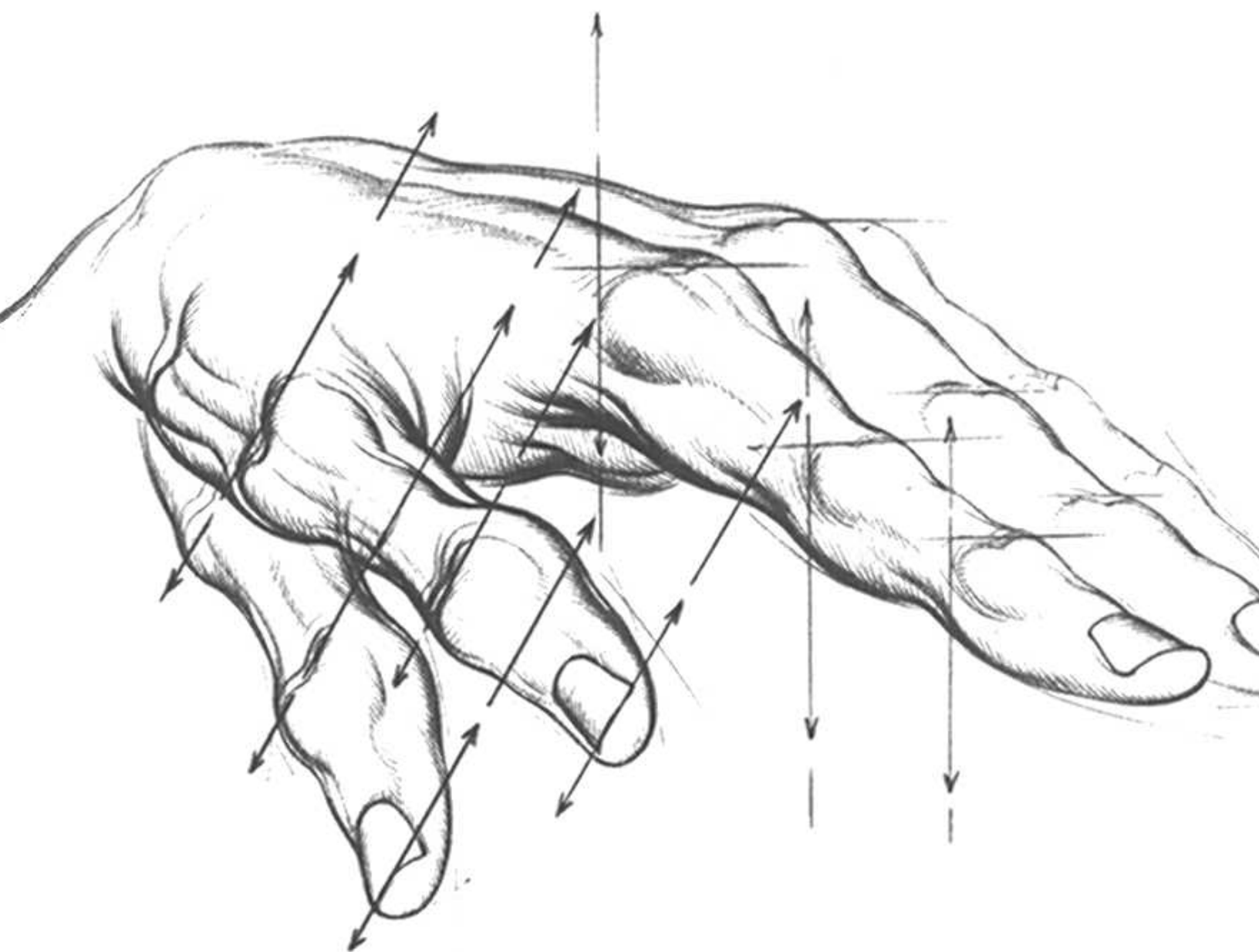
In the closed fist, it is important to note the correction of the thumb in opposition to the fingers. In ri

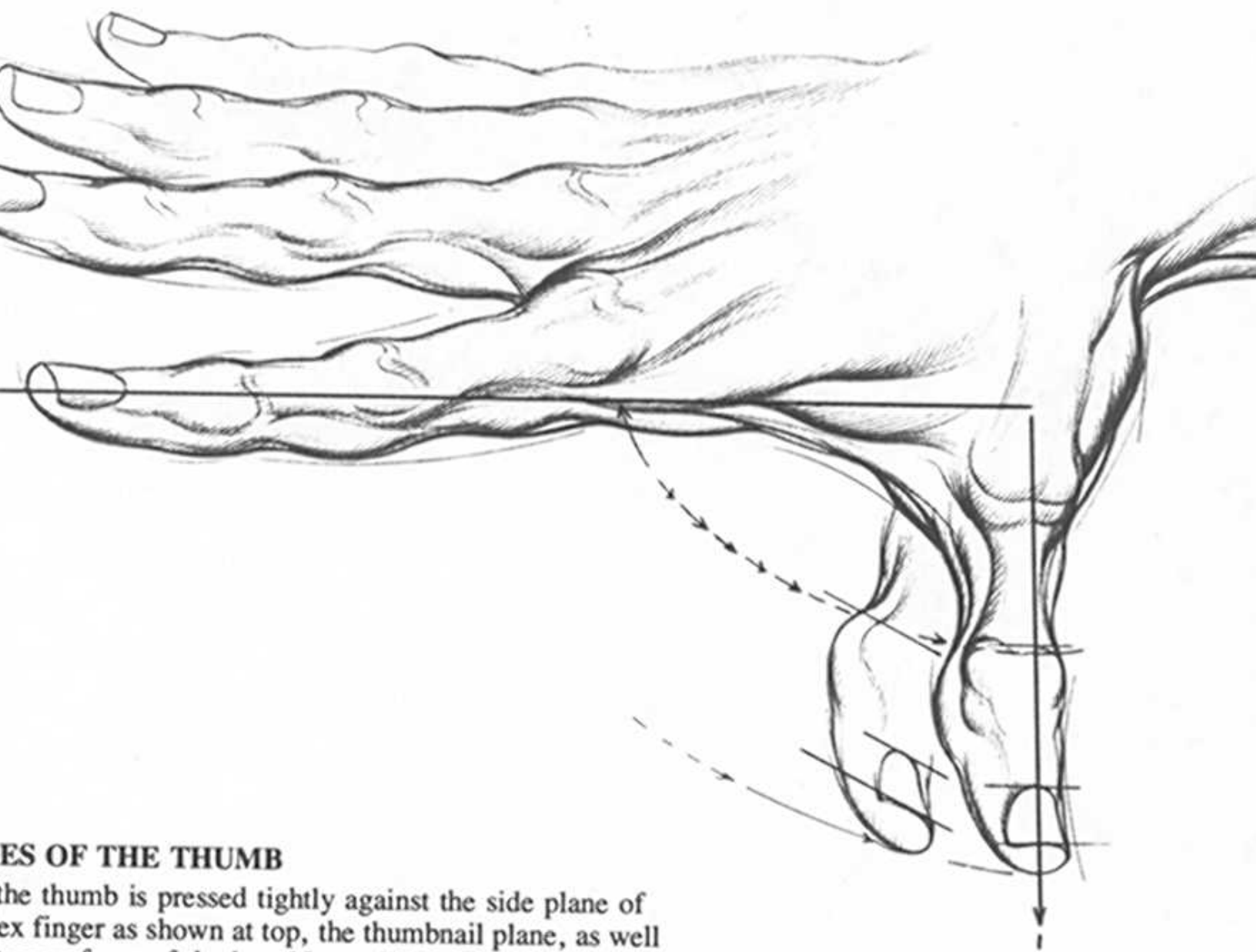
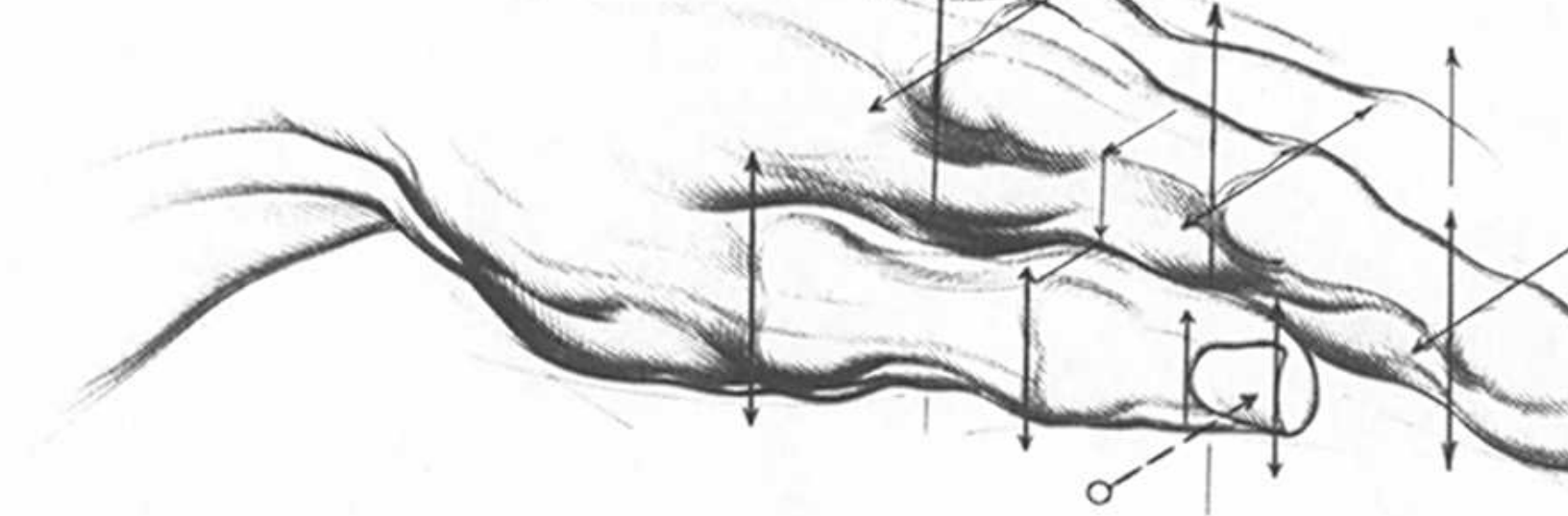


INSIDE AND OUTSIDE ANGLES

The diagram here illustrates the swing of the hand from extreme inside to extreme outside positions. The hand is placed on a flat surface, palm side down, with the pivot position at the wrist. The broken line (A), continuing from the inner arm line, represents the line of the index finger in normal position.

how this angle of tipping is consistent if the thumb is brought
down, but will *not* hold if the thumb is brought inward
under the palm.

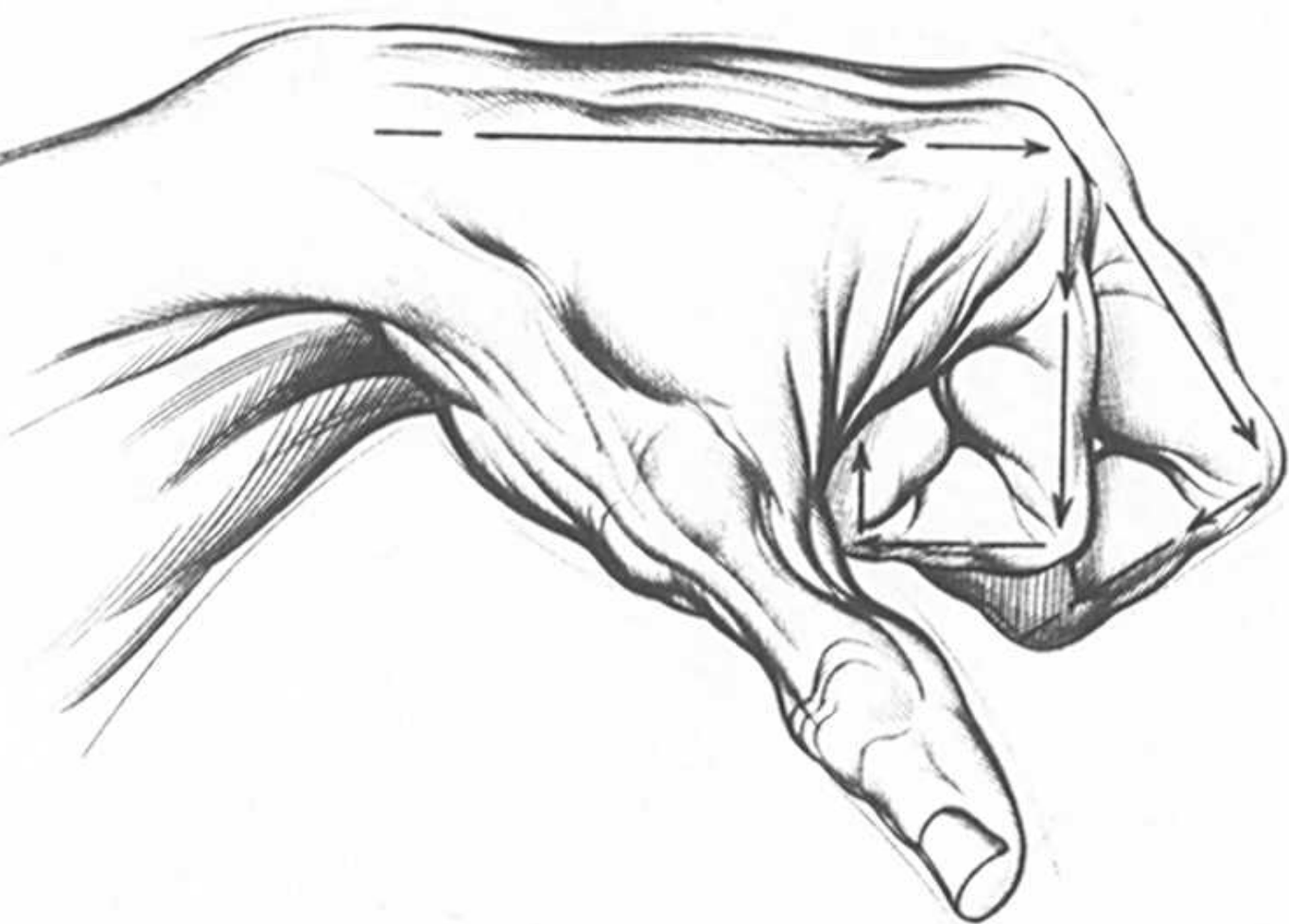




MOVEMENTS OF THE THUMB

When the thumb is pressed tightly against the side plane of the index finger as shown at top, the thumbnail plane, as well as the top surfaces of the knuckles, will lie at a 90-degree angle to the top of the hand and the index finger knuckles and nail. Note the contraposed angles of the fingernails of the thumb and index finger.



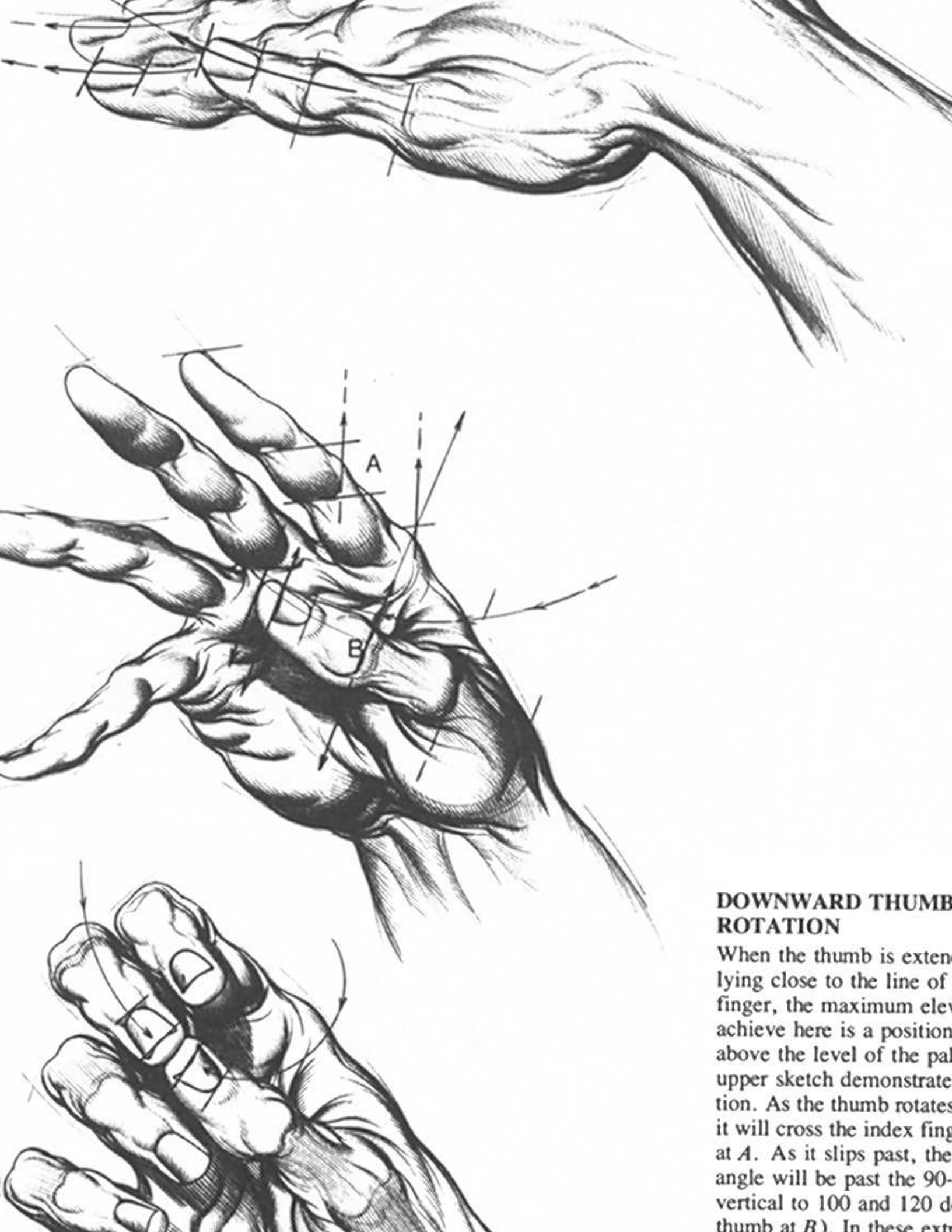


R ANGLES

ers tend to show a general 90-degree limit of closure,
to knuckle, from the thumb through the little finger

thumb. In the sketch
back fingers in closure
degree angles at each





DOWNWARD THUMB ROTATION

When the thumb is extended lying close to the line of the index finger, the maximum elevation achieved here is a position above the level of the palm. The upper sketch demonstrates this position. As the thumb rotates downward it will cross the index finger at *A*. As it slips past, the angle will be past the 90-degree mark (vertical to 100 and 120 degrees at thumb at *B*). In these ex-

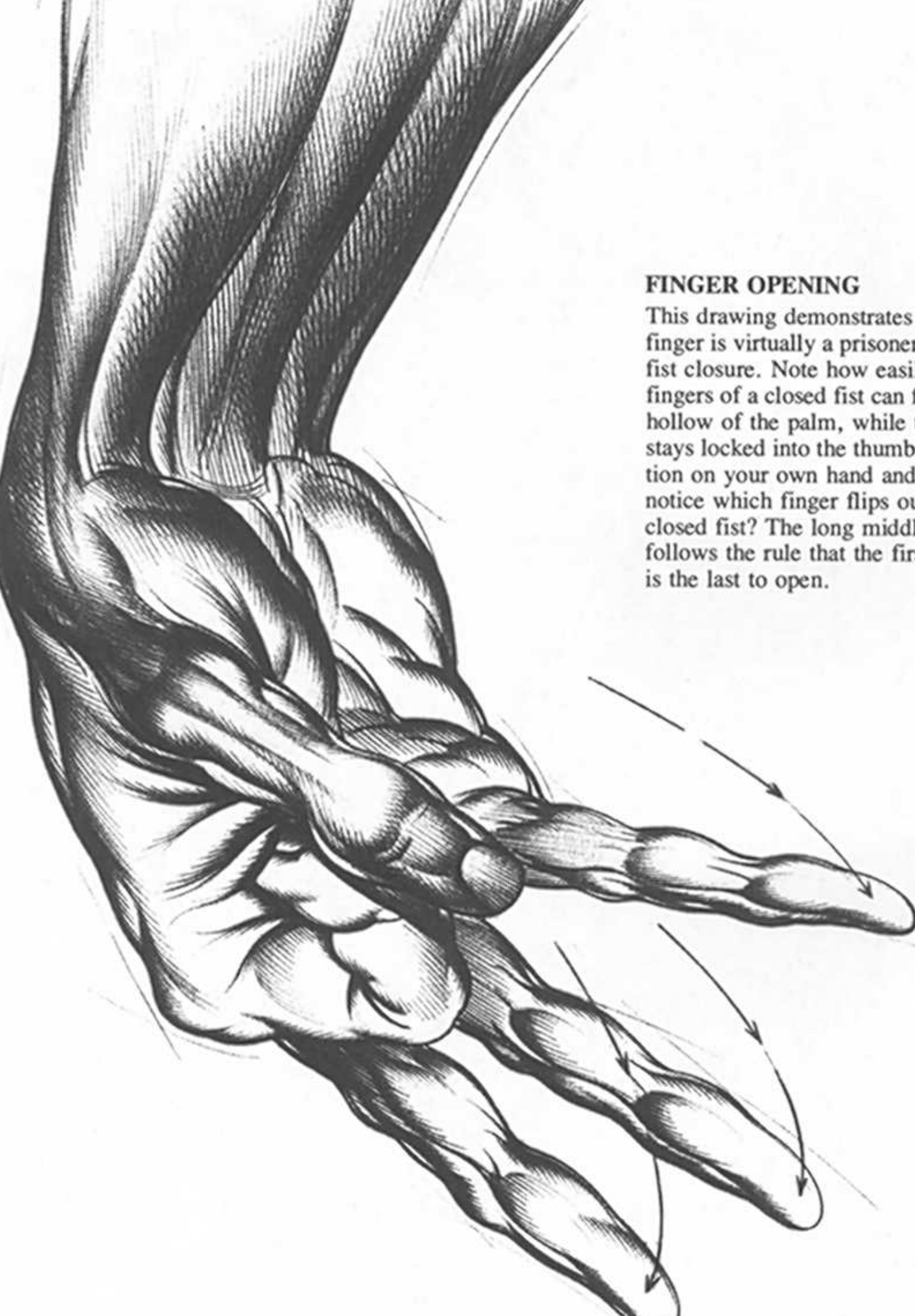
and the tips line up in the palm h
low. In the second phase, as the t
rear fingers go into a tight flexion
there is little room in the palm fo
closing the forefinger. Any attem
do so feels uncomfortable. But th
thumb closing in opposition to th
fingers creates a cradle and is fol
in. When the index finger is lock
into the enclosing thumb, its prox
knuckle will project beyond the l
of the other knuckles. This proje
is a marked characteristic of ever
tightly flexed fist.





STAGES OF FIST CLOSURE

This stage sequence shows the right hand going through the stages of flexion toward fist closure. In the various stages, the little finger begins folding down, followed by the ring, middle, and index fingers in numerical order—five, four, three, two, one, with all fingers coming together in a spiral formation. The thumb is the last to close. In phase 1, upper sketch, the palm is over-extended, but the little finger bends slightly. In phase 2, lower left, the fifth and fourth fingers are beginning to bend. In phase 3, center right, the bending is more pronounced. In phase 4, center left, shows fingers five, four, and three beginning to overlap the palm. In phase 5, lower right, the three rear fingers are definitely overlapping the palm.



FINGER OPENING

This drawing demonstrates how the index finger is virtually a prisoner of the thumb during fist closure. Note how easily the last three fingers of a closed fist can flip out from the hollow of the palm, while the index finger stays locked into the thumb box. Try this motion on your own hand and fingers. Do you notice which finger flips out first from a closed fist? The long middle finger! This follows the rule that the first finger to close is the last to open.



FINGER VARIATIONS

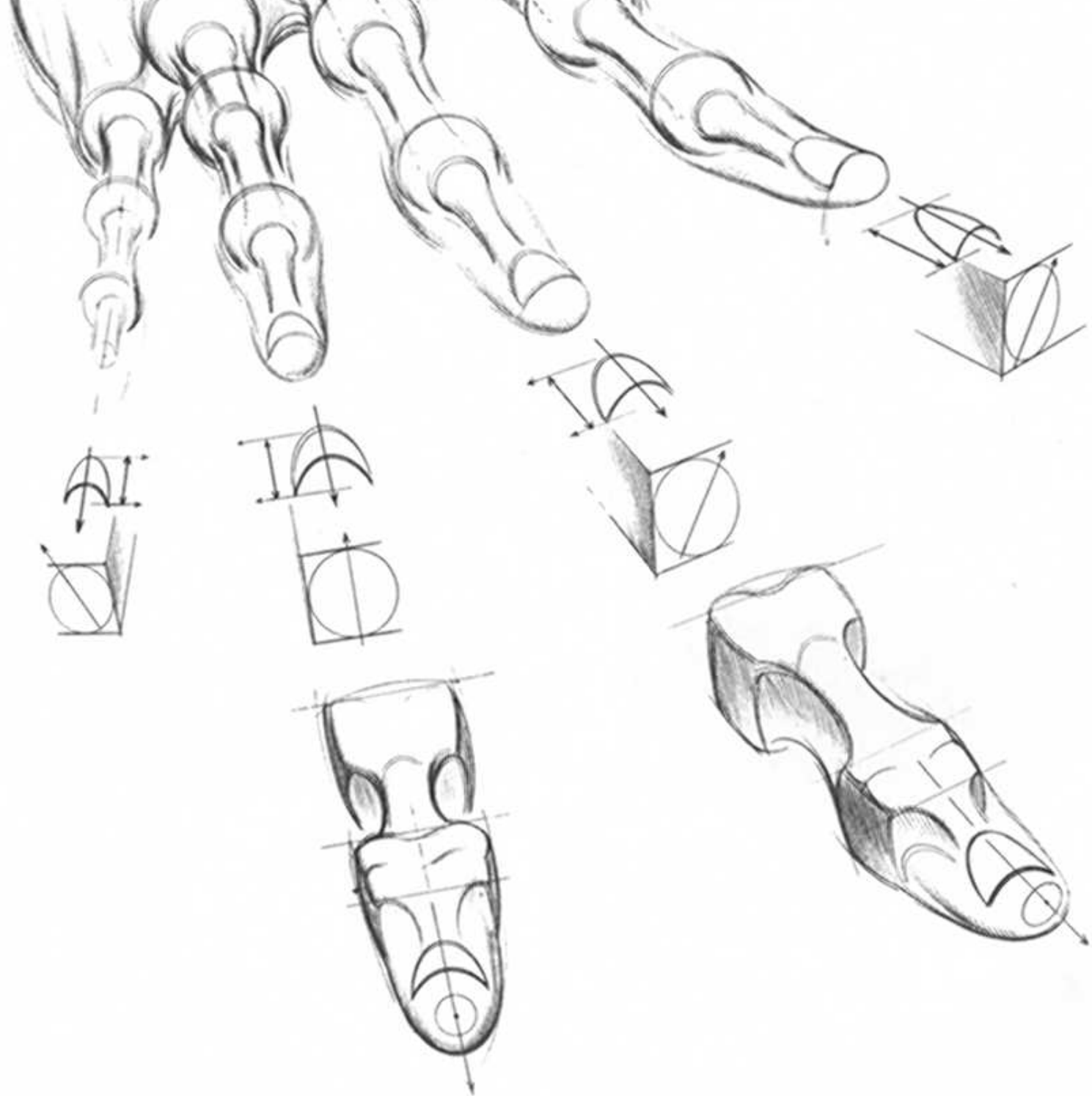
Looking at the finger *closure* sequence in the previous sketch, the sketches here show *open* finger variations. In this sketch, the index finger opens in a pointing gesture. The thumb is closed on the long middle finger, but impor-



6.

FORESHORTENING

It is impossible to draw the human hand accurately and artistically without an understanding of foreshortening, the overlapping of forms seen in spatial recession. Because there is scarcely any hand position which does not involve some form seen in deep space, in order to achieve a three-dimensional rather than a flat effect, it is important to see and understand advancing and receding forms. A difficulty often encountered is the problem of retaining the hand's rhythms, its flow, and its sense of unity when drawing it from angles of deep foreshortening. Because forms are seen one in front of, on top of, or behind another, or not clearly seen at all, there is a tendency for them to look bumpy, segmented, and abrupt. Principles such as overlapping, interlacing, spiraling, and tonal contrast to achieve depth are given here as aids to learning to draw the hand as a dynamic, alive volume moving in space.

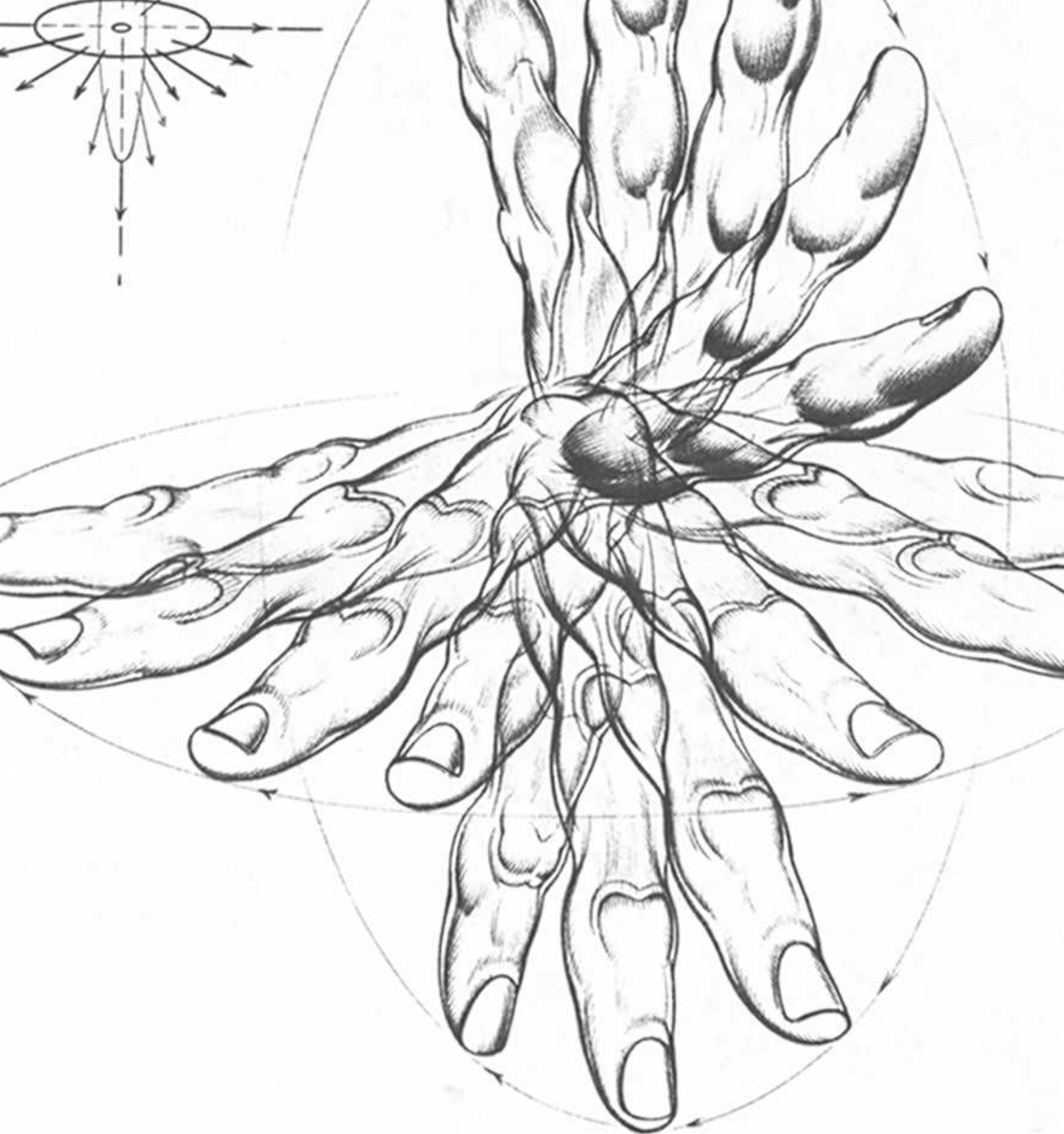


ALL FORMS OF THE FINGERS

...le ball (knuckle) and rod (shank) forms we
 ...arlier, note that the three rods (shanks) of the
 ...appear quite long in this three-quarter view. We
 ...fingers more straight on, as we move progres-
 ...ft. The rods or bone shanks are seen as short-
 ...the rear shank, on the fourth finger. This is
 ...shortening or compression of frontal space. One
 ...test the accuracy of the drawings of foreshort-
 ...to check the fingernail *lengths* seen in depth
 ...ives in the different views from side to front as
 ...middle diagrams.

...middle finger is more circular because its tip is seen
 ...the front. It is also shorter from front to back, and the
 ...less elliptical and more curved, as shown by the sche-
 ...block. The fourth finger is seen from the deepest view
 ...its tip seen at almost full circle with the nail fully ar-
 ...Conversely, the nail length is also the shortest of all
 ...of the deepest foreshortening. Note the full circle on
 ...schematic block. The little finger is veering left of ce-
 ...the slight side view gives a somewhat elliptical nail
 ...front.

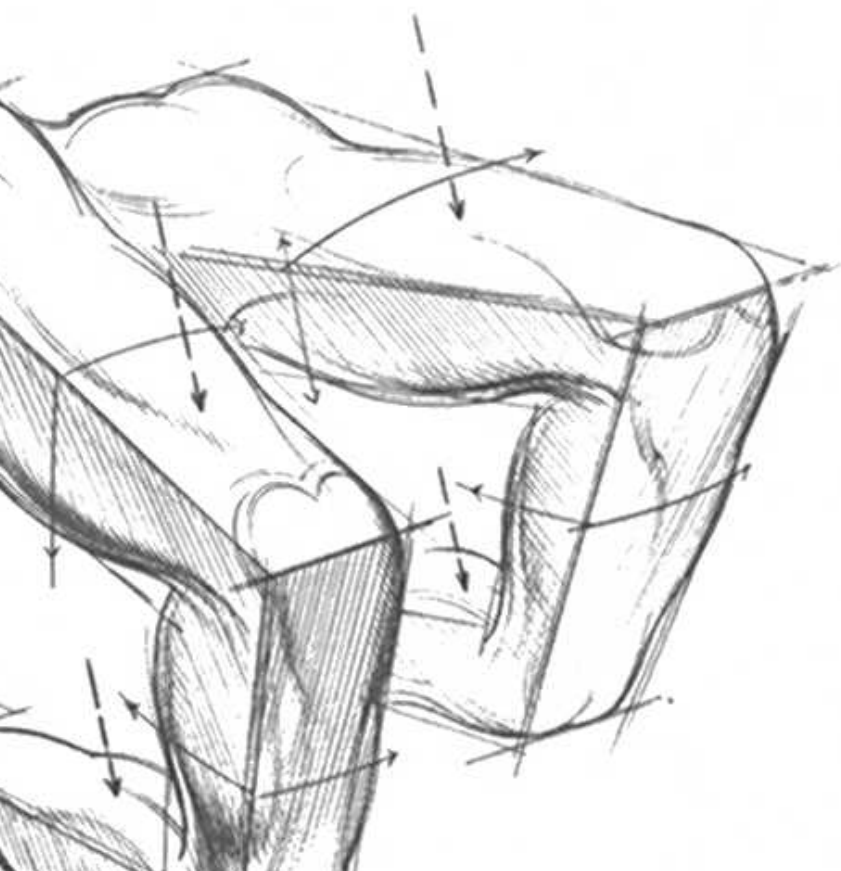
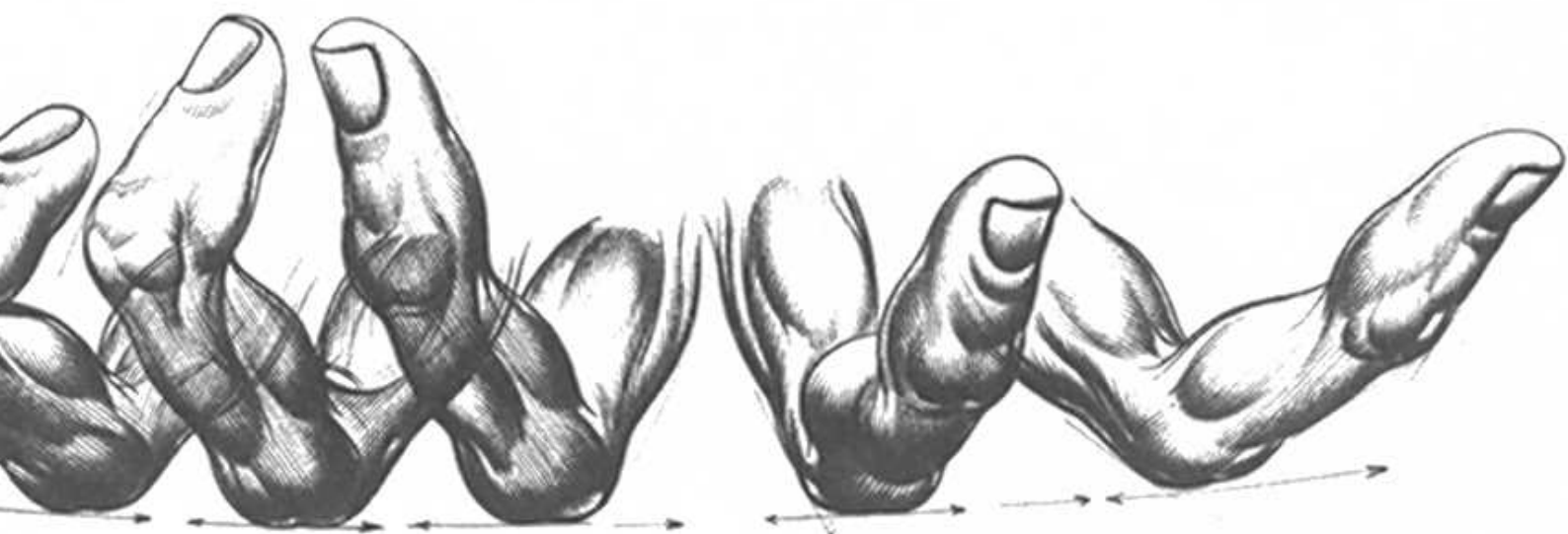
The two sketches at bottom show the knuckle and sh



SHORTENING IN ROTATION

Drawing here is a wonderful exercise in foreshortening, using just the single long finger. The finger is seen in rotation in two directions—on a horizontal plane side to side and on a vertical plane from top to bottom. The rotation scheme is in miniature in the diagram at upper left.

On a horizontal axis, the *shorter* the radius, the *deeper* the foreshortened view of the



TONAL CHANGES TO ACHIEVE DEPTH

The use of tonal or value changes is an indispensable factor in the development of spatial recession. The drawing at lower left, showing top, side, and underplane surfaces of the two fingers, reveals that *advancing* surfaces seen horizontally are defined with light tones; *receding* surfaces which fall away to side planes are given intermediate tones; and *regressing* forms, such as underplanes, which are farthest from the light, are expressed in deepest tones. The tonal or value system shown in the sketch is simplified in order to permit the use of accentuated dark contours on undersurface areas.

The developed drawing in the center shows a sequence of a single bent finger moving in an arc. The foreshortened changes. The advancing plane highlights the middle phalanx of each finger. Thus the top surface is generally lightest. The intermediate surfaces are found mainly on side planes and small protrusions and are defined with grayish tones. The surfaces lying deepest are toned the darkest.

In the upper sequence, the single finger is turned



forms are curved — knuckles, mounds, fleshy finger pads. They are linked by lines formed by shanks, tendons coursing down the surface skin covering, interphalangeal webs, and skin wrinkles, which occur at the hollows and depressions of the hand. In the drawings shown here, the combination of these two forms creates a spiraling effect, particularly in the rounded views. Note the sinuous term of knuckle mounds linked by shanks, skin sheathes, and creases. Also note the accented areas of muscle protrusions and the lines running through the spiraling volumes.



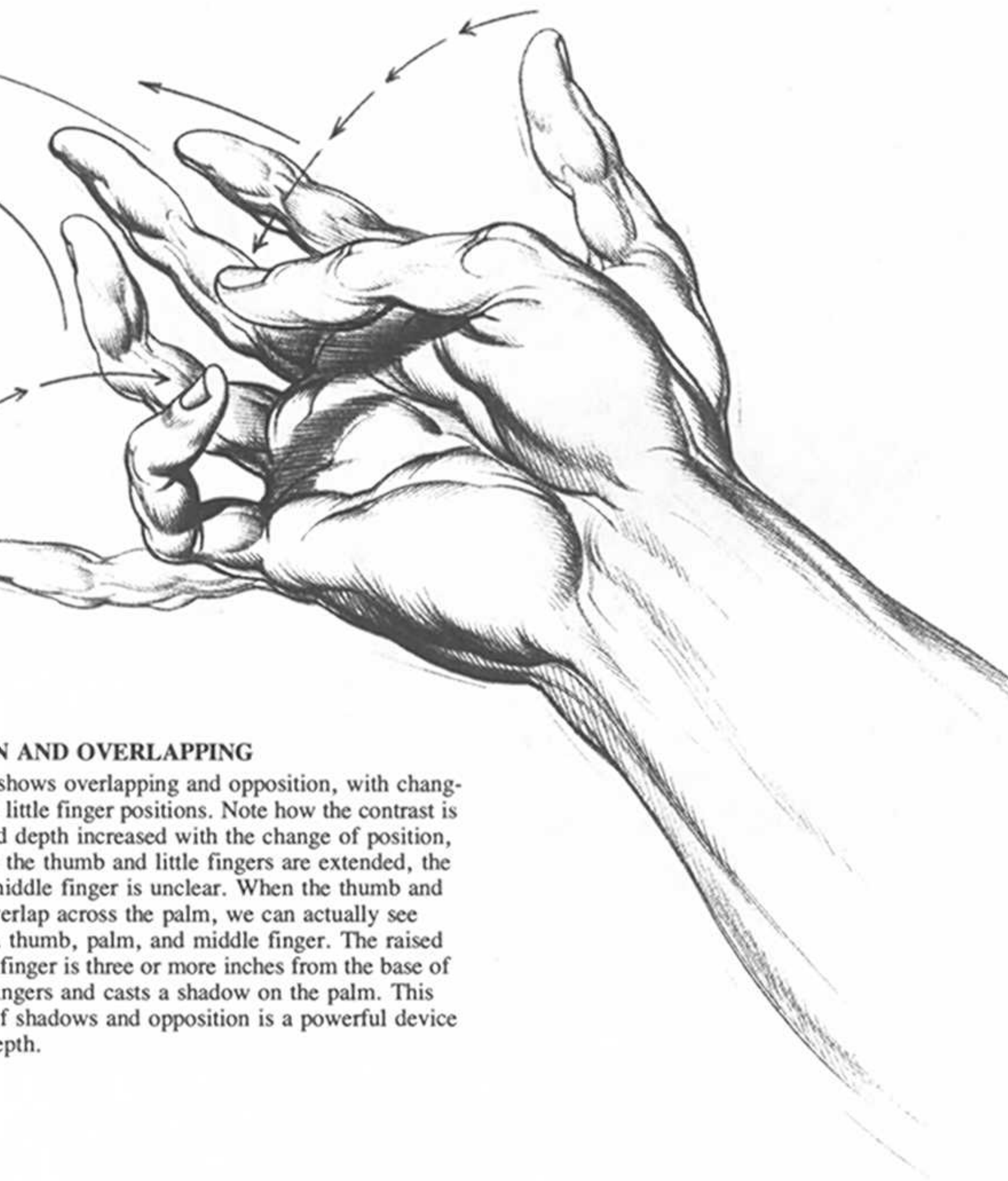


FORMS

interlacing are shown here on the three
side the completed hand. In both upper and
es, the interlace arrows move along tendons
. Note how the forms on the hand at right
interlaced continuity. The lower schematic

th increases visual tension and impact when fingers con-
ose each other, especially in overlapping. In this drawing,
x finger and thumb are thrust left and out (note direction
rows), while the rear fingers, less tense and darker, bend
ard for contrast. The arm is also part of this leftward,
gized thrust. Note how solid the near forms appear and
recessive the ones farther back seem.



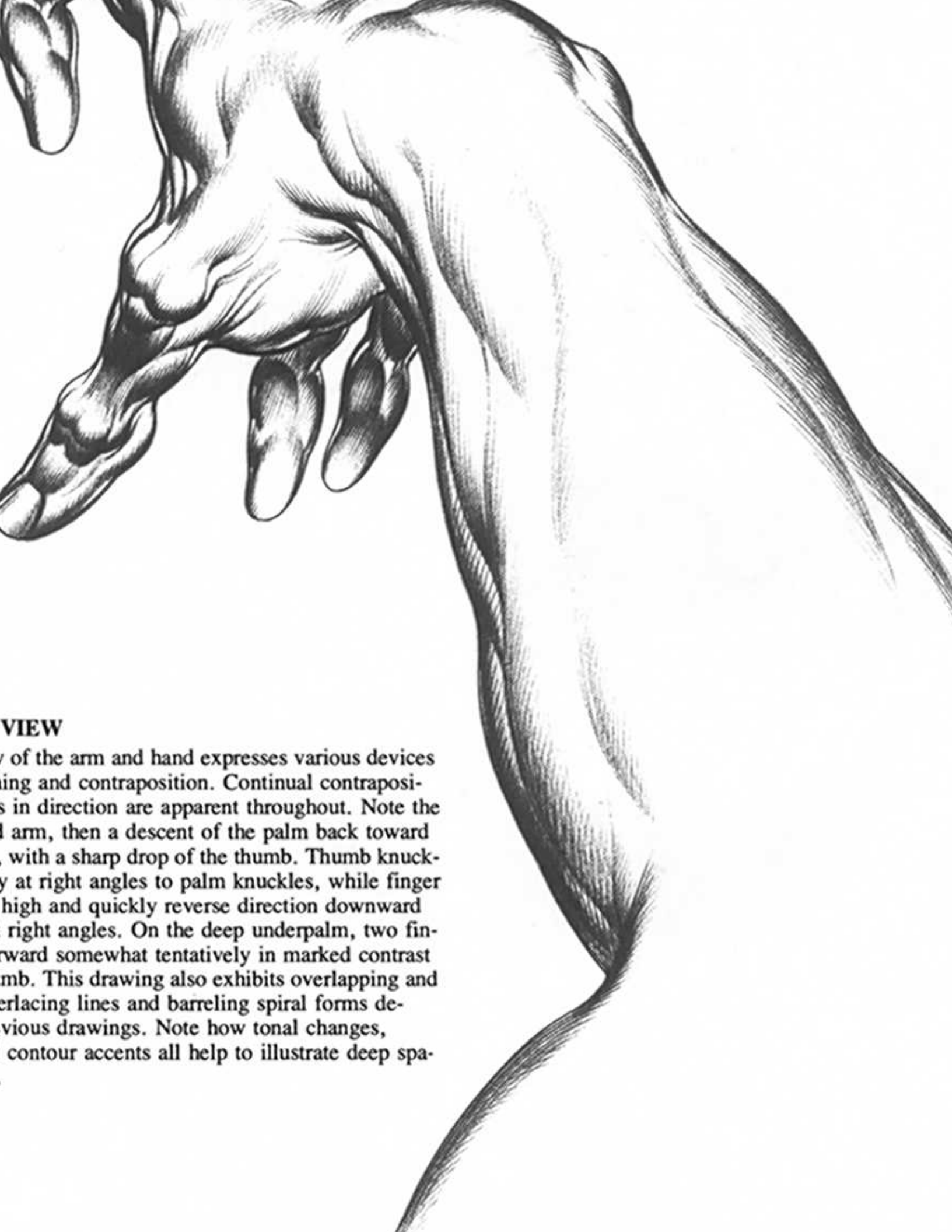


CONTRAST AND OVERLAPPING

This illustration shows overlapping and opposition, with changing little finger positions. Note how the contrast is increased and depth increased with the change of position. When the thumb and little fingers are extended, the middle finger is unclear. When the thumb and little fingers overlap across the palm, we can actually see the thumb, palm, and middle finger. The raised little finger is three or more inches from the base of the other fingers and casts a shadow on the palm. This use of shadows and opposition is a powerful device for creating depth.

diametrical cross-palm overlap. The extreme distance excites the eye with its tension. Yet also note the motion of knuckles in a much less tense visual sequence.

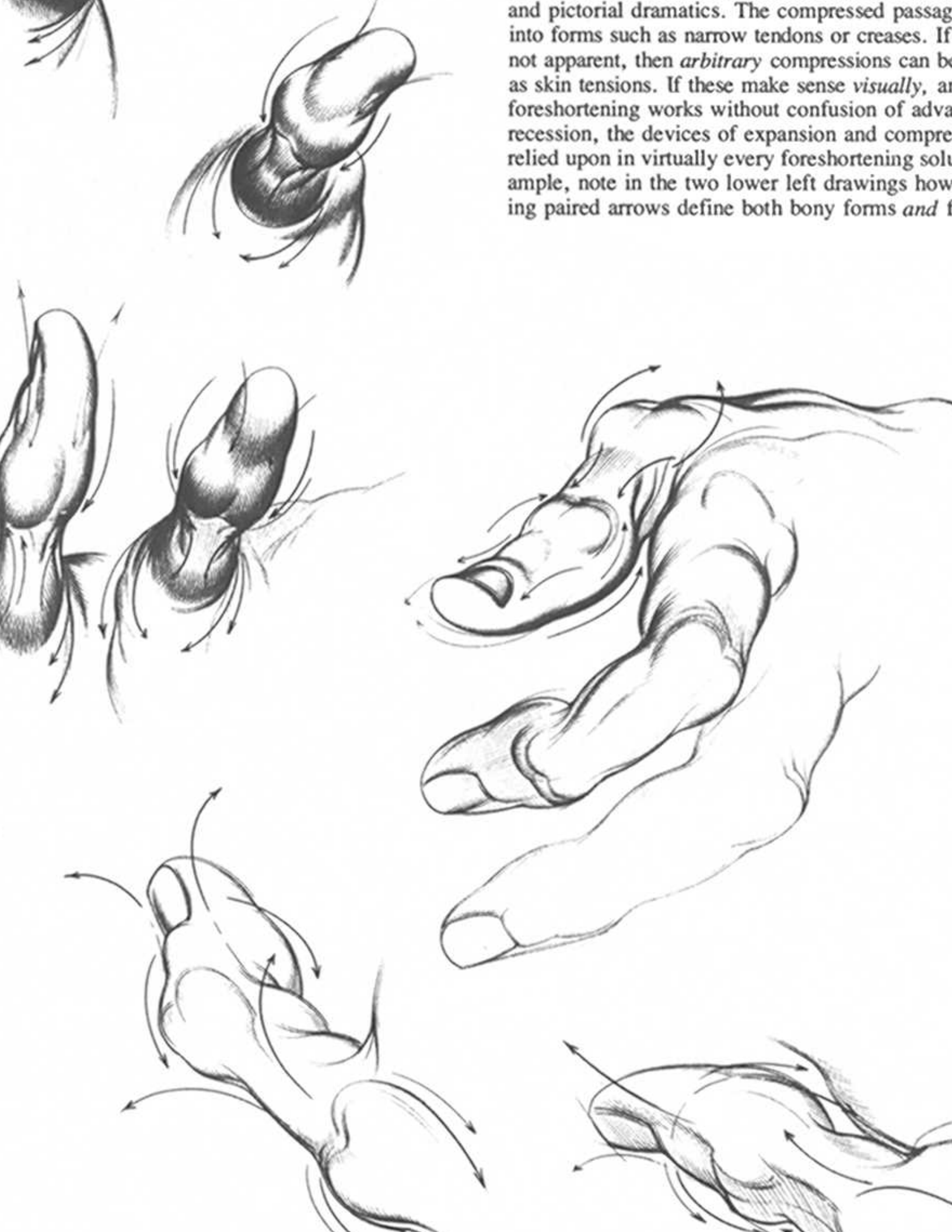




VIEW

of the arm and hand expresses various devices of line and contraposition. Continual contrapositions in direction are apparent throughout. Note the ascent of the forearm, then a descent of the palm back toward the wrist, with a sharp drop of the thumb. Thumb knuckle is at right angles to palm knuckles, while fingers rise high and quickly reverse direction downward at right angles. On the deep underpalm, two fingers point forward somewhat tentatively in marked contrast to the thumb. This drawing also exhibits overlapping and interlacing lines and barreling spiral forms deviously drawn. Note how tonal changes, contour accents all help to illustrate deep spa-

and pictorial dramatics. The compressed passage
into forms such as narrow tendons or creases. If
not apparent, then *arbitrary* compressions can be
as skin tensions. If these make sense *visually*, an
foreshortening works without confusion of adva
recession, the devices of expansion and compre
relied upon in virtually every foreshortening solu
ample, note in the two lower left drawings how
ing paired arrows define both bony forms and f





FINGERTIP FORMS

This sketch, without explanatory text, shows a series of expanding and contracting fingertip forms. As you study the drawing, decide whether it works visually. Tonal changes and cast shadows emphasize the depth, but note how

7.

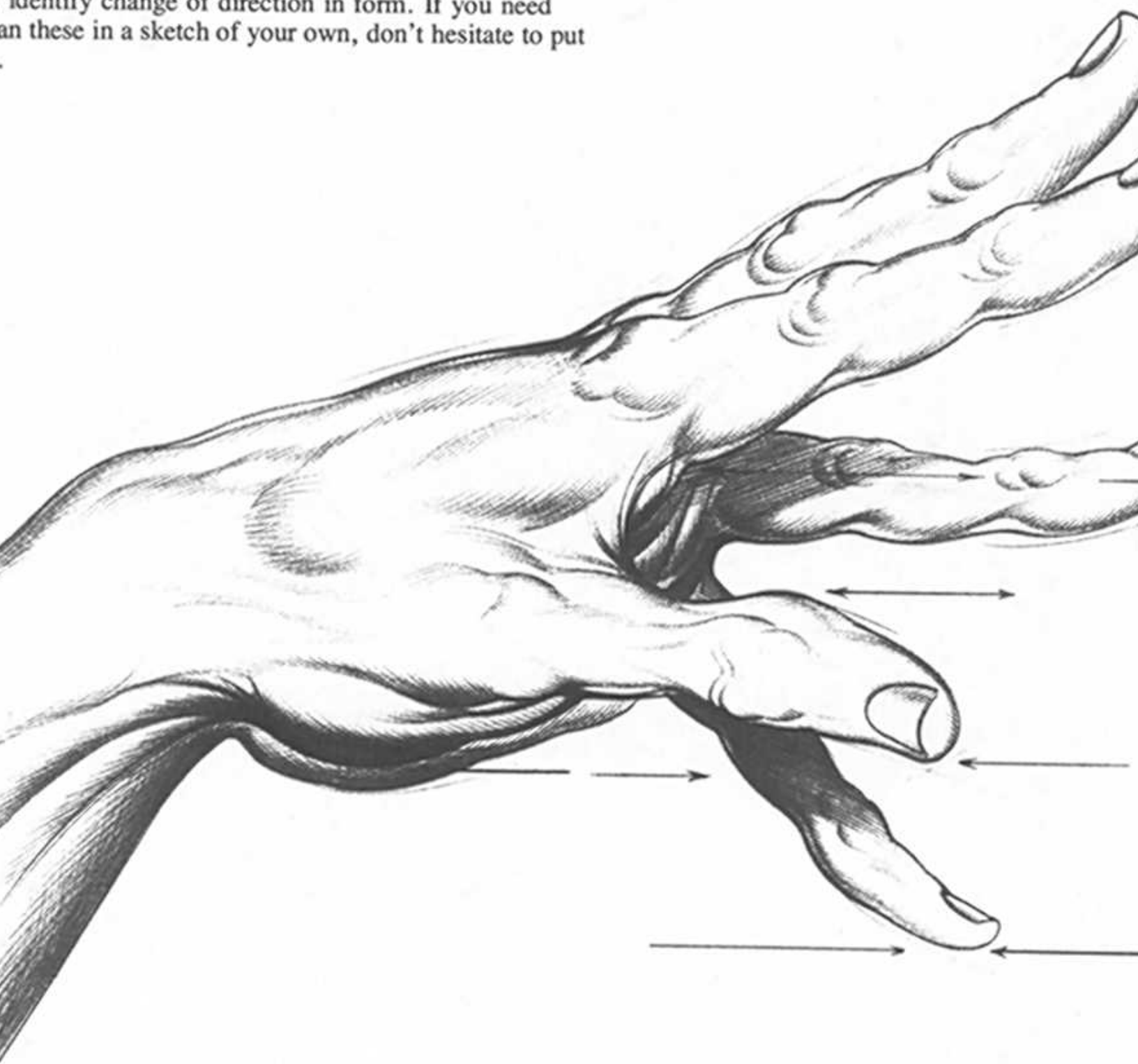
INVENTING HANDS IN ACTION

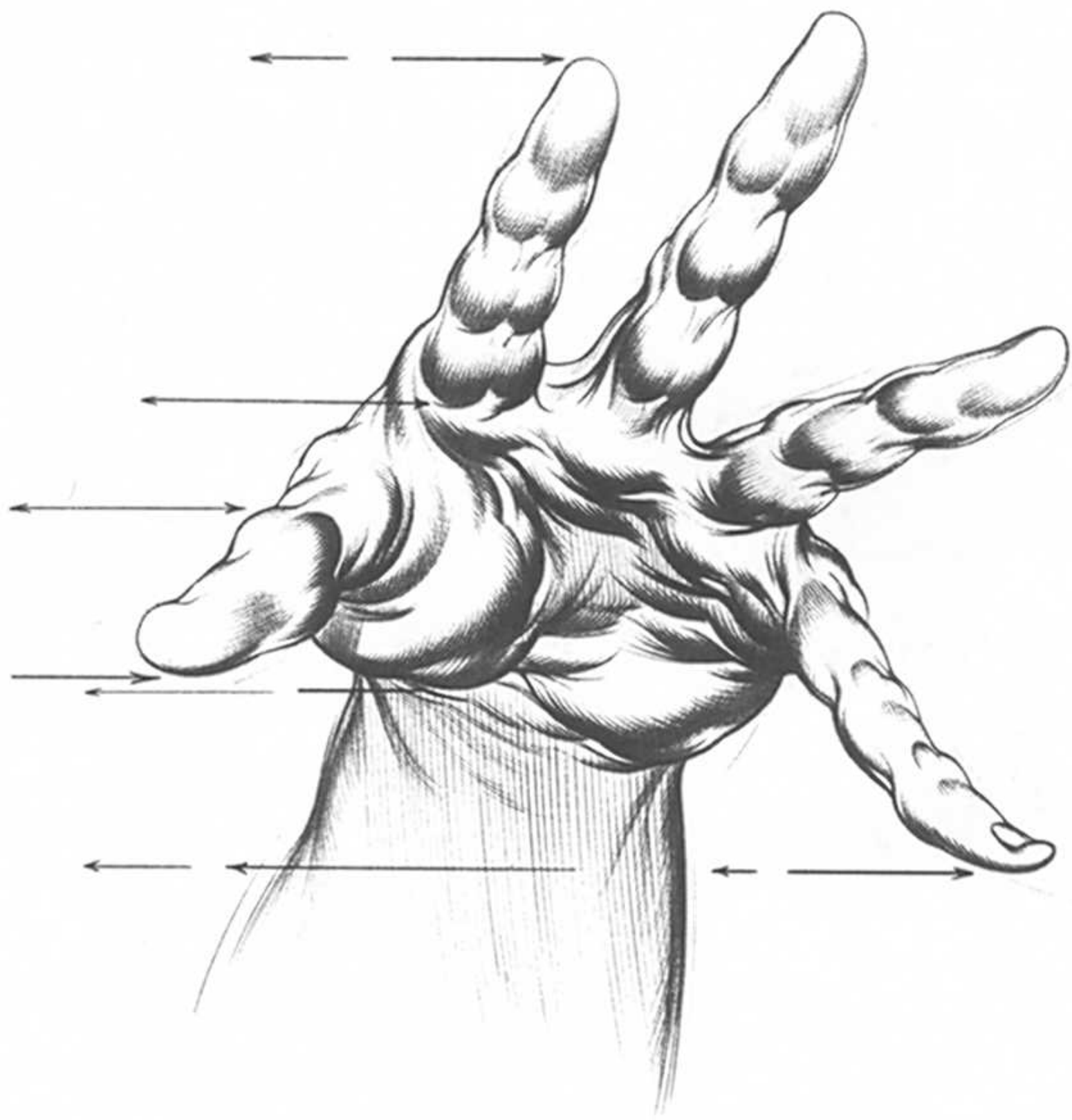
The best hand actions are not necessarily copied exactly from life. Pictorial logic, design necessity, and the overall concept of the work impose their own demands. Anyone who has seen the interpretive and expressive responses of Leonardo, Michelangelo, Grünewald, or Rodin, will understand the need of the artist to create form in response to his intuitive impulses. A starting point for drawing an original and personal hand in action is to sketch, perhaps even copy, a prosaic view of one of the hand's numerous gestures. It does not have to show a remarkable attitude or even a near relationship to the expected result. It can be only a starting point from which you can develop your own personal vision.

...ions to the movement. In
ing, each finger change alters
the gesture. Study these
experiment with changing
notations by moving the
different positions.



ingers shown here. They set out a few horizontal
es extending from major forms. In this case, thumb
n muscle thickness and index and little finger lengths
g tracked. These choices are purely arbitrary and only
identify change of direction in form. If you need
an these in a sketch of your own, don't hesitate to put





FRONTAL PARALLEL PROJECTION

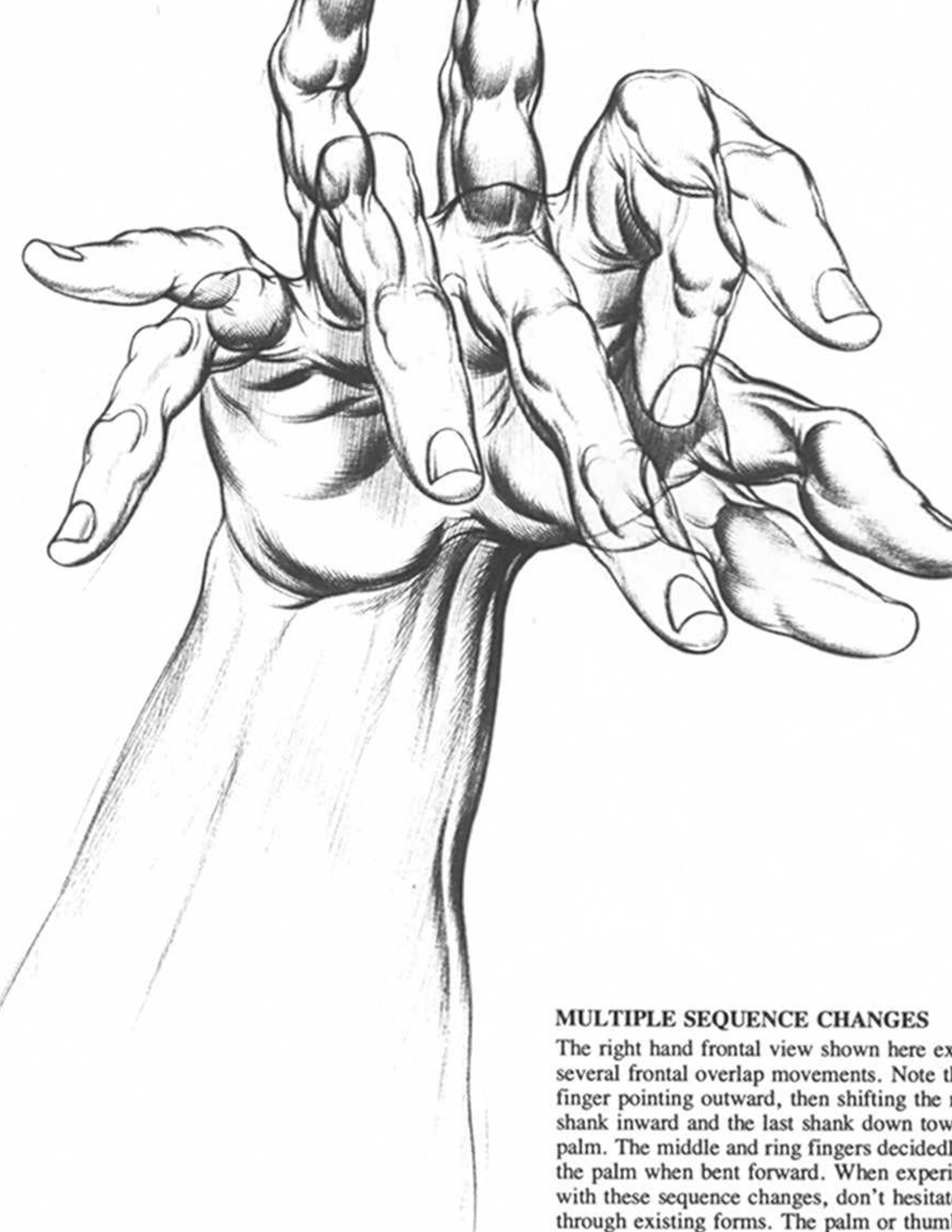
With tracks laid out, sketch in a tentative deep from a hand, holding the forms to the limits of the extent. If they confuse the eye, sketch them in erasable color on label each line with the form's name. With



ING POSITIONS

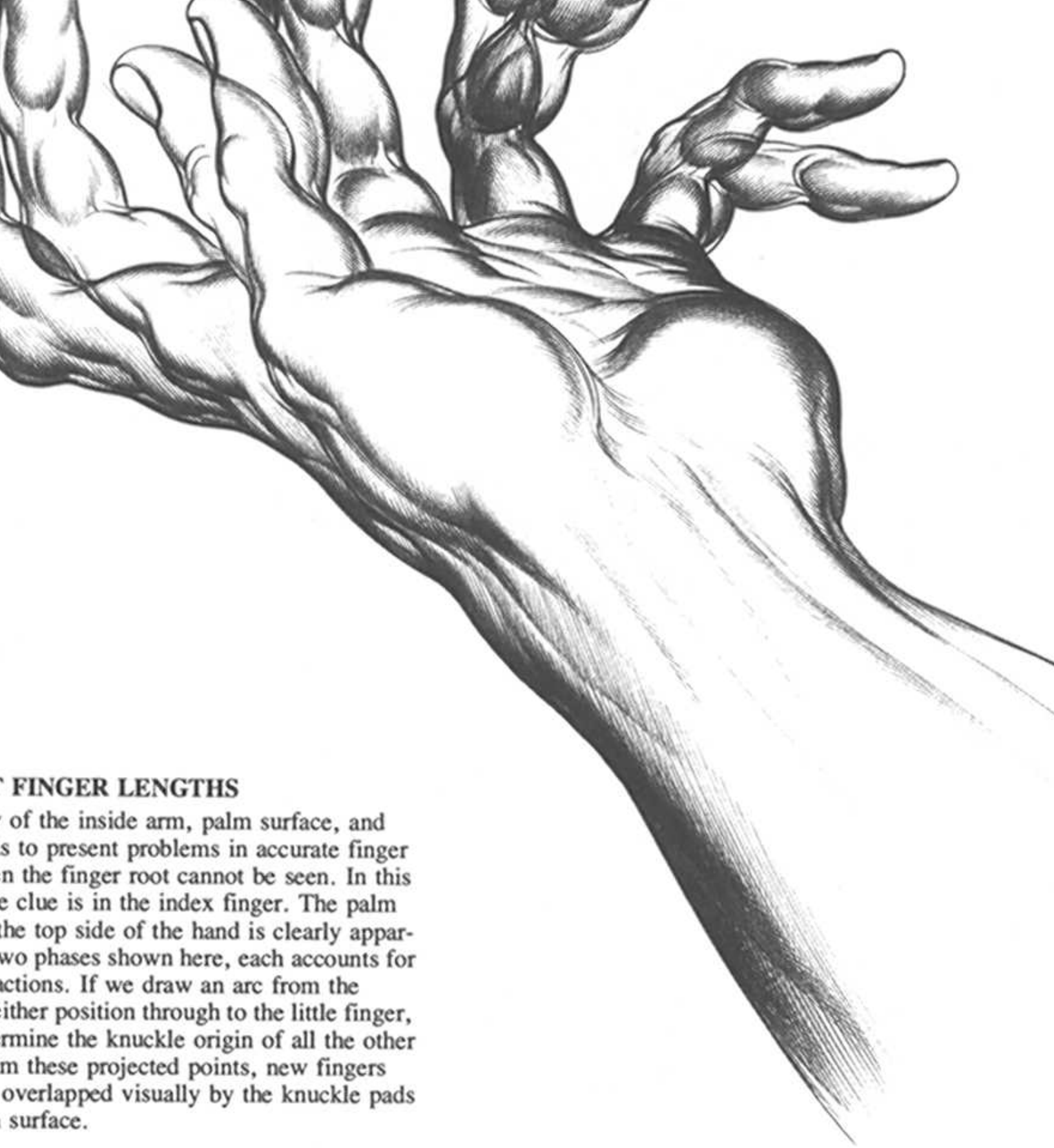
ow do a surprising thing—you can develop the
of frontal foreshortening just discussed into its re-
sition. First trace or copy closely the position of

joining the outside arm, and the line of the radial
inside arm moving toward the index finger. The



MULTIPLE SEQUENCE CHANGES

The right hand frontal view shown here exhibits several frontal overlap movements. Note the index finger pointing outward, then shifting the middle finger shank inward and the last shank down toward the palm. The middle and ring fingers decided to point toward the palm when bent forward. When experimenting with these sequence changes, don't hesitate to move through existing forms. The palm or thumb



FINGER LENGTHS

of the inside arm, palm surface, and
s to present problems in accurate finger
n the finger root cannot be seen. In this
e clue is in the index finger. The palm
the top side of the hand is clearly appar-
two phases shown here, each accounts for
actions. If we draw an arc from the
ither position through to the little finger,
rmine the knuckle origin of all the other
m these projected points, new fingers
overlapped visually by the knuckle pads
surface.

were reversed and drawn from a rear
ne previously, finger lengths could also
from the index finger and carried into the
Try looking at each finger crease as if it
an arc connected to the other fingers.
ngertip relationships. The forms in space
ted carefully, section by section. The
ions here are modest ones. More dramat-

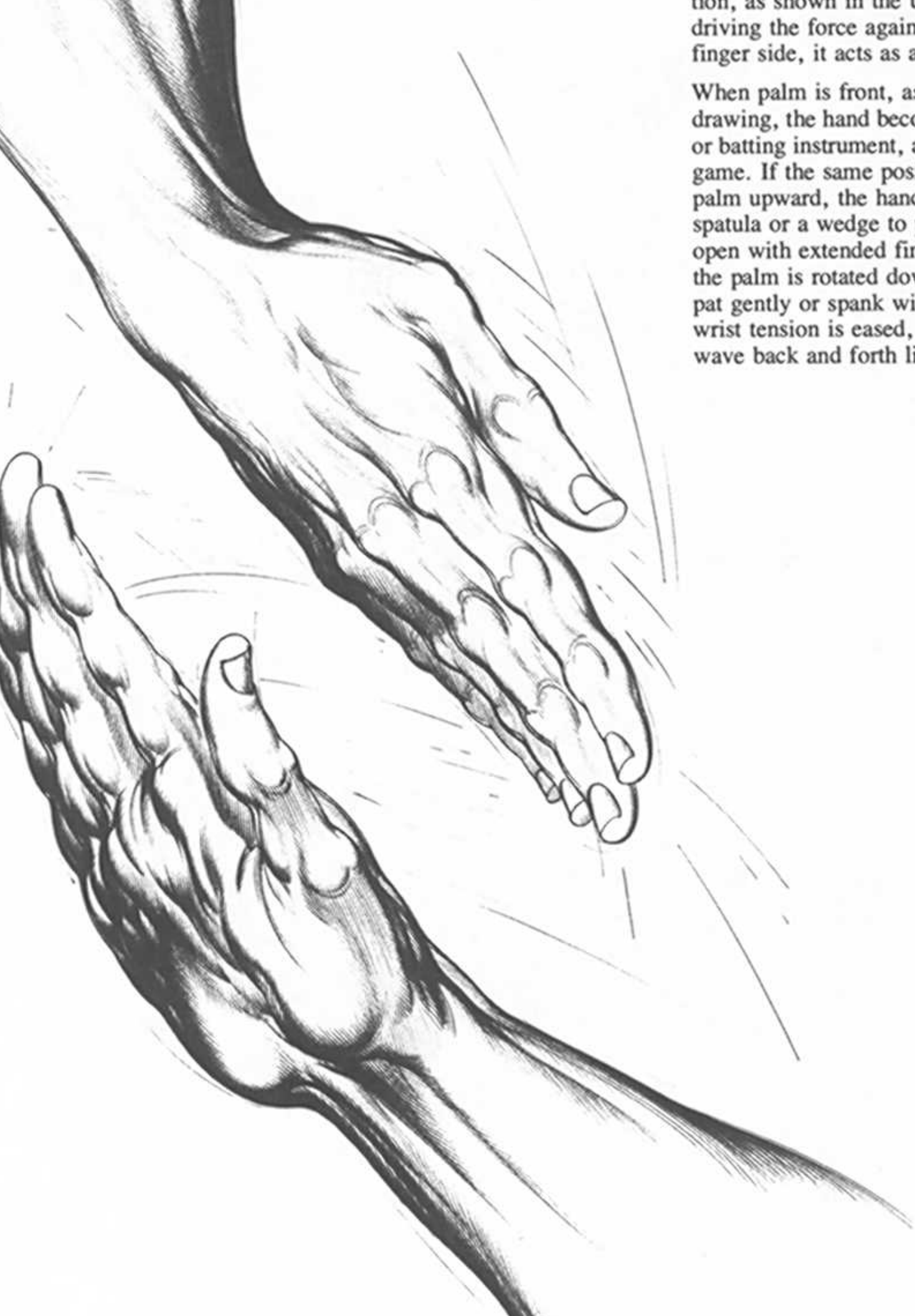
and the other fingers in two. Most aspects are developed transparently, which helps in making judgments about placement and measurement. It is important to train your imagination with multiple views as shown here, and it will be useful for you to return back to this chapter at a later time for further study and refinement.



8.

THE HAND AS AN INSTRUMENT

While most anatomical structures tend to serve discrete and specialized ends, the hand, because of its plasticity, is designed to serve a wide range of needs. In a certain position, with only slight shifts in tension or direction, it can be used for very different purposes and can even express very different meanings. You will see this subtle shift in use and meaning in the drawings in this chapter. After you have explored the various ways the hand can function as a tool or an instrument as shown here, go on to other exercises of your own and explore new possibilities of the hand as an instrument.

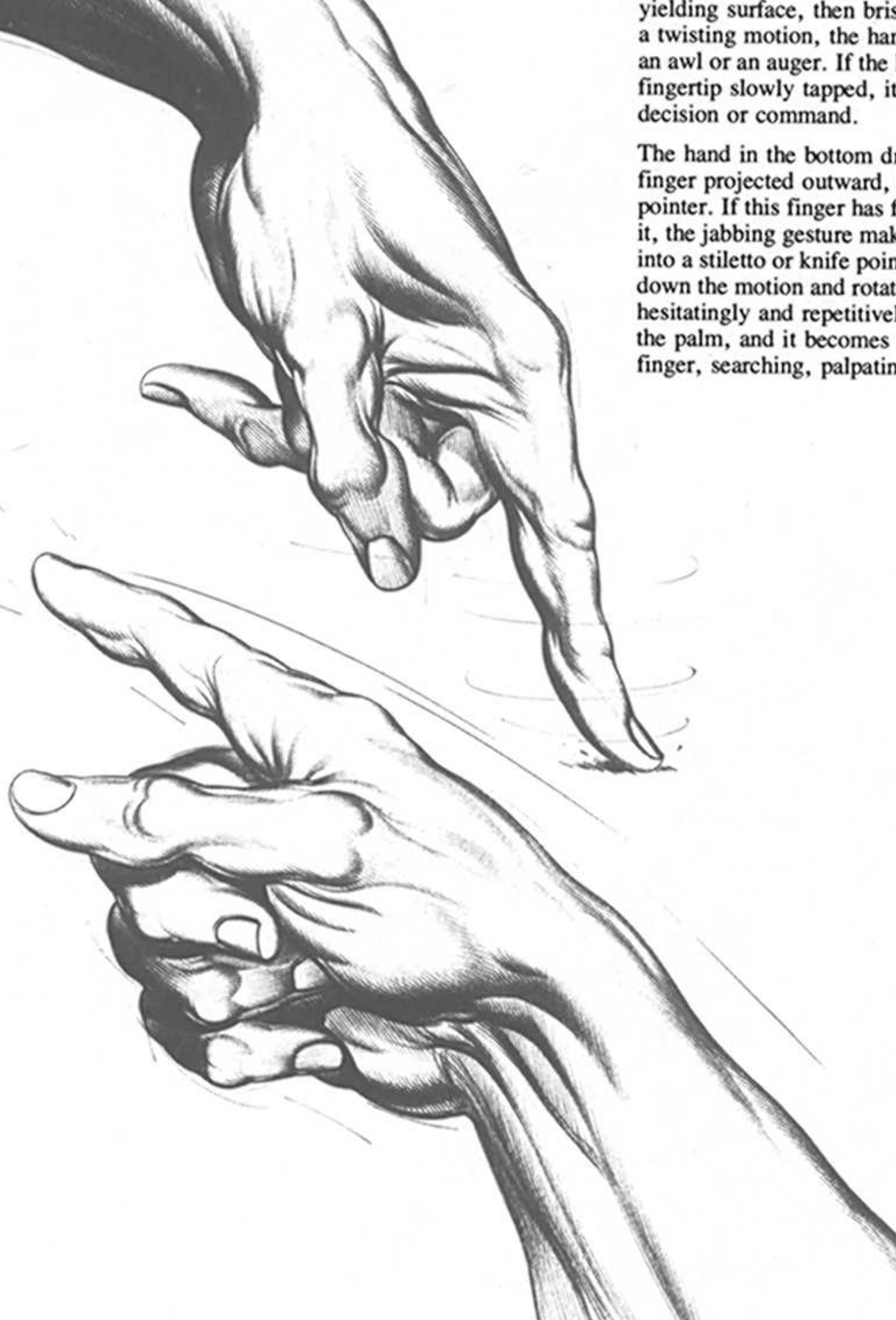


tion, as shown in the upper drawing, driving the force against the little finger side, it acts as a chopper.

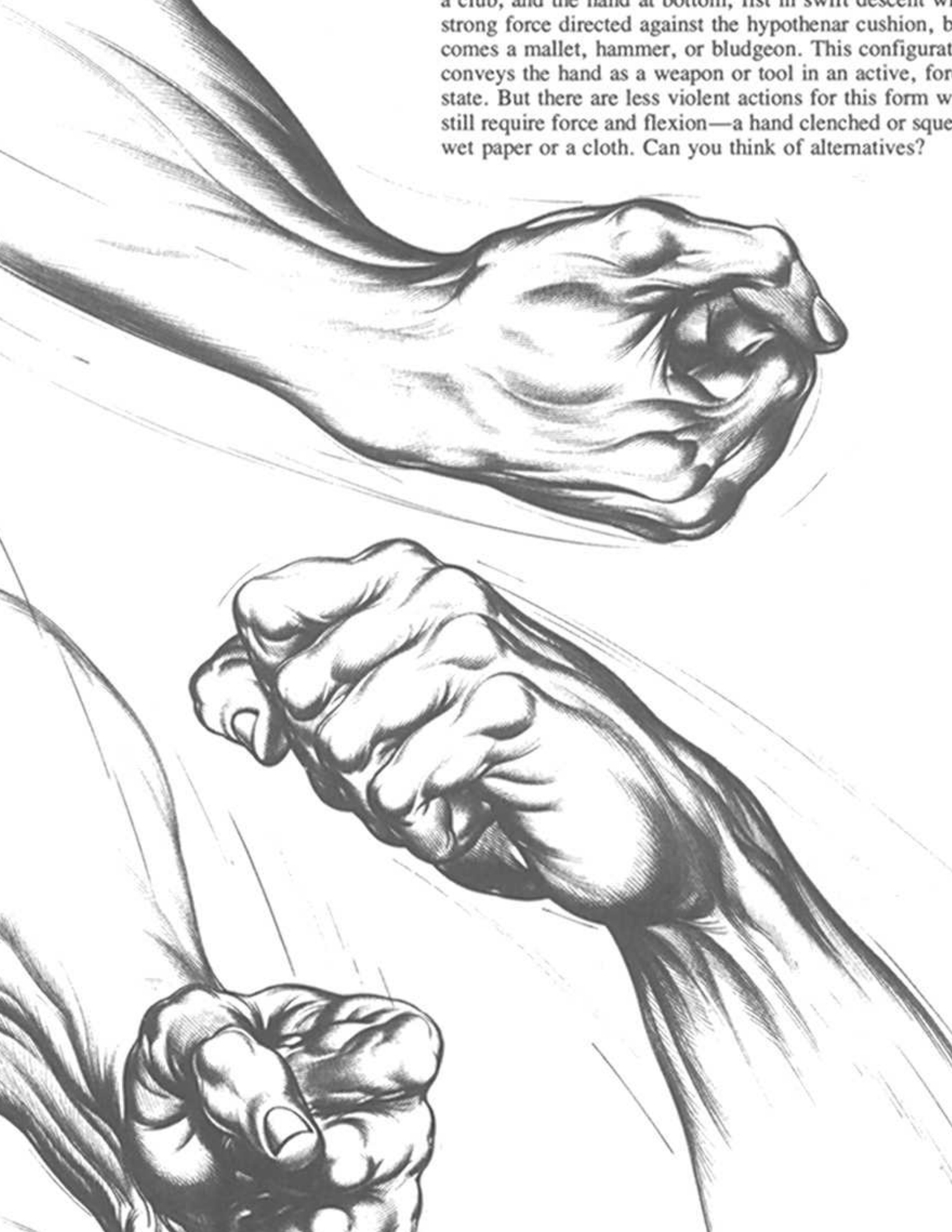
When palm is front, as in the lower drawing, the hand becomes a slap or batting instrument, as in a hand game. If the same position is turned palm upward, the hand becomes a spatula or a wedge to pry something open with extended fingers. And if the palm is rotated downward, it can pat gently or spank with force. If wrist tension is eased, the palm can wave back and forth like a fan.

yielding surface, then brings
a twisting motion, the hand
an awl or an auger. If the
fingertip slowly tapped, it
decision or command.

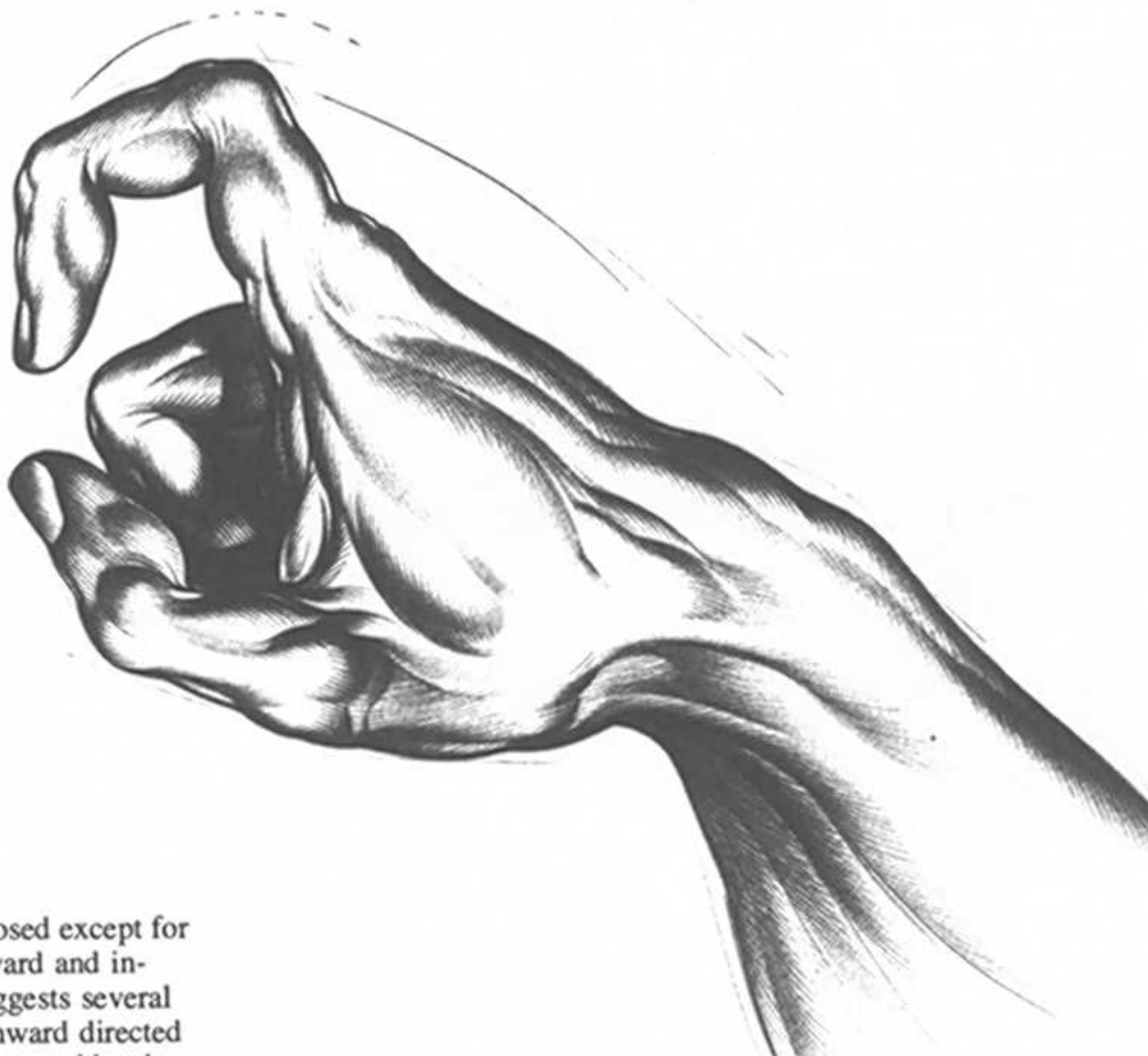
The hand in the bottom d
finger projected outward,
pointer. If this finger has f
it, the jabbing gesture mak
into a stiletto or knife poin
down the motion and rotat
hesitatingly and repetitive
the palm, and it becomes
finger, searching, palpatin



a club, and the hand at bottom, fist in swift descent with strong force directed against the hypothenar cushion, becomes a mallet, hammer, or bludgeon. This configuration conveys the hand as a weapon or tool in an active, forceful state. But there are less violent actions for this form which still require force and flexion—a hand clenched or squeezed wet paper or a cloth. Can you think of alternatives?







POWER HOOK

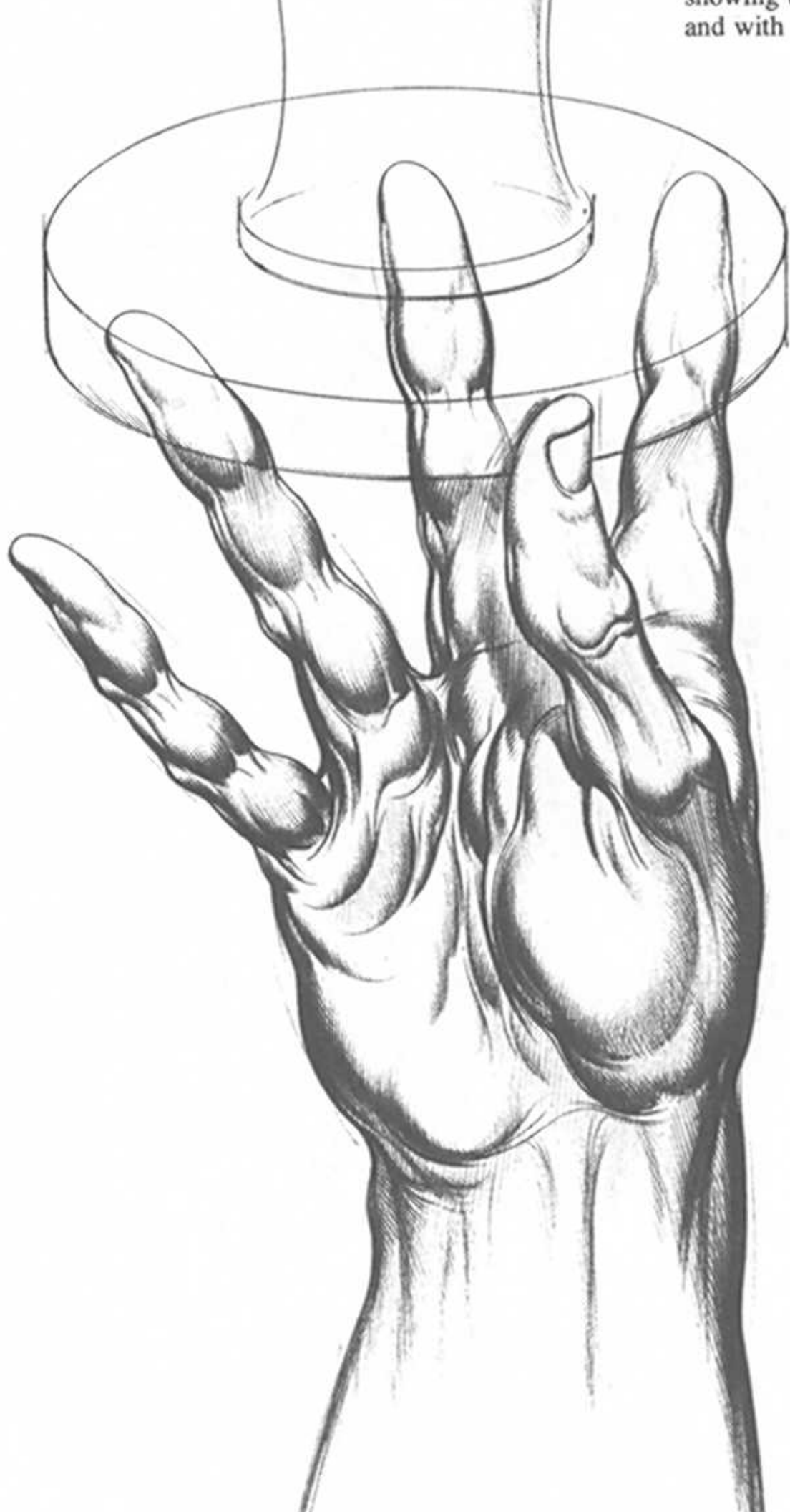
is virtually closed except for
er arching forward and in-
l as a hook suggests several
ons. The downward directed



S AND TWEEZERS

e thumb and forefinger meet at the
, as shown in the upper drawing,
can perform as pincers or pliers,
probe, using a brush as shown, or
nail. Such acts may need the sup-

showing the support with only three
and with all five fingers.



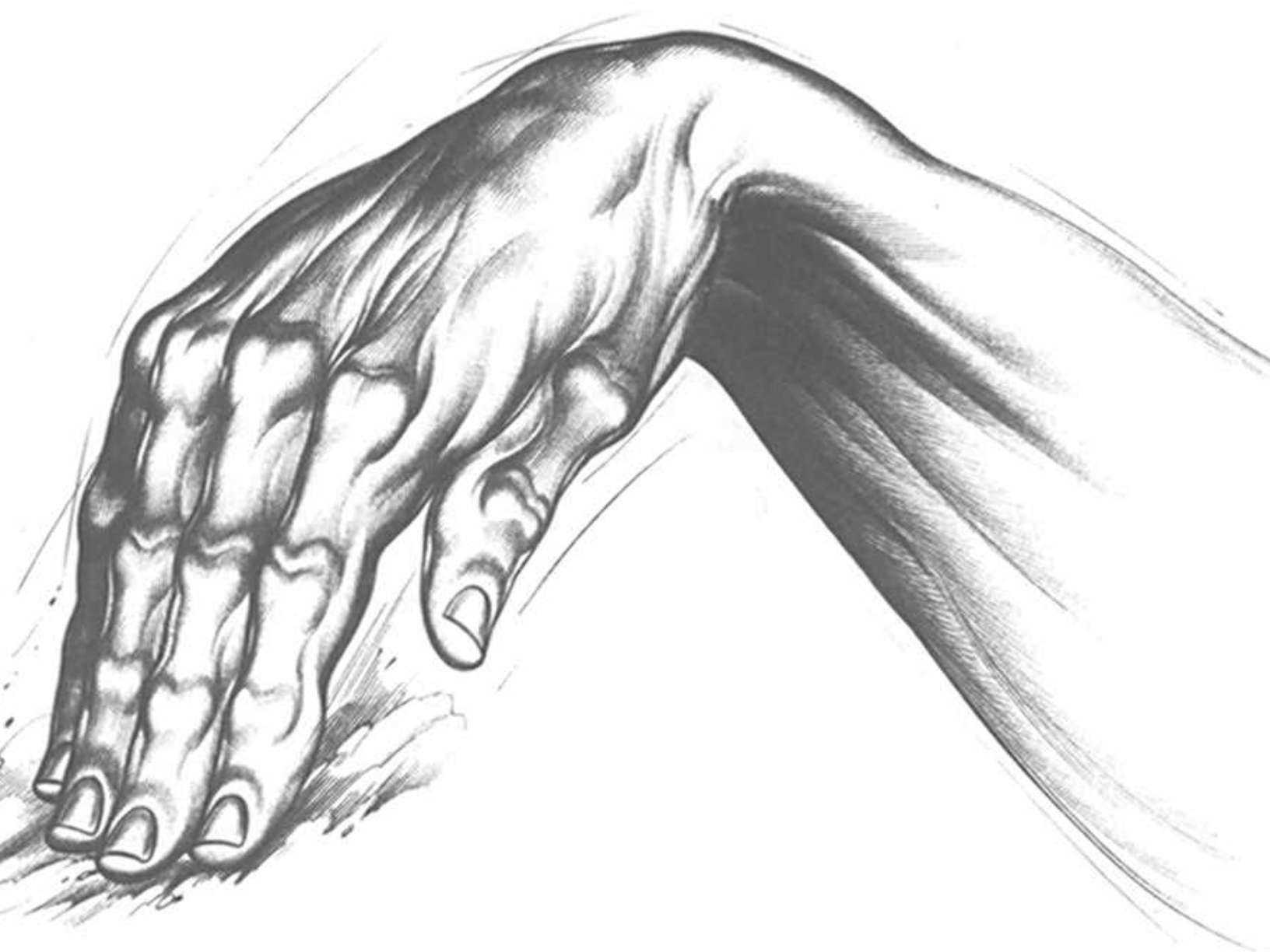


AS A CUP

l can also act as a cup or a bowl,
ers extended in a circle holding
g, as shown from the side view in

of a supporting trestle structure. The tips will tend to flatten and push forward from the taut, angularly elevated hock, the almost inverted stress of the little toe which seems to be near buckling under the weight put upon it.

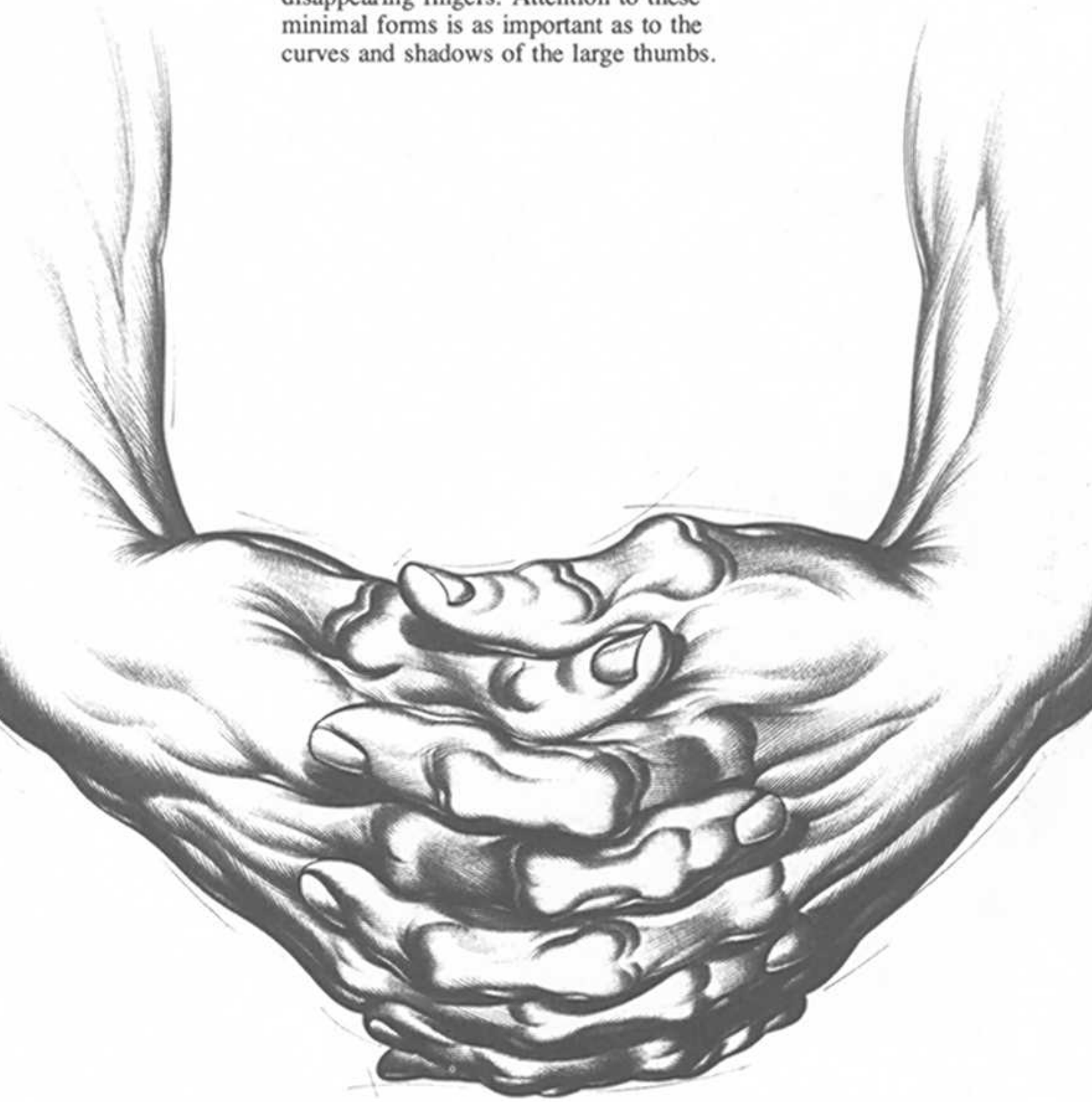




AS A DIGGING TOOL

The entire hand projects down at a sharp angle from the out arm, close-set fingers projecting down from the knuckles, the hand becomes a digging tool. The form is a spatulate, flat wedge discussed at the beginning of chapter. If the hand were to act as a spade or shovel, both the direction and the action of the hand would be reversed.

ball forms. Note the fingernails gradually turning toward the underside of the basket, becoming less and less round down to the disappearing fingers. Attention to these minimal forms is as important as to the curves and shadows of the large thumbs.



9. COMMUNICATION AND GESTURE

The hand not only functions as a tool, it also communicates meaning and experience, supporting facial and bodily expression. These meanings often go beyond the level of verbal expression and are meant to be picked up by the acute swiftness of the eye. In this chapter we shall look at some typical and well-known gestures, and study how only the gestures made by the hand could communicate the meaning intended. Some gestures discussed here are cultural and cross-cultural, still carrying close to their original historical meanings such as the concept of number, the concept of leadership and deity, and both ancient and modern sign language.



OWN GESTURES

at top left, the thumb
form an opening, while
fingers form a se-
, conveying the number
communicating *OK!* If
signifies a particularly en-
the palm would more

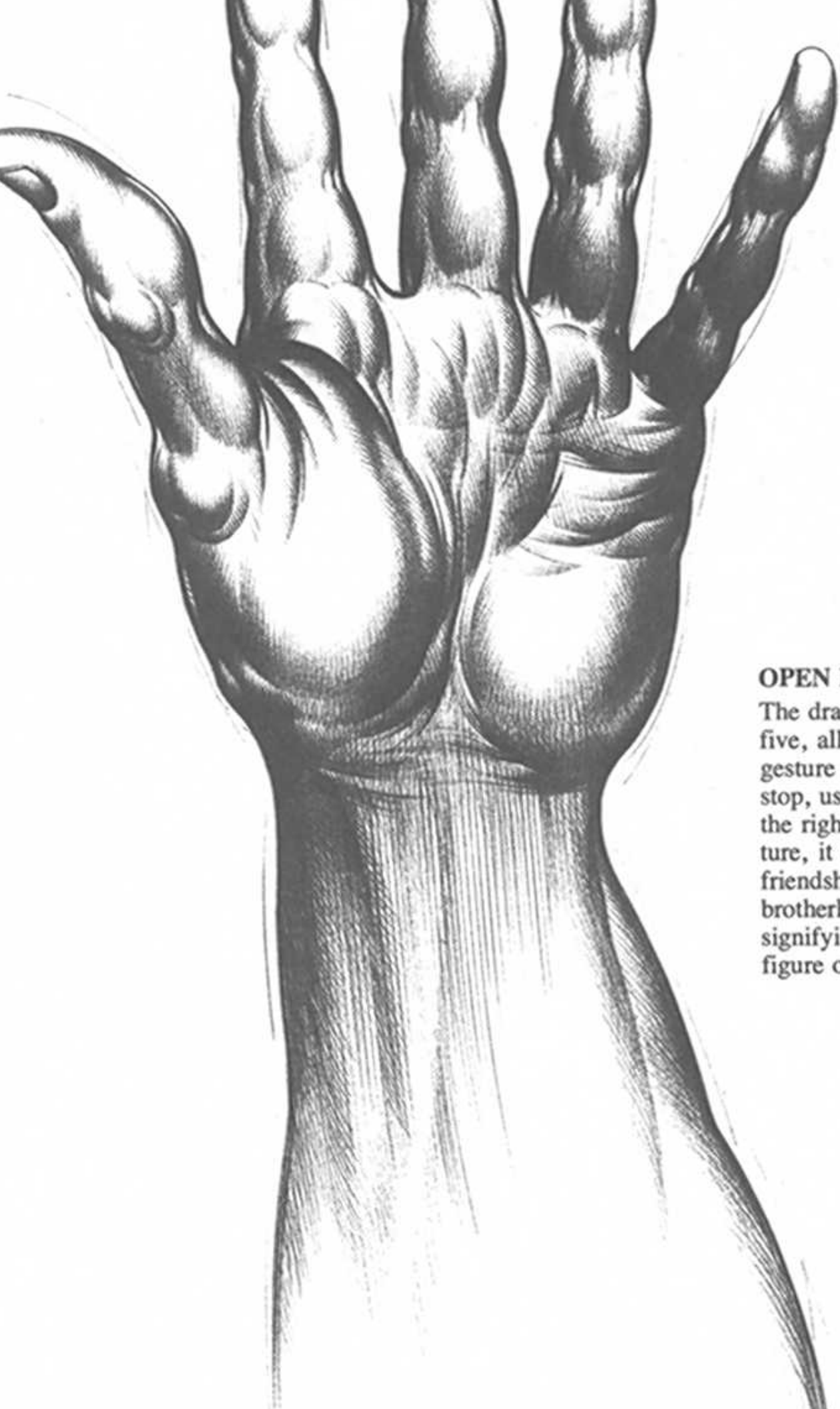
The hand at bottom, with index
middle fingers upraised and the
resting on the last two fingers,
veys number two. But the posi-
the two fingers spread in a *V* sig-
thrust skyward is also the famou-
tory symbol used by Winston C-
hill during World War II.

In the drawing at top right, the
finger upraised, means, of course,
number one. But it can also sym-
bolize the deity, conveying respect,
command, and authority. It is



COUNTING

The hand with three fingers upraised signifies number three, indicating the presence of three persons, a food order, a place or date, an umpire's call, or a bid for cards. This is a special cultural form of counting, widely known but not universal. Another means of counting puts *both* hands to work. One hand is closed into a fist, and the opposite index finger tallies off each number as the fingers flip out of the fist, starting with the *little*



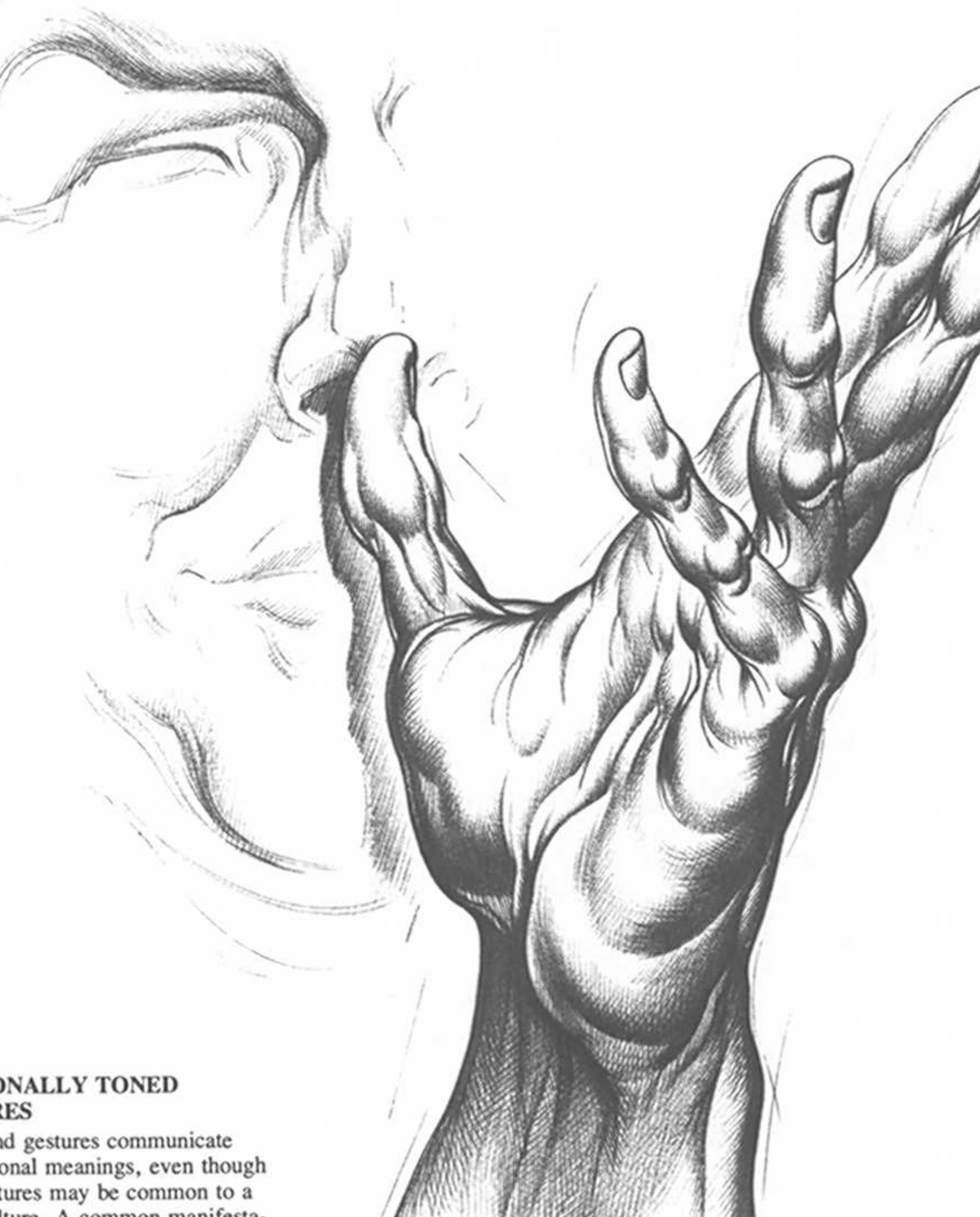
OPEN PALM

The drawing here expresses nu
five, all fingers extended, but
gesture can also signal a comm
stop, usually done by the left ha
the right hand were used in thi
ture, it would become a sign o
friendship, a salute, an express
brotherhood, a pledge, or a ge
signifying the presence of a sp
figure or a figure of majesty.

GOOD LUCK GESTURE

Sketch, showing middle finger
and index finger, expresses a
bit of hope, a hedge for good
or a deeply superstitious fear.

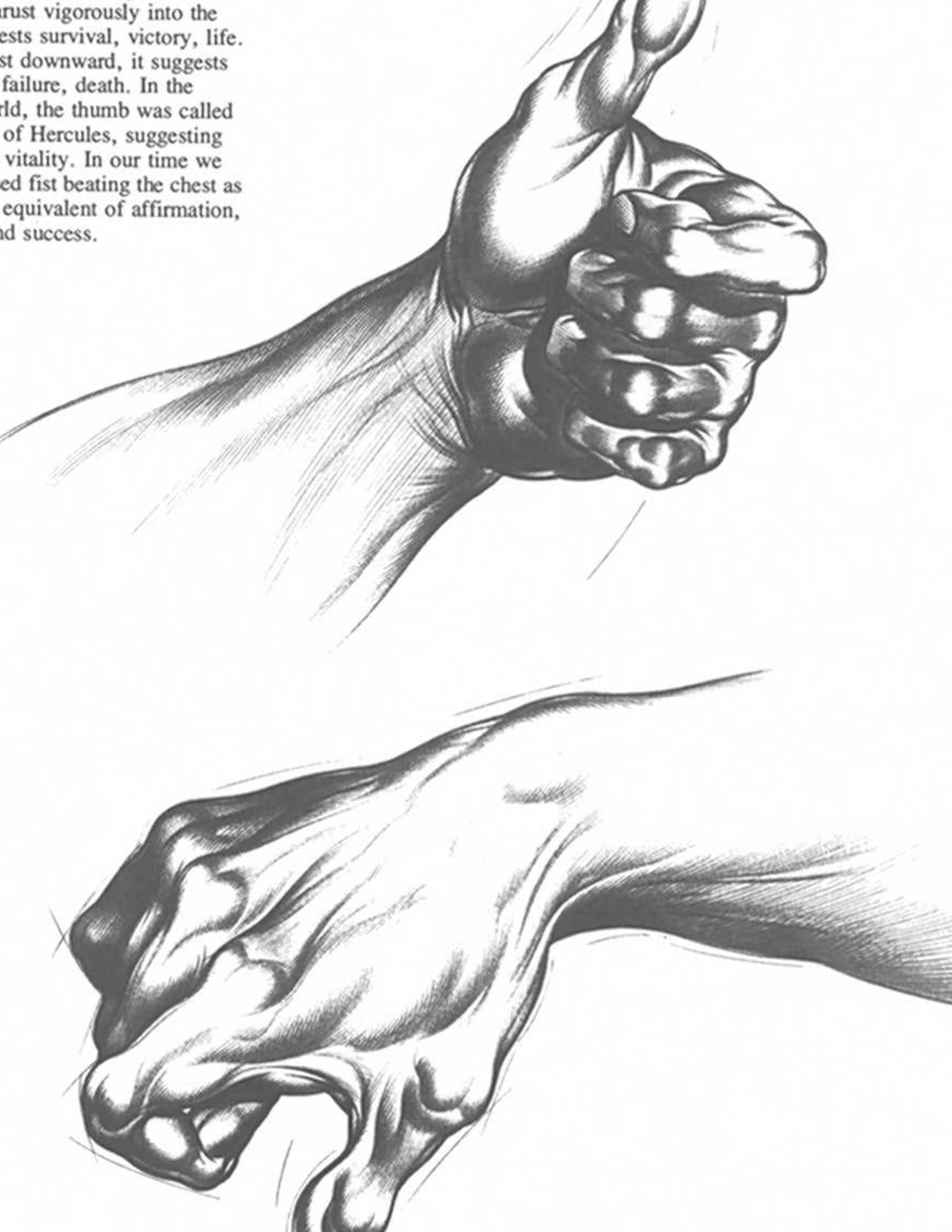


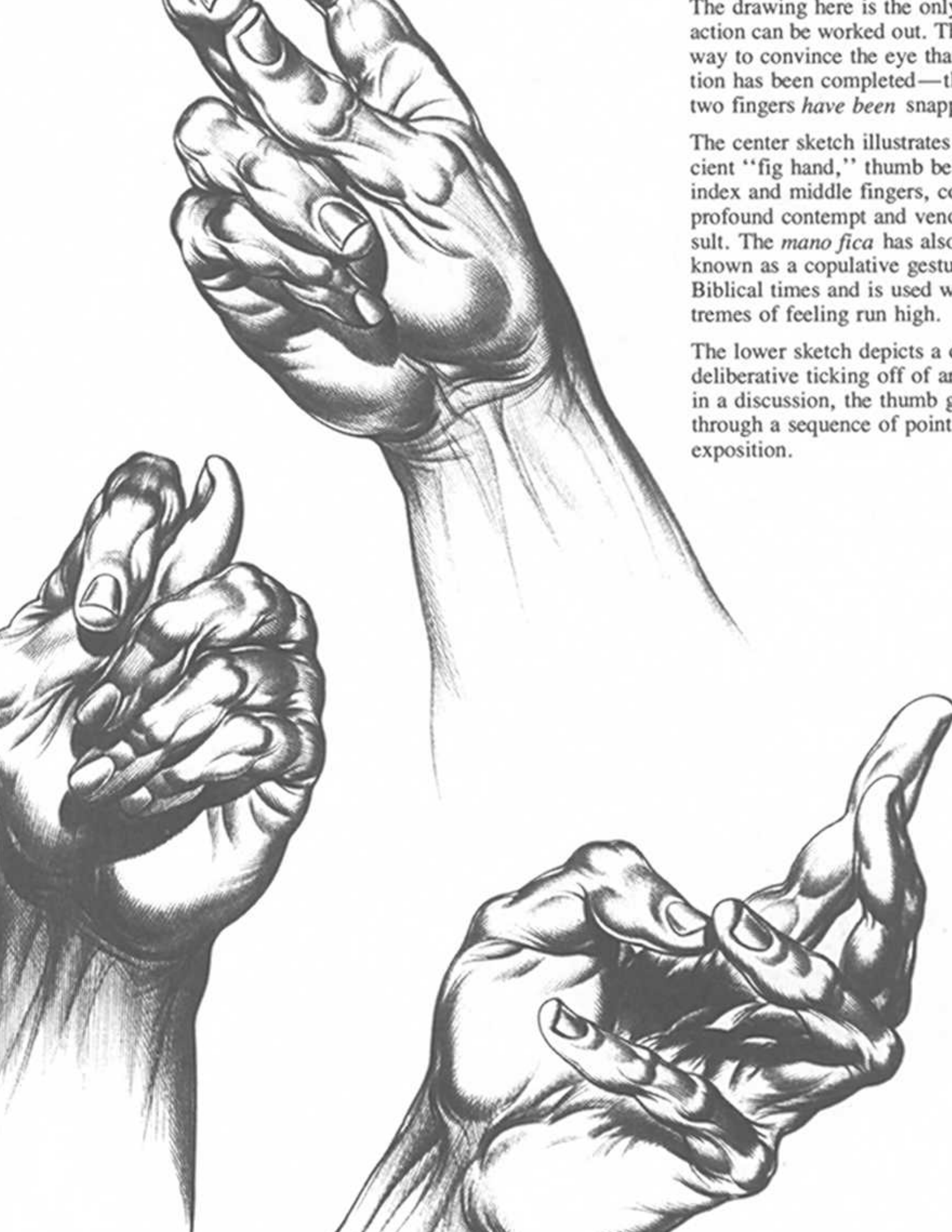


**PHYSICALLY TONED
GESTURES**

and gestures communicate
personal meanings, even though
gestures may be common to a
culture. A common manifesta-

trust vigorously into the
ests survival, victory, life.
st downward, it suggests
failure, death. In the
rld, the thumb was called
of Hercules, suggesting
vitality. In our time we
ed fist beating the chest as
equivalent of affirmation,
nd success.





The drawing here is the only action can be worked out. The way to convince the eye that the action has been completed—the two fingers *have been* snapped.

The center sketch illustrates the efficient "fig hand," thumb bent, index and middle fingers, conveying profound contempt and venting a result. The *mano fica* has also been known as a copulative gesture. At Biblical times and is used when the extremes of feeling run high.

The lower sketch depicts a deliberate ticking off of a point in a discussion, the thumb gesturing through a sequence of points in exposition.

10. AGING

The hand changes radically from infancy to old age, not only in size, proportion, and structure, but also in skin texture, tissue structure, and surface characteristics such as hair density, pigmentation, and size, shape, and texture of fingernails. Its dexterity and capabilities, its responsiveness, its range of gestures, and the subtlety of its emotional communications also change.

Studies of the developmental and aging aspects of the hand have sometimes been overlooked in anatomical works. This chapter will trace the development of the hand from infancy to old age.



that there are no protrusions such as the olecranon or prominent wrist bones which are points at which forms are joined. In the infant hand the wrist has only dimpled indentations at the finger segments and is not defined at the wrist, since the skeletal structure of the hand is only partially formed. The phalanges, finger and metacarpal shanks. These are cartilaginous material, soft and unformed, as are the wrist bones.

The top sketch shows the infant hand at about two weeks. Note that the length of the stretched hand from wrist to tip of the middle finger is about the same as that from the tip of the middle finger to wrist. Also note the pudgy looking fingers and the contractions at the knuckles described above.



The middle and lower sketches show the infant hand at about four to six months. At this age the forms are more defined and the fingers more active, the behavior more purposeful. This shows in the hand becoming more open, rather than curled and contracted as in the newborn infant. Also note the developing knuckles.



Y TO ONE YEAR

ral character of the baby's
s not change substantially
e first year. The forms are
, square, and fleshy, with
ng delineation between
oth dorsal and palmar sides
nd are palpable and chubby,
ty shell-like fingernails. Yet
of a one-year-old child have
move with more certainty—
seeking, feeling. The hand is
orm to project into and ex-
nfamiliar world.



TWO YEARS

The two-year-old child is not quite an infant anymore. He has become physically active, emotionally responsive, and playful, expressed in the excited, alert movements of the hand. The hand at rest flexes from the wrist inward, fingers extended while the hand below is reaching and searching. The hand is still soft, with chunky finger pads and palm and fingers, but note the lengthened palm losing its baby puffiness, the fingers are a bit more defined and it generally looks more autonomous. Proportionally, the whole hand from palm base to tip of finger is about the length of the adult hand from palm to the crease of the first digit of the little finger.



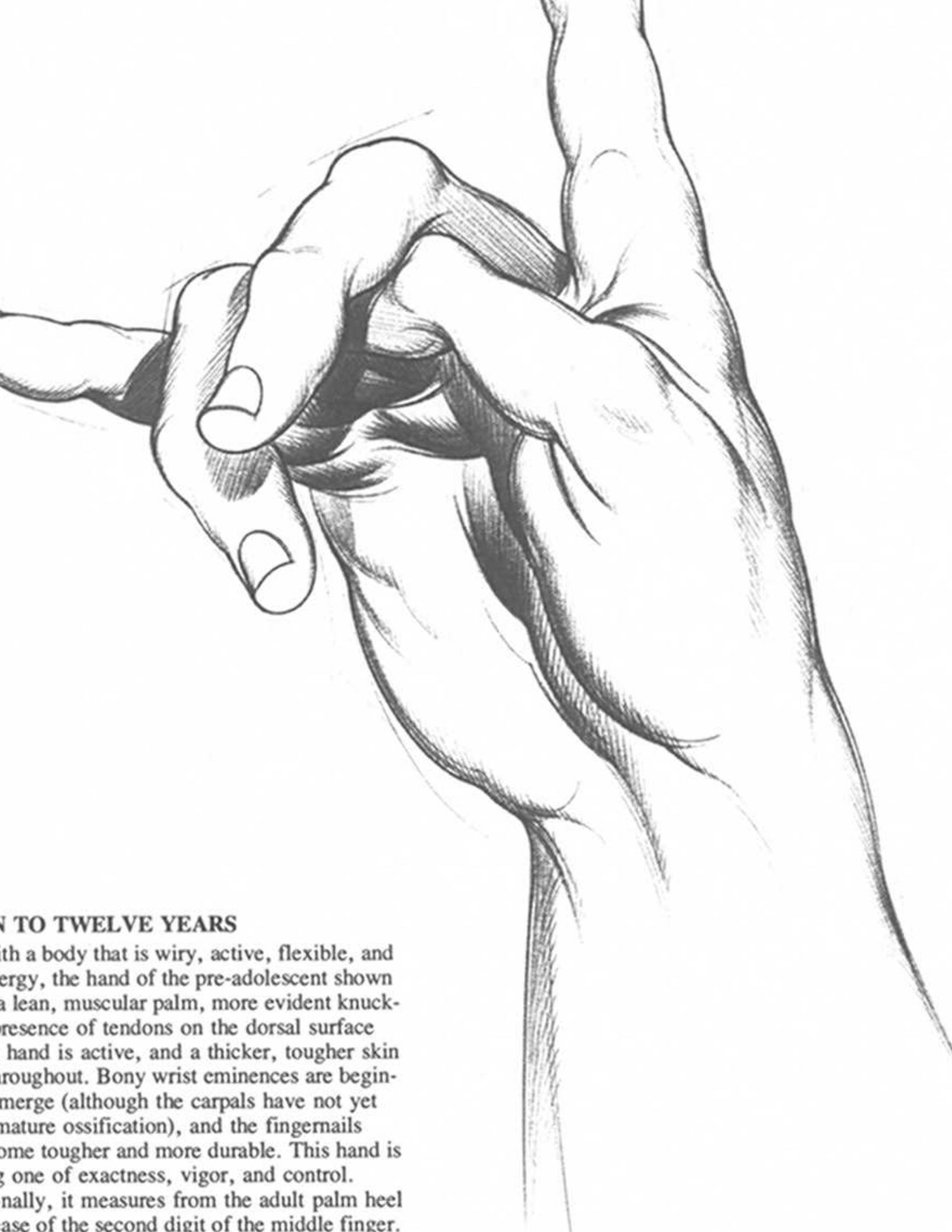


FOUR YEARS

The hand of the four-year-old superficially to be an enlargement of the two-year-old hand. It is fleshy and delicate, with rounded forms. However, the four-year-old is no longer an infant. Fingers have more firmness, tips are spatulate, and muscular pressure can be asserted. Certainty and control are all new qualities which mark the maturing abilities of the child. The size is now from palm base to the crease of the first digit of the middle finger of the adult.

and have lost their baby softness. The hand is ac-
ll of fantasy, releasing feeling and exhibiting
finger dexterity. The child at this stage will reveal
ere of physical activity, reveling in acts that are
ginative, and pragmatic. Compared to the adult
child's hand will measure from the heel of the
to the second digit of the index finger.

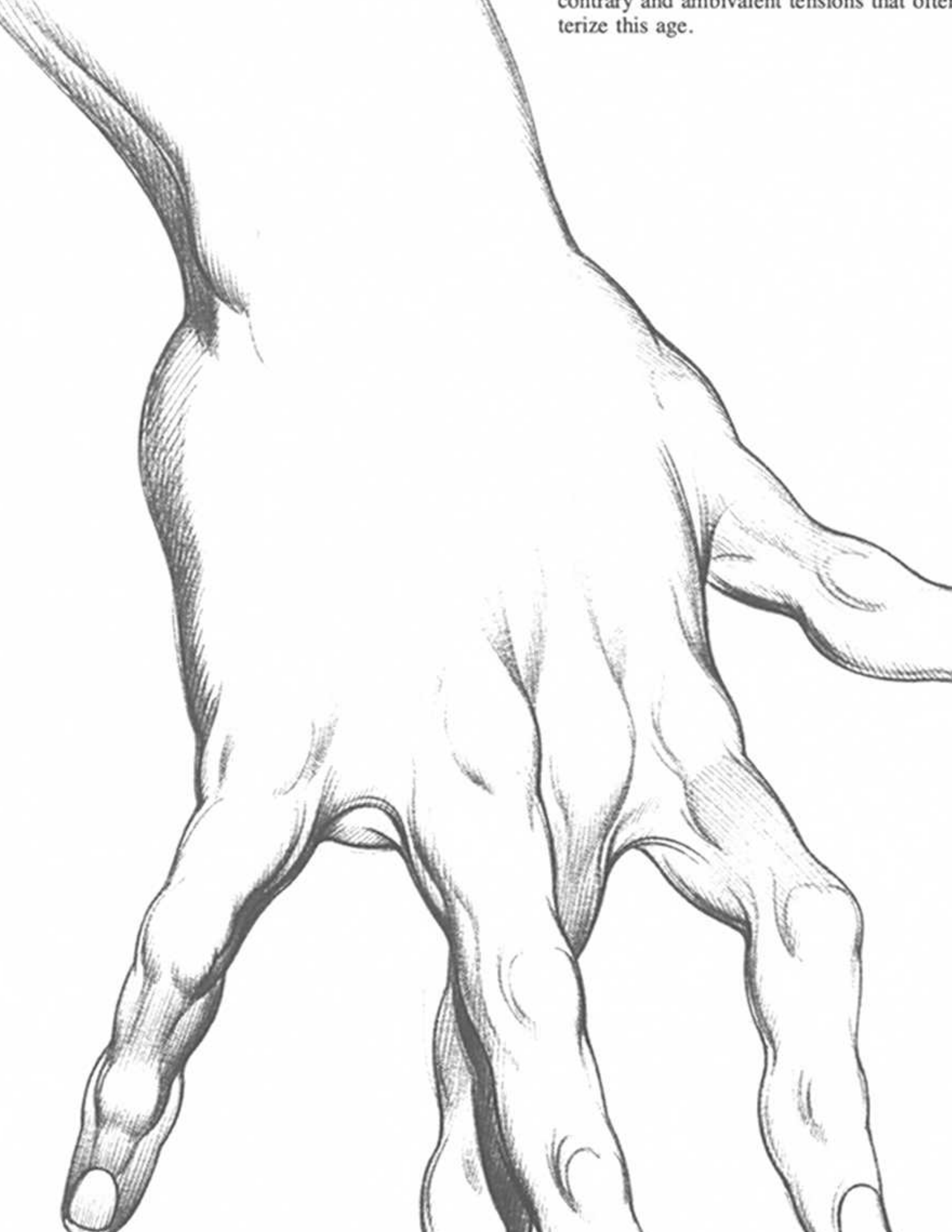




FROM TWELVE YEARS

With a body that is wiry, active, flexible, and energetic, the hand of the pre-adolescent shown has a lean, muscular palm, more evident knuckle-joints, and the presence of tendons on the dorsal surface. The hand is active, and a thicker, tougher skin covers it throughout. Bony wrist eminences are beginning to emerge (although the carpals have not yet reached mature ossification), and the fingernails become tougher and more durable. This hand is characteristic of one of exactness, vigor, and control. Finally, it measures from the adult palm heel to the base of the second digit of the middle finger.

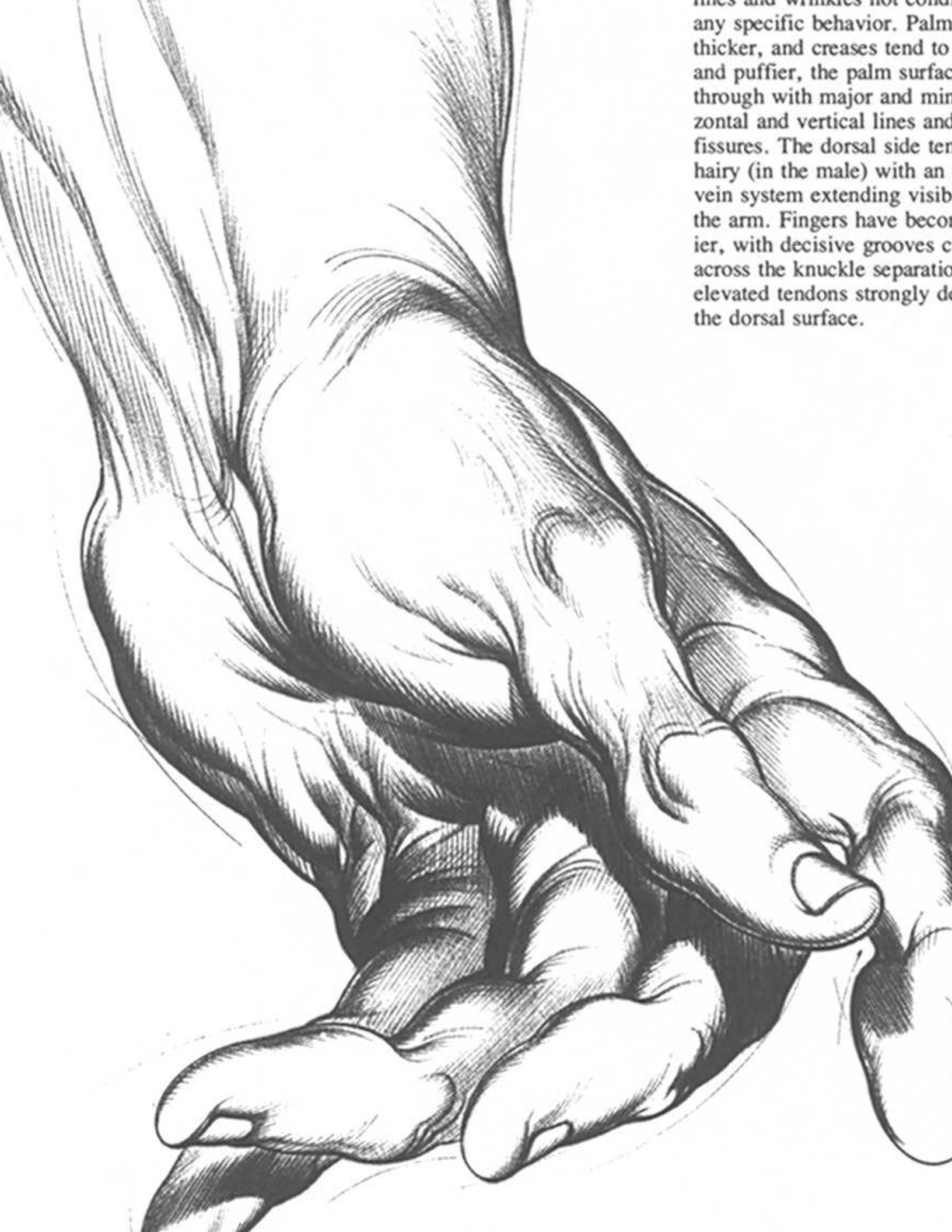
contrary and ambivalent tensions that often
terize this age.



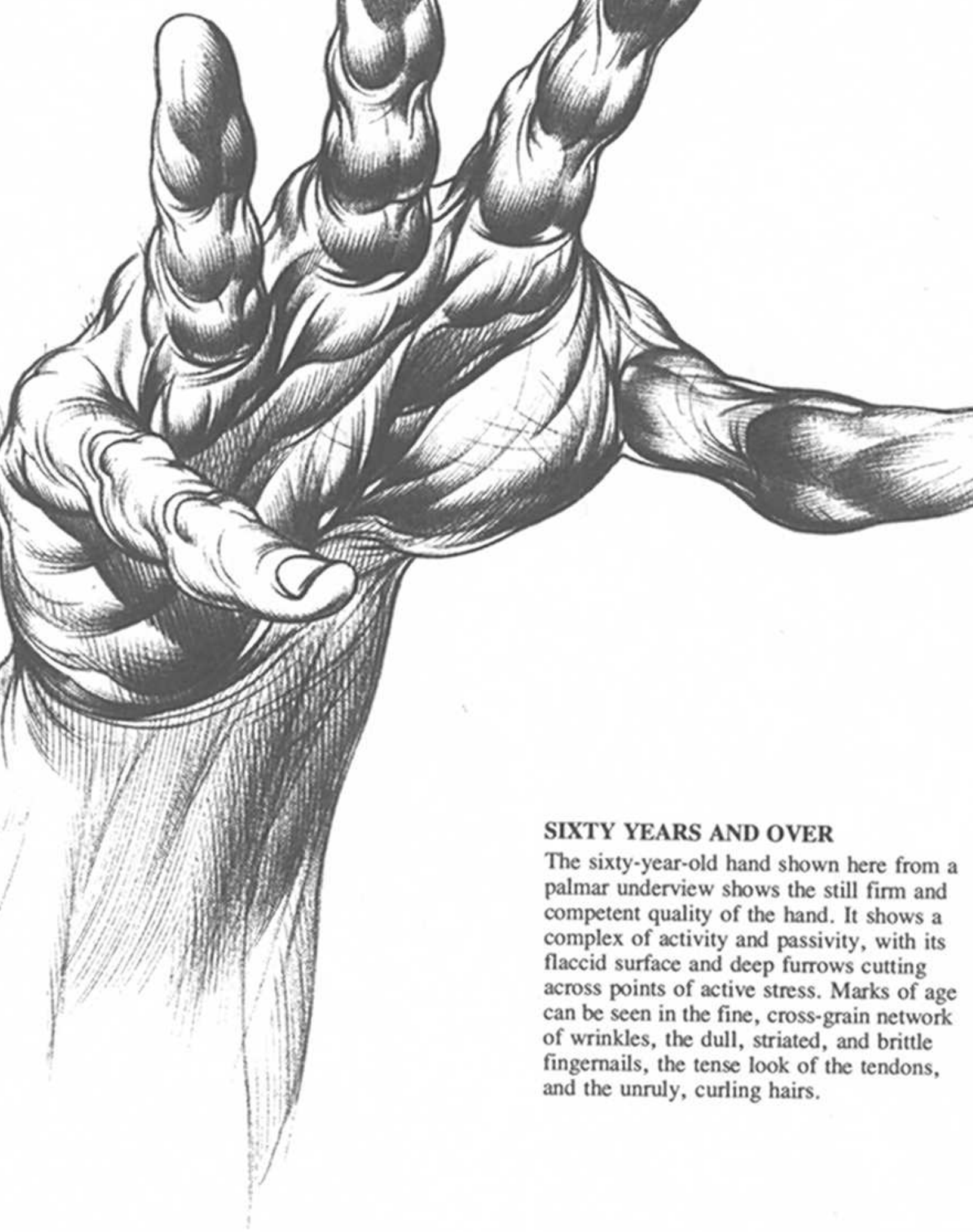


Y TO TWENTY-FIVE YEARS

At striking changes that occur in the mature hand after years of age are in behavior. A more purposeful, coordinated behavior emerges, as shown in the assertive of the hand here. The mature hand you draw may be al or physical, depending on its expression, but it is t that it be thematically whole and coordinated in its



lines and wrinkles not cond
any specific behavior. Palm
thicker, and creases tend to
and puffier, the palm surfac
through with major and min
zontal and vertical lines and
fissures. The dorsal side ten
hairy (in the male) with an
vein system extending visib
the arm. Fingers have becom
ier, with decisive grooves c
across the knuckle separatio
elevated tendons strongly de
the dorsal surface.



SIXTY YEARS AND OVER

The sixty-year-old hand shown here from a palmar underview shows the still firm and competent quality of the hand. It shows a complex of activity and passivity, with its flaccid surface and deep furrows cutting across points of active stress. Marks of age can be seen in the fine, cross-grain network of wrinkles, the dull, striated, and brittle fingernails, the tense look of the tendons, and the unruly, curling hairs.

m wrinkling, thickened muscle
ged joints also add to the typical
with the slight tremor suggesting
nd activity. Higher, the carpus
and the thin shanks of the arm
advancing age.

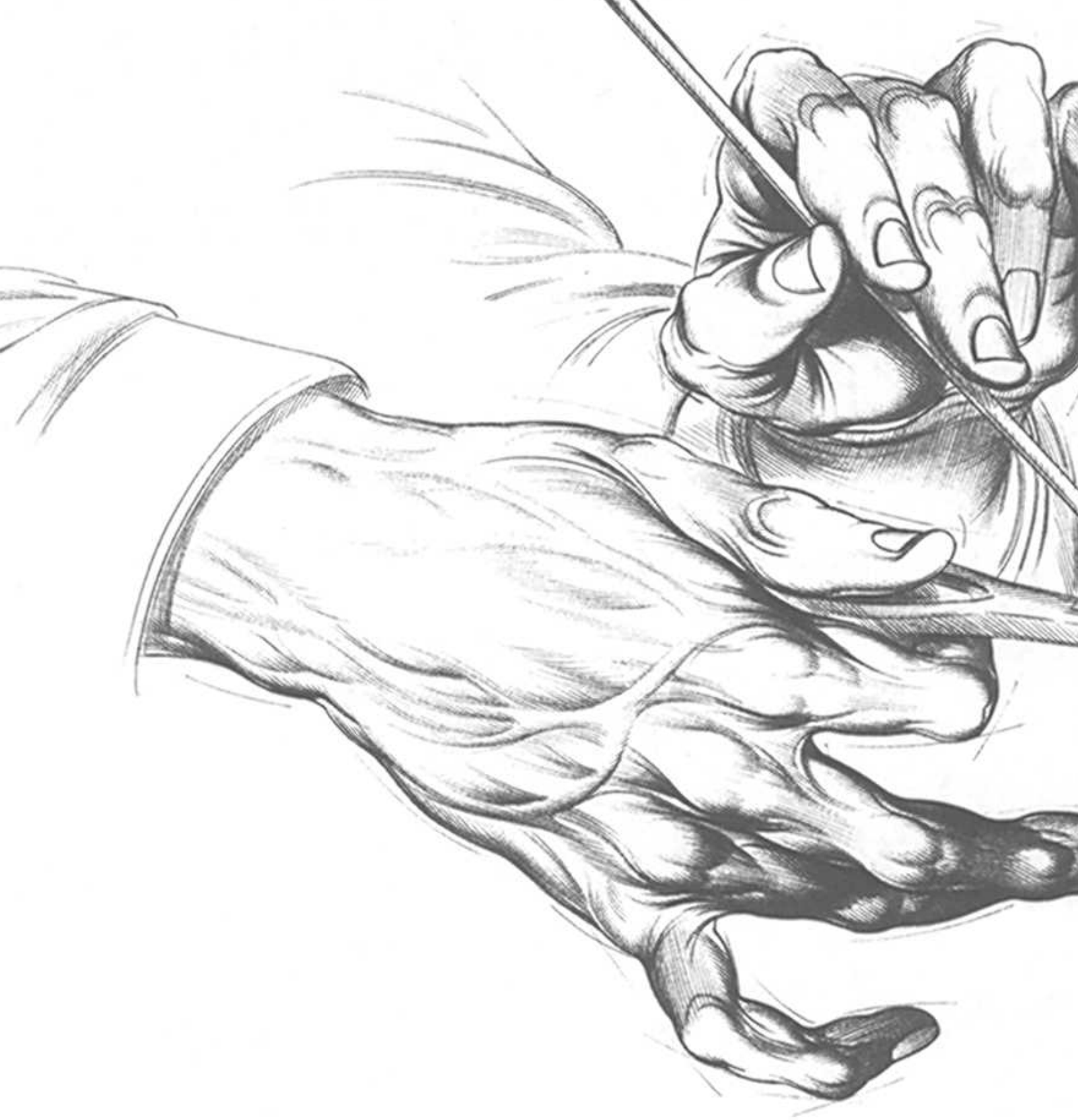


11. HAND BEHAVIOR AND OCCUPATIONS

Drawing hands involved in various occupations can be either prosaic or exciting. Since the hand is the most plastic part of the anatomy, it can fit around or grasp an infinite variety of shapes in countless positions. Thus an enormous variety of occupations can involve highly complex use of the hands. Occupations often require the use of some kind of utensil or tool to which the hand must adapt itself. The kind of drawing one does of the hand working at various occupations is determined to a great extent by the instrument the hand must use. In this chapter you will see how the element of design plays an important part in executing not only a visually clear but also a visually appealing drawing of the hand involved in an occupation.

appears firm but soft, suggesting both youth and maturity. The hands in all sketches reveal character in the middle and lower ones, an object helps the form of the hand.

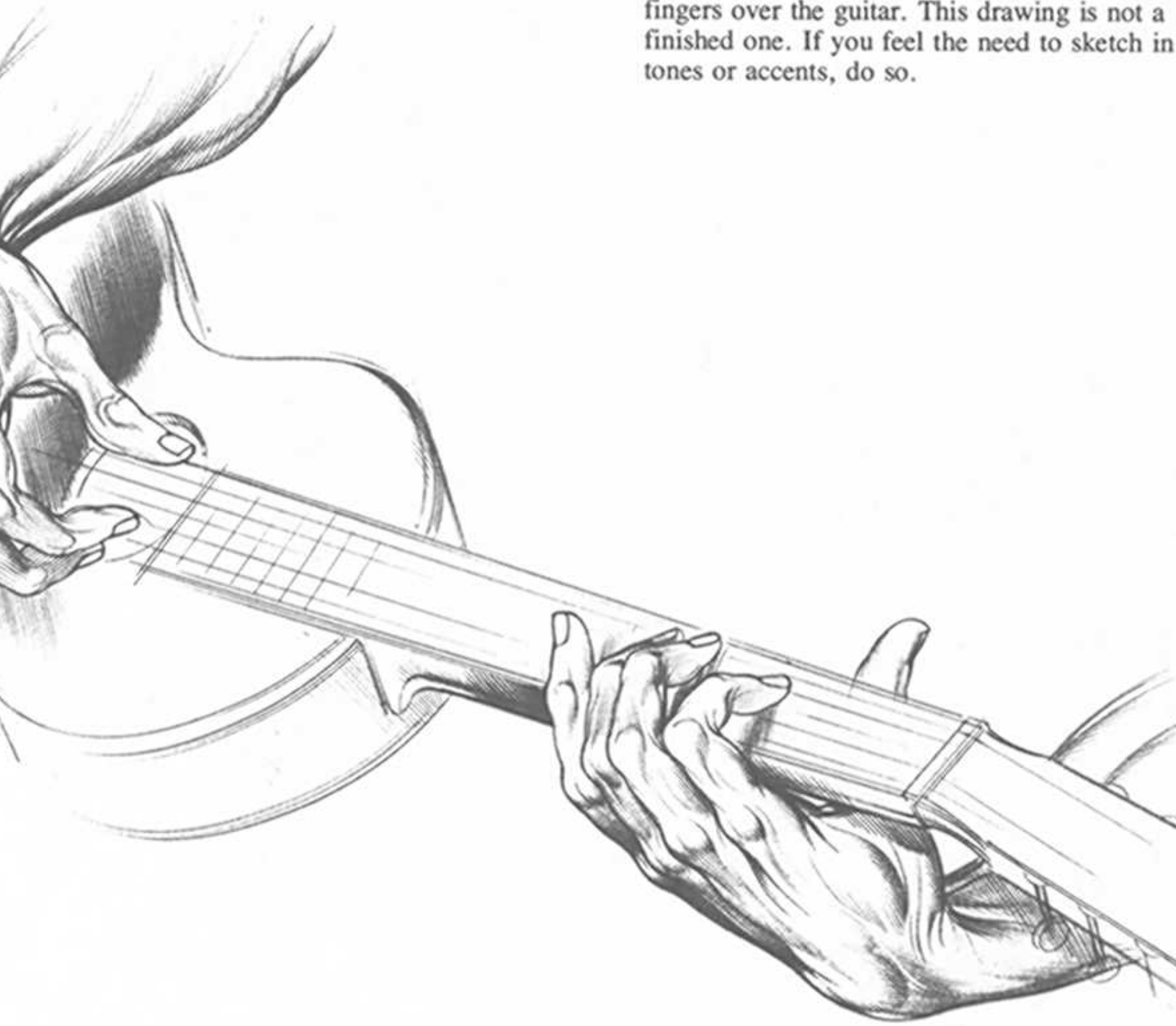


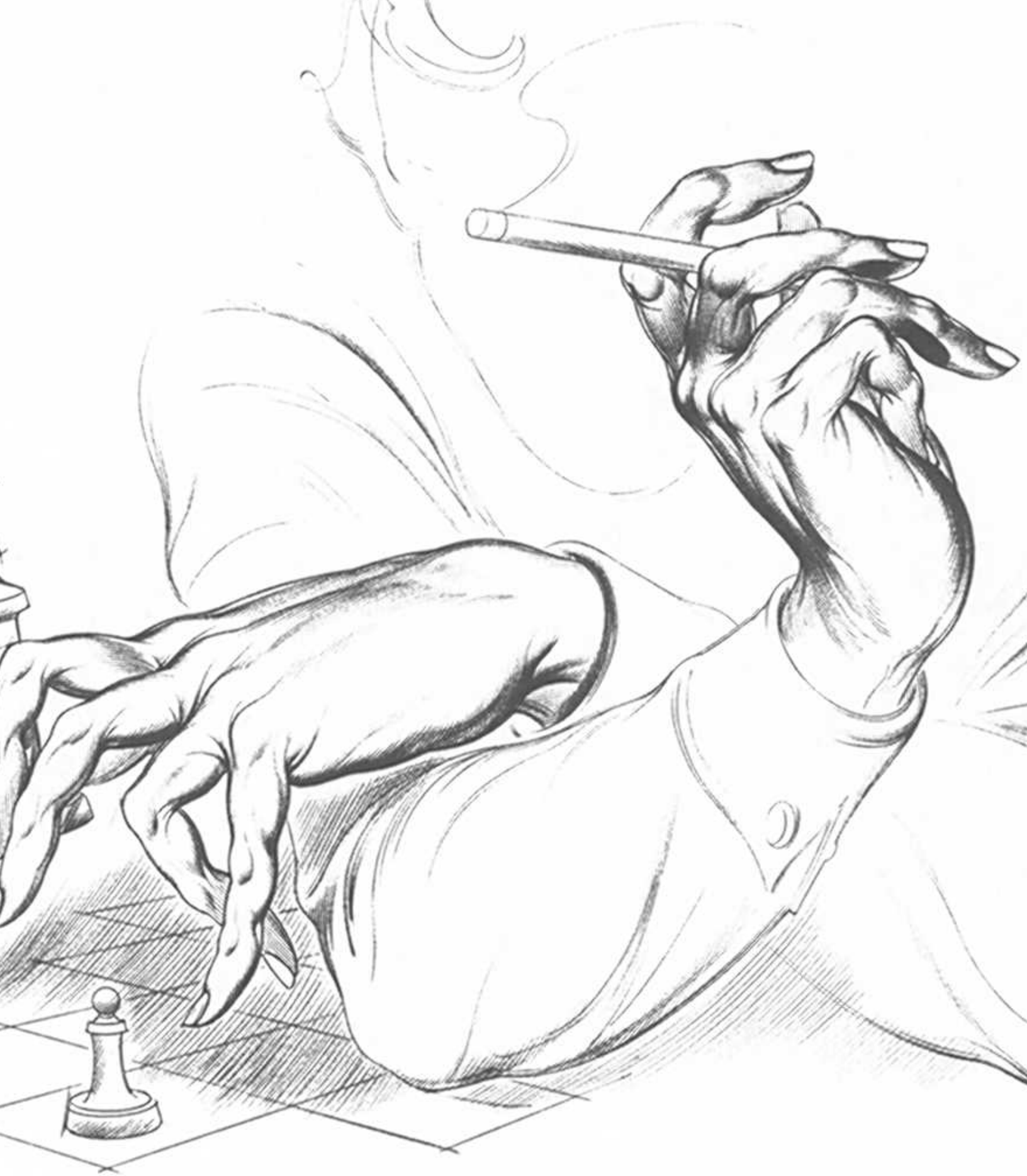


TRAINING A TECHNICIAN'S HAND

Bringing out the eloquence of a prosaic subject takes skill. Here the hands of a technician using ordinary instruments could become both dull and flat. But not if a design concept is incorporated. In drawing the focal point of the design is the elements connecting at an angle. All the fingers point to this angle, and the veins of the lower hand

ished. The hands have a special configuration for playing, and a good reference source such as a photograph or a live model should be used to ensure this is accurate before proceeding with refinements such as form stresses, finger tension, wrist bends, and fingertip contacts and pressures. Shaded accents and cast shadows are also necessary to let the eye see where one form relates to another or to understand the correct positioning of the fingers over the guitar. This drawing is not a finished one. If you feel the need to sketch in tones or accents, do so.





VARIATIONS IN HAND ATTITUDES

Hands of a woman playing chess and smoking a cigarette.

R AND LIAR ACTIONS

great difference between drawing
and an unfamiliar hand behavior.
drawings here are good examples
contrast. In the sketch showing the
procedure of a sailor splicing
pects must be clearly expressed.
this kind of drawing are illustra-
nematics found in texts or ency-
where priority is given to proce-
the other hand, the commonplace
smoking is so well known that
son's hand at right could have
in a dozen ways from different
s and still have been easily un-
sually.



... and subject to numerous interpretations. Drawing
... allows the imagination free rein and is much less
... than the one at right.





TO NEW DISCOVERIES

There is really no point at which the student's hand ought to stop. Its complexity and complexity offer many more vital possibilities for experiment and experiment than have been covered in previous pages. The drawing here, showing hands

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HANDS

The most challenging skills require the artist who draws the human form. Burne Hogarth, master of human form, presents the most comprehensive book ever published on human hands. This latest volume in his series of drawing books—includes *Dynamic Figure Drawing*, *Human Head*, and *Dynamic Anatomy*—presents, in over 300 illustrations, a revolutionary system for visualizing the hand in an almost infinite number of positions from a multitude of angles. Designed for the professional artist, illustrator, and serious amateur who study the human form, *Drawing Dynamic Hands* is an essential reference book. 8 1/4 x 11. Over 300 black-and-white illustrations. Bibliography. Index.

Designed by Bob Fillie



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A member of the Board of Directors of the National Cartoonists Society, Hogarth was awarded the Society's "Plaque for Best in the Special Category" in 1974, 75, and 76.