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Balance in the Working-Breed Dog
 Front and Rear Angulation in the Working Dog
 by Fred Lanting

Dog breeds are grouped — often arbitrarily or erroneously — into from five to ten categories based on function, superficial appearance, or geographical origin, depending on the registry organization. Just because it may make more sense to assign them to groups based primarily on ancestry and then on historical function, does not mean that such will be the case. In most dog circles, the “working” breeds have always been considered as those that originally did such work as herding or guarding livestock, pulling loads, and protecting property. Even though other breeds had specific occupations in the service of man, they are not known as working breeds: sighthounds running down prey or predators, gundogs flushing food for the table, terriers and toys terrorizing vermin — these were more or less doing what they would do without human ownership, anyway, so their jobs were considered less like “work”.

Many dog organizations split the huge Working Group into two, with the ones that had historical development for tending, driving, or bunching flocks and herds being called “Herding breeds”. Never mind the confusion about whether the reindeer-herding Samoyed is hardly much different from the sled-pulling Husky — that’s a puzzle for another time. Most of the Group that did not resemble the mastino-type wagon puller or the bear-fighting wooly flock guardian type were once employed to trot around the animals raised by man for his food, and assigned to the herding subcategory. These latter were specialists in trotting, in covering much ground with the most efficiency (least effort). This meant that success favored those with the most shoulder angulation over those with the stiffer, more vertical front ends.

When we speak of a shoulder in a dog, we usually include a lot more than just the scapula (shoulder blade) — although the flat, broad bone is often the center of attention. No part of a dog exists alone, not even those “floating” bones such as the hyoid, sesamoid, clavicle, patella and penile bones, all of which are connected to muscles and other bones by ligaments and tendons. The shoulder is intimately related to most other portions of the foreassembly or “forequarters”, from the skull to the ribs, from vertebrae to arm and breastbone.

The scapula does not articulate with any bones at its top, but is attached by four muscles to the spinal column at a number of places from the first cervical to the ninth thoracic vertebra and to the first seven or eight ribs. This is the case whether the dog is steep-shouldered or well-laid back, so differences between the two types must be due to minor differences in scapula and humerus lengths and ratios; perhaps the lengths of the vertebrae; and the tightness and condition of the ligaments and muscles that hold the bones in their positions.

At the most forward and lowest portion of the scapula is a shallow socket in which articulates the head of the upper arm (humerus). This area, especially the humeral greater tubercle that protrudes in front of the articulation, is called the “point of the shoulder”. Running roughly up the center of the blade from that point nearly to the top is a ridge of bone known as the spine of the scapula. The lowest and thickest section of that spine close to the socket is the acromion. See Figure 2. There are several muscle groups attached to the scapula. Don’t be frightened by their names; use abbreviated nicknames if you stumble over pronunciation. What matters is that you know what action each gives to the blade and the entire limb, and where the muscles are attached.

The first of these is the triangular *trapezius* muscle originating on the bones and ligaments of the vertebral column from the third cervical (neck) vertebra to the ninth thoracic vertebrae. Its insertion is on the spine of the scapula. Since part of this thin broad muscle lies forward of the ridge it is attached to, and part extends to the rear, it can easily be seen that its function is primarily to elevate the limb. It also brings the

arm forward and helps in changing the angle of layback during movement. The *omotraversarius* starts from the first cervical vertebra (the atlas) next to the back of the skull, dips beneath the other muscles of the neck, which extend to the sternum and arm, then attaches to the scapular spine near the acromion. Its obvious action is to draw the limb forward and rotate the bottom of the scapula forward while other muscles are trying to hold the rest of it in place. Knowing that, you can easily understand why a dog trotting in the show ring isn't going to extend its forelimbs in ideal or equal reach if it has its head turned toward its handler. Nor will it cover as much ground if it trots with its head held high instead of forward and slightly above back level. Yet terrier and cocker dog-show handlers are notorious for the silly spectacle in which their dogs often barely touch the floor with their front paws!

Beneath the trapezius lies the *rhomboideus* muscle, which originates on the vertebrae from near the head to about the sixth or seventh thoracic vertebra. Its insertion is along the edge of the scapula, farthest from the acromion. Because of its wide origin, it can lift the limb upward, pull the limb and shoulder forward or backward and draw the scapula against the rib cage, depending on which portions are enervated (stimulated by nerve impulses.)

The muscle filling the space in front of the scapular spine is called the *supraspinatus*, and it is attached to the top of the humerus. Thus, you can envision it straightening out the shoulder-arm angle and bringing the limb forward. The (behind the spine) will either flex or extend the shoulder joint, depending on the position when the muscle contracts. It also is inserted on the humerus. Other muscles include the *infraspinatus*, *serratus*, *teres*, *deltoideus*, and *sub-scapularis*; all play some parts in moving the scapula in relation to the ribs, vertebrae or upper arm.

Now that you have a little more understanding of the muscles and their actions on the bones, let's get back to the subject of angulation. Some of what follows is similar to an excerpt from [The Total German Shepherd Dog](http://www.Hoflin.com). (www.Hoflin.com)

The Front

Variouly called the front assembly, forequarters, or shoulder, the whole combination made by the shoulder blade (scapula), upper arm (humerus), breastbone (sternum), and their related soft tissues is at the heart of much poor movement in dogs the world over.

Shoulder assembly — The least understood and most controversial portions of the AKC and most other Breed Standards relate to the angles proscribed for the forequarters and hindquarters. I disagree with the angles commonly reported to be ideal in the shoulder area, though much of the discrepancy may be a matter of how that angle is usually measured. To specify angles is useless unless exact points of reference are not only agreed upon but also easily determined. Since the bones forming these angles are curved, such "landmarks" as (1) the highest point of the scapula, (2) the foremost point of the upper arm where it meets the shoulder, and (3) the topmost point of the elbow should be used as well as a detailed illustration decided upon. None of the editions or versions of the Standard for the German Shepherd Dog AKC has been so explicit, nor have they been in other breeds. Many years ago I radiographed standing dogs and found that what I had been reading in books and seeing in artists' drawings was not so, even though I had already discovered that by palpation of bones and joints.

In examining the standing dog, the good layback of 35 or 30 degrees can be determined either by feeling the line of the slope of the scapular spine, or by palpating those points mentioned a few paragraphs earlier, and imagining a line between these points. These two sloping lines will be essentially parallel, so take your choice; in either case, you will have approached the question more scientifically. By observing the facts for yourself you will be able to arrive at a conclusion or hypothesis. The sooner we understand what is as opposed to what we imagine, the sooner we'll understand how to get the most out of our dogs. Feeling that scapular spine is more difficult in a heavily muscled breed such as the Rottweiler.

The call for a 45-degree shoulder layback plus another supposed 45-degree angle to the "line" of the upper arm, equaling a 90-degree shoulder angle, is inaccurate and misleading. If lines are drawn on a radiograph or a sketch, along the scapular spine and down the center of the humerus as they usually are, a 90-degree angle in the real, live dog standing there before you will never be realized. Since the time I started challenging this notion, there have been noted authorities who have corroborated my claims with independent research, but it will be a long time before the old books are all revised and longer still before writers do their own investigative work instead of copying sketches from each other. One of the best

drawings of the "ideal" (according to American tastes) German Shepherd Dog ever made in this country is Lloyd Fanning's which appeared in the Review and in a small booklet on the breed published by the German Shepherd Dog Club of America. Strange, that so many have used incorrect representations instead of this fairly accurate sketch. An even better sketch is available from the SV and appears in many posters and magazines owned by those who appreciate the international (German) type.

If you draw your line from point of shoulder to the highest part of the ulna that we call the point of the elbow (leaving the humerus to do so), you get points of reference you can see and feel. Now draw your second imaginary line from point of shoulder to top of shoulder blade. The angle between is *closer* to 90 degrees than if you tried to imagine and use a line going through the shaft of the humerus, but you still don't get a right angle, even with the best laid-back shoulder blades. That touted right angle cannot be attained by drawing your lines down the middle of the upper arm on a radiograph. Whether or not you have x-ray vision, you will not be able to agree where a "center" line of this slightly curved, well-padded bone is!). In my live-dog illustrated lecture, "Analytical Approach to Evaluating Dogs", I show where the lines can connect palpable points by drawing chalk lines on dark, short-coated canine volunteers. Even without using a protractor, my audiences can see the fallacies of those printed standard specifications. See Figures 1 and 4.

Sketches in my book on the breed represent the typical German Shepherd with a good shoulder. Dogs with better reach and a floating gait have close to the same angles and layback. I suspect much more credit for such gait lies in the muscles and ligaments than has been imagined, measured, or hinted at in the past. And of course, desire and drive make a big difference, too. In actuality, the ideal shoulder with a nearly-90-degree angle from point of elbow to point of shoulder to highest point on scapula has about a 30 to 35-degree shoulder blade layback, not 45 degrees. Additionally, factors such as the relative lengths of scapula and humerus, the angle at which the humerus inclines, and the dog's attitude play parts in the standing appearance and in the reach in motion. While they didn't have all the answers, Humphrey and Warner had most of them, and they determined that 102° was ideal for the working German Shepherd Dog.

Another problem in reports of a 45° or greater layback is that it doesn't occur in the standing dog. Possibly you *might* exclude achondroplastic dwarf breeds such as the Corgi, although a noted Dachshund breeder once told me that my statement about "no such shoulder angle as 45 degrees" was true for his breed as well. It does happen when the dog is trotting, running, deeply crouching, or lying. The reason for this is that the scapula is not fixed or stationary; its lower end is pulled back by the trapezius and forward by the omotransversarius and serratus, with many other muscles being involved to a lesser extent. These angles can be visualized by watching slow-motion movies or the frames taken from those, and superimposing (technically, *infra-imposing*) the skeleton or lines representing the bones. Examining many dogs of varying qualities, hopefully with the guidance of a knowledgeable veteran, will enable you to see these proper angles in motion and in standing.

What is "shoulder layback?" Many dog fanciers are not sure. See Figure 1. It is the front-to-back inclination of the shoulder blade, seen and felt when one touches both the point of the shoulder and the top of the scapula or the withers at the same time. The withers is the area atop the shoulder from where the neck ends to where the "true back" begins. In most dogs, the last cervical vertebrae and the first thoracic vertebrae are down between the shoulder blades, so you might not be able to feel them, especially in well-muscled dogs. The withers is thus a transition stage between the neck's relatively upright carriage and the nearly level back called for in most working breeds. (I use the term "working" in the utilitarian sense, and especially refer to the herding breeds.) The beginning judge (or the one evaluating heavily-coated breeds) often checks and compares layback by running his thumbs down the spine of the scapula. Even so, among novices there is usually great disparity between what fingers feel and what mouth spouts! A very unfortunate situation has arisen out of ignorance and laziness: many AKC breed standards were written by people who copied the wording from other erroneous standards without checking accuracy first. The same problem is seen in the multitude of breed books in which artists' drawings of canine skeletons could almost have been traced from other books, judging from the mistakes they have repeated.

I had been preaching scientific honesty and artistic accuracy for years, thinking I was like Elijah: "the only prophet in the land of Baal", until Rachel Page Elliot's book *Dogsteps* came out. As I had done on a smaller scale, she x-rayed many standing and running dogs to prove the nonsense about 90° angles between humerus (upper arm) and scapula, and the impossibility of a 45° layback of the shoulder or humerus.

The Bouvier's AKC standard has quite good wording on this subject, as does the Collie's. The "about a right angle" in the AKC German Shepherd Standard is misleading. Is slightly less as good as slightly more? Is it even possible? Their Doberman Pinscher standard is a travesty, what with the 45° layback and 90° shoulder/arm angles being specified. Might as well specify cubical tires for cars! And Dobes have a terrier-schnauzer-sighthound type of structure, with more "open" front angulation.

Why are some shoulder angles better than others? In a few cases this is the same as asking why some scapulas are laid back at a greater angle than others, though most deficiencies in front angulation lie in the upper arm rather than the scapula layback. If the angle of the spine of the scapula does indeed differ between dogs, it is possibly because some dogs have proportionately shorter vertebrae in the neck or sacrum, and some may have longer bones in the true back and loin (the true back being between the scapula and the croup). If the dog has shorter vertebrae and disks, the shoulder may more upright.

Remember that those trapezius and rhomboideus muscles extend to the ninth and sixth thoracic vertebrae with only a small portion of their fibers, and if the vertebrae are relatively short or the scapula is slightly more upright in that dog for another reason, the muscle attachment will be relatively forward and less broad. The same may be true to a lesser degree with the serratus ventralis, which runs from the scapula to the last five cervical vertebrae and the first seven ribs. The more forward all these attachments are, the less the blade will be inclined when a pup first learns to walk, and muscle forces help shape its semi-cartilaginous bones and joints. In such a dog, there would be less muscle mass present to rotate the top of the scapula back and forth, thus a restriction of motion here contributes a little to a lack of reach in front and even follow-through beneath.

There is a far greater cause for poor reach, or less smoothness of front action. Some dogs have an upper arm (humerus) that is not laid back at a good angle from point of shoulder to elbow joint. This is often accompanied by a proportionately shorter arm compared to the scapular length. Because of cyclic neglect, German Shepherd Dogs have periodically become alternately better and worse in this respect. At the time of this writing, the AKC-GSDCA type has lacked good upper arm layback for many years while the international type has improved since the 1970s.

Whether herding livestock, doing police work, performing obedience exercises, or pulling loads, the trotter-built working dog needs a well-angled shoulder/upper arm assembly. Let's consider this synonymous with good layback of *both* bones, for convenience's sake. A "straight" (more vertical) foreassembly is somewhat like a car without springs. Imagine a dog with poor front angulation hitting the ground with its forelimbs after climbing over a wall in pursuit of an errant lamb or thief. The hard shock could have a detrimental effect before long.

A dog with better angles (yet strong ligaments in pasterns, elbows, and shoulders) can spread that shock over an imperceptibly longer period of time, during which the muscles slow the impact while the bones go through their "folding up" action relative to each other, then release that stored energy by straightening out again (bouncing back). Trotting creates very nearly the same sort of shock that jumping does, only far less violent. The primary need for good angulation (maximum in front and moderate or proportionately balanced in rear) is to promote long stride, with consequent efficiency of ground-covering gait.

A successful parachutist survives because he takes only a tiny fraction of a second longer to hit the ground than someone whose chute didn't open. A good boxer "rolls with the punches", while the guy who holds his head still when the other guy's fist approaches finds himself waking up some time later. The baseball player relies on padding *and* moving his hand back to slow the speed of the ball as it makes contact with his glove. The differences in time intervals in each illustration are truly minute, but they can mean the difference between ease and pain, or life and death. Likewise the differences in layback from dog to dog may be small, but a tiny difference can mean smoother action, greater ability to hit the ground effortlessly whether jumping or trotting, and a longer useful working life. The galloping breeds minimize that shock by increasing the horizontal-to-vertical motion ratio. My show champion, lure-coursing Whippet was undefeated after he learned to run "flat" instead of "up and down". The trotter breeds have a little more need for more acute angles in the foreassembly.

Not many dogs are used for pulling loads anymore, but the dog with a smaller angle between scapula and

upper arm is better suited for this type of work, too. Even if only for historical interest, the *ability* to pull carts or sleds should be preserved in those breeds that are developed for such purposes, for breed *type* is inextricably bound to that utility. Form follows function, and if we get too far in the evolution of breeds from their original purposes, we will have created (though gradually) a distinctly different breed. What time traveler from centuries past would recognize today's utterly non-functional English Bulldog from those he had seen chase and tame wild bulls in the days when the breed had a useful purpose? Do not let our working, utilitarian breeds slip away into uselessness as some other breeds have. There is a good reason why I put so much emphasis on shoulder and upper arm angles, and reward good examples in the show ring. It's the same reason why it is so difficult to improve in breeding.

In the case of angulation at the knee ("bend of stifle"), ignorance and fad-following have resulted in GSDs with lower-thighs that are too long, with hocks too far behind the torso to be adequately controlled by ligaments and muscles. This rear angulation at the stifle can go either direction from the middle (moderate) ideal for most breeds, with the American-fashion GSD at one extreme and Chows at the other. However, in the case of the shoulder, the ideal is not in the *middle* of a normal range, but on one *end*; namely, closer to the fictional 45° layback and 90° shoulder/arm angles. Actually, depending upon breed and whether you draw the lower line to the point of the elbow, a layback of 35° in either scapula or upper arm is very good, and a withers - point of shoulder - point of elbow angle of 95° is excellent for a herding breed. Drawing that line through the upper arm, you would get about 115° in most of the efficient trotters. If it were possible to create a 45° layback in both bones, some say that such a dog might fall on its face.

But back to those palpable points of reference, those being the indentation at the point of shoulder, the highest point of the scapula, and the top of the ulna. If a number of genes affect the angle between these bones, some would be "ideal genes" (let's say they'd call for a 35° angle from vertical, for each bone, for purpose of illustration), and others would be "less than ideal genes" calling for some lesser angle. Of all the possible genes that could be transmitted, the vast majority would be calling for an angle of somewhere in the 20° to 30° range, with a miniscule number calling for the coveted ideal of approximately 120° remaining between the scapula and humerus. Genes are inherited randomly, and statistically would show a bell curve with the smallest amplitude in the two extremes (say, 15° and 35°, for example) and the greatest in the middle of the curve.

Despite all the talk about angles, it boils down to this advice: forget the numbers, examine as many dogs as you can get your hands and eyes on, compare one dog to the next, and reward or admire those with the smallest apparent angle between shoulder and upper arm, while proving what appears in stance by watching the dog perform in the trot. See Figures 4 and 5.

Since he cannot do "better" than the ideal shoulder angle, which is *at one end* of a range of possibilities, the breeder must be more diligent to cull from breeding programs all dogs which drift an undesirable distance from that good end of that spectrum. More so than is necessary in any trait in which the ideal is at some intermediate point between the worst on one end and the worst in the opposite direction. In the case of good forequarter function in a herding breed, and in most other working breeds, there is *only* one direction from the ideal, when we speak of breeds developed for trotting.

The Hindquarters

The thigh — What is meant by "the whole assembly of the thigh" in the wording of the AKC Standard for the GSD? Viewed from the side, it includes the croup, upper thigh (femur and associated soft tissues), and lower thigh (tibia and fibula). If these three skeletal sections are too "vertical" or steep, the hindquarters will not present the broad picture called for by the Standard. Obviously, if the croup and lower thigh are slanted downward toward the rear, the femur will not also be so. Nor is it angled forward when the GSD stands in a normal pose, in spite of the AKC Standard's inaccurate statement about it paralleling the scapula. Many books on many other breeds have made the same error; even some written by well-known judges who should have known better than to report on something they did not experience in real life.

From experience both in radiographing live, standing dogs and in feeling for the bones in the hindquarters, and getting my seminar attendees to do the same, I have repeatedly shown that the femur

is vertical when the metatarsus (hock) is vertical. The natural stance for German Shepherd Dogs is with one rear leg placed a little (and only a little) under the torso for added support of a long, substantial body. In this leg, the femur is not vertical, but neither is the hock. Stand your dog with metatarsi vertical and parallel. Lift the dog's rear leg while you feel with your fingers for the acetabular (hip) joint capsule, and make a chalk mark there. Then feel the depression between the upper and lower leg bones. This is some distance below the patella, which is too hidden in cartilage to be accurately palpated. Make another chalk mark there. You can now see that the femur is quite vertical between these two easily-located points.

The slant of the lower thigh in the GSD can roughly approximate that of both the croup and the humerus, although there is considerable variation, and it probably comes closest when the metatarsus is vertical, but even then not in all dogs — too much has been made of this similarity and the concept should be dropped. The angle the lower thighbones makes with the femur in a natural stance is not a right angle. Here again I am forced to contradict a poorly worded line in the AKC Standard which is more fancy than fact, and probably harks back to the days before radiography was used much.

Even von Stephanitz may have understated conditions a little when he said this angle should be "90 to 100 degrees, sometimes even a bit more." He was talking about the angle made between the pelvis (croup) and femur, which right angle we have shown is not possible. But one of the axioms of geometry indicates that if the croup is parallel with the tibia, the angle between the femur and tibia equals that between the femur and croup. Remember that this premise of parallel lines is approximate at best. The angle between pelvis and femur is not a 90° angle, as you now know. With a slope of (typically) 35° to the croup, and a nearly vertical femur, that angle between lower thigh and femur in most excellent moderately- or even very-angulated dogs will be around 125° (90 + 35) from the horizontal, however one measures it. To have a right angle would necessitate a horizontal croup or a forward-slanting femur, neither of which are found. The angle between a vertical line from hip socket through the stifle indicating the femur, and the line from stifle joint to point of hock varies from 95° in an "extreme" dog to about 130° or 140° in a less-angulated, straighter-stifled dog. This means the angle of the lower thigh from the horizontal varies from 5 to 50 degrees in various breeds. The relative length of the lower thigh is the biggest anatomical factor in determining this angle. See Figure 6.

For a good understanding of the anatomy of the dog, additional pictures and discussion would be helpful. Toward that end, I urge you to get your own copy of "The Total German Shepherd Dog" (www.Hoflin.com), regardless of what breed you have, and study the illustrations and information.

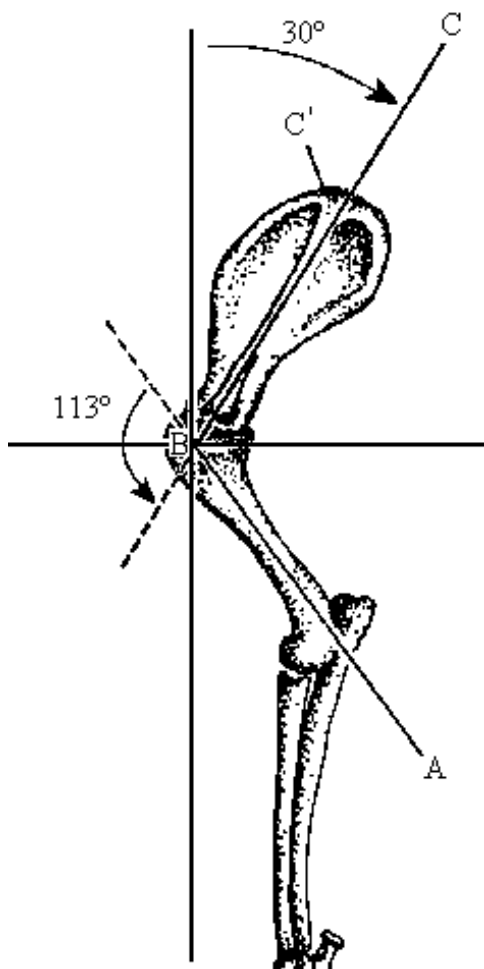


Fig.1 Shoulder Angles – It is almost impossible to duplicate, by eye or hand, the typical illustration in most books that shows a 90-degree angle between limbs, with lines going through the middle of the humerus and from either the most-forward point of the shoulder or the imagined location of the center of articulation to the highest point of the scapula or along the scapular spine. Only in the “best” fore-assemblies will an angle of 90 degrees even be approached, and then only if lines are drawn on radiographs from top of ulna to front of upper arm to a point behind the highest point of the scapula.

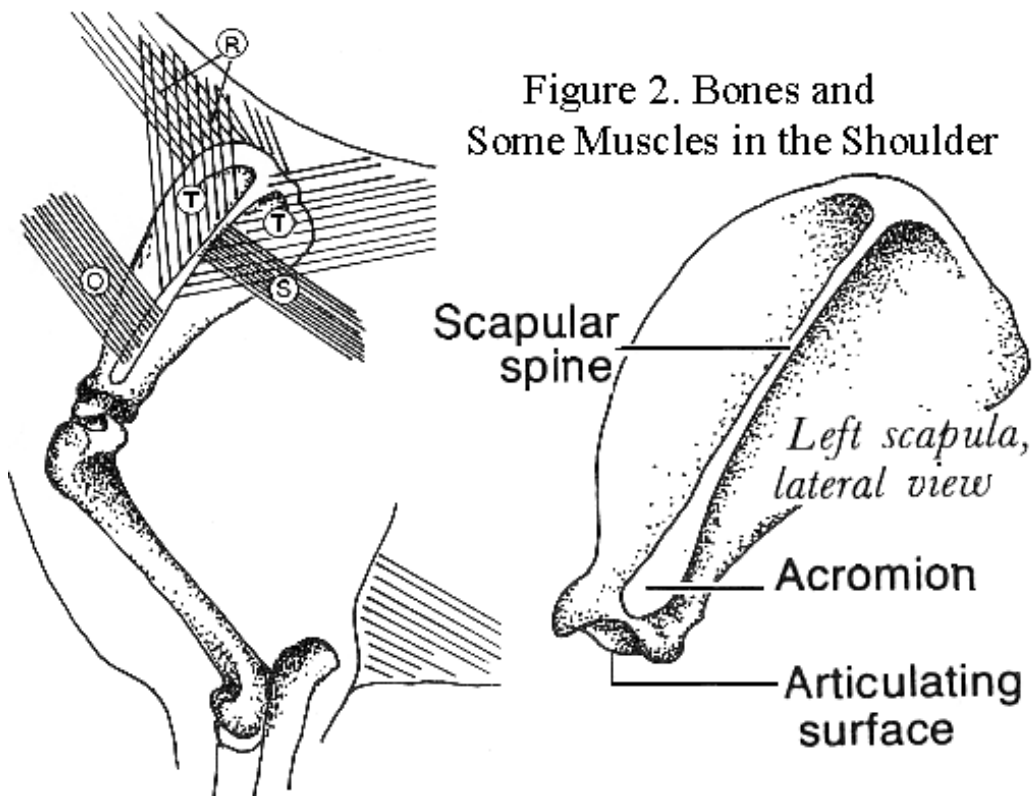


Figure 3 (below) Various Bone-Joint Angles in a Well-built Herding/Working Breed

(Actually, few GSDs have this good a shoulder, and very few from American lines since the 1970s)

A Typical American-style GSD with 8:10 Proportions

(too long for Germany)

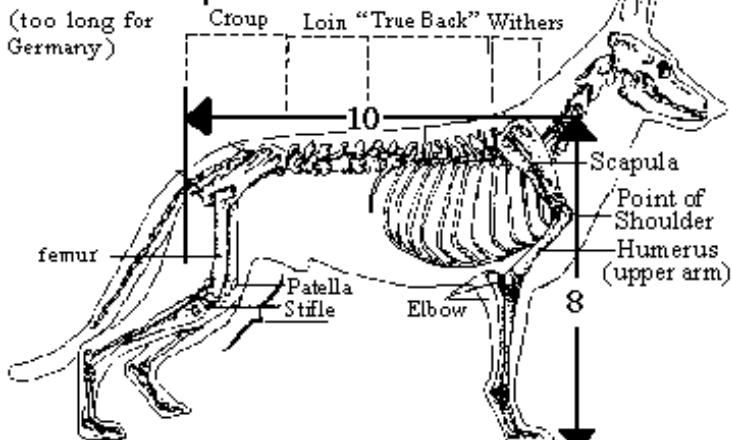


Figure 4
Measuring or Estimating Angles

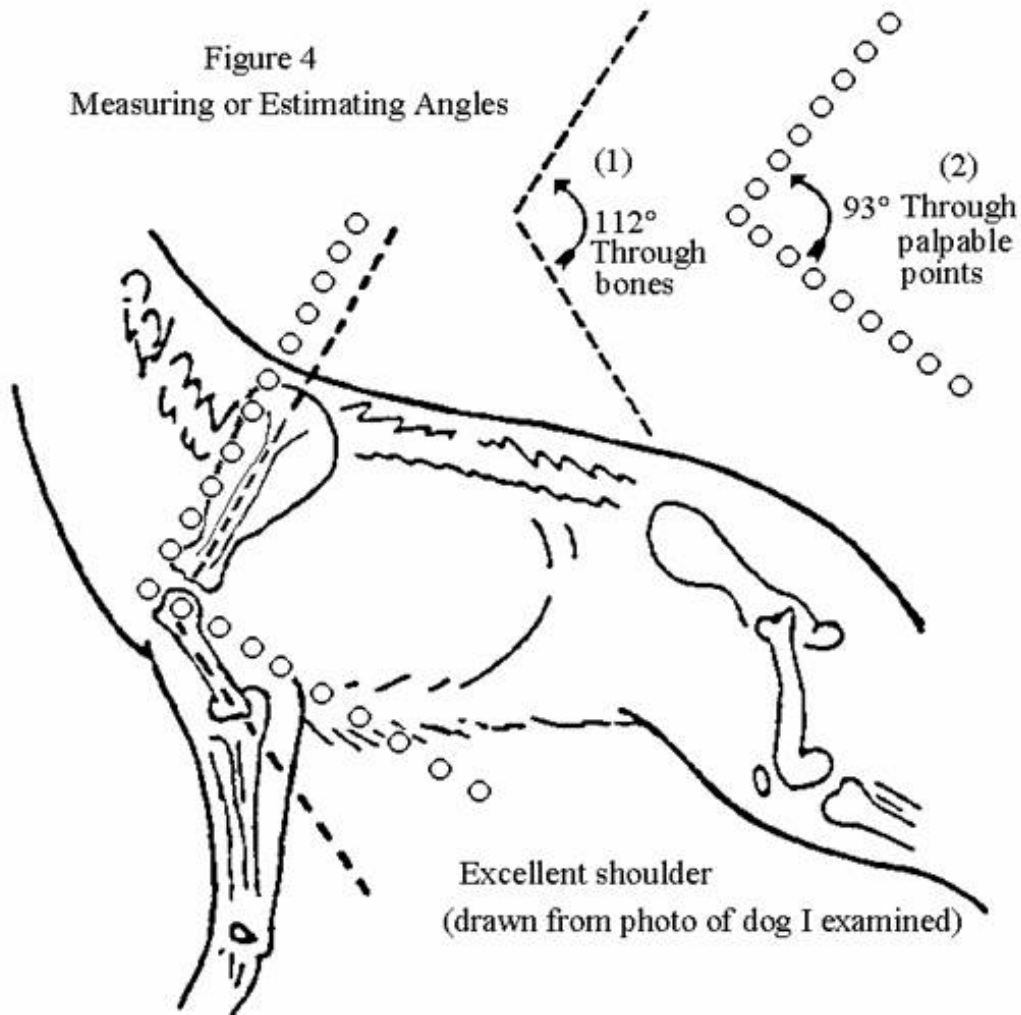


Fig. 5a Very good shoulder during trot. Trommel's Jasmin of Ryandale.

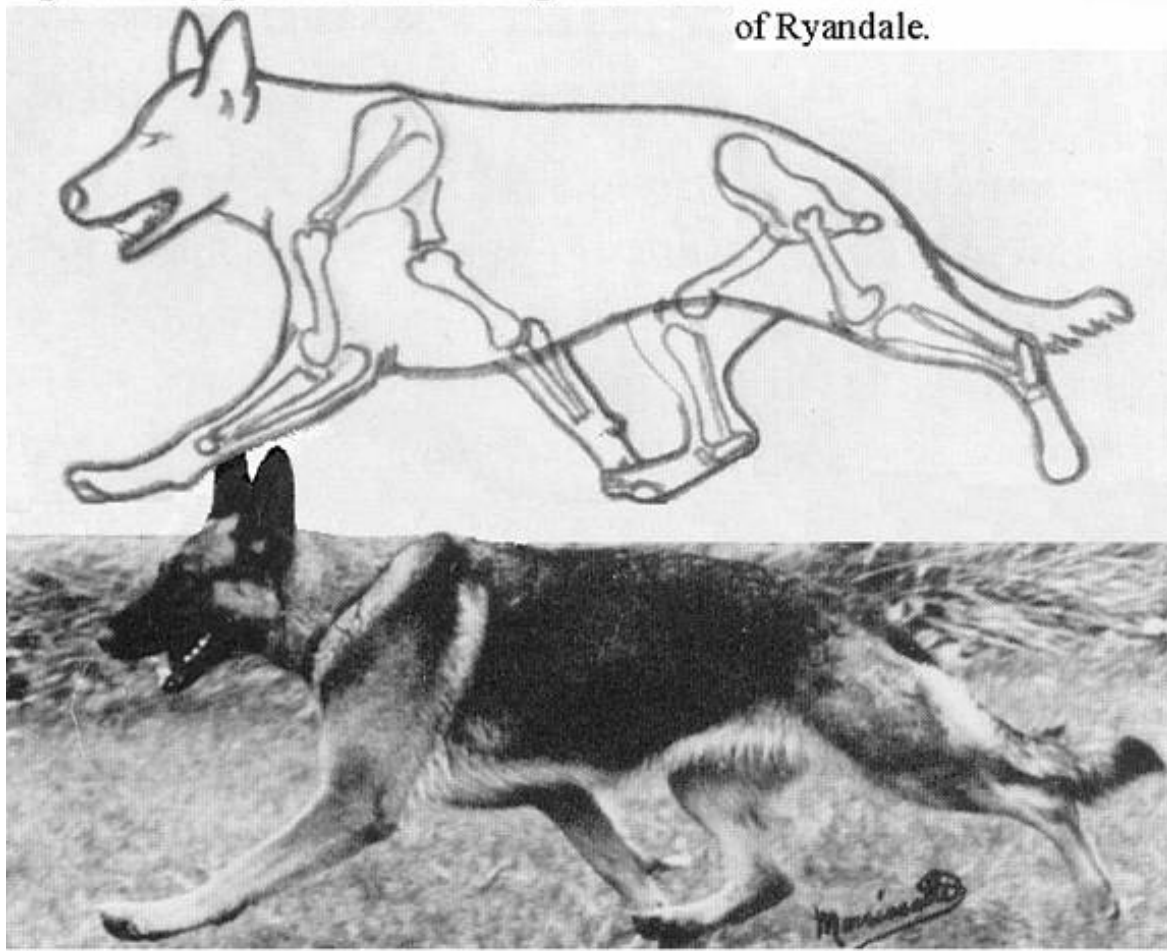
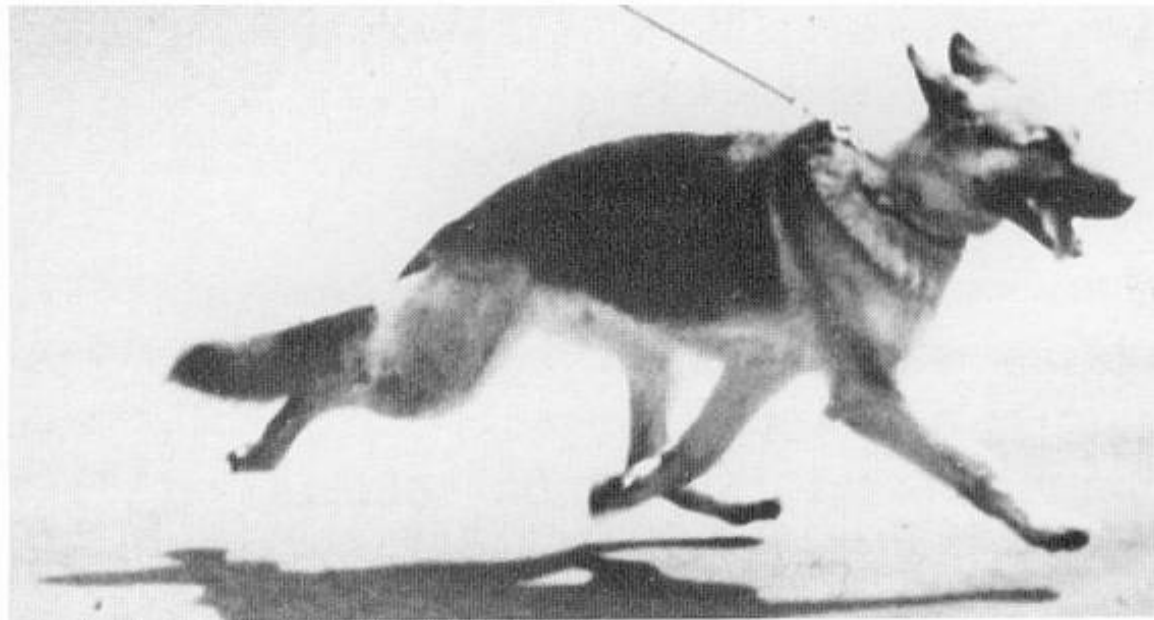


Figure 5b. Demonstrating the "Flying Trot" (all four in suspension off the ground), Atrice v. Klämmle shows a beautiful shoulder opening



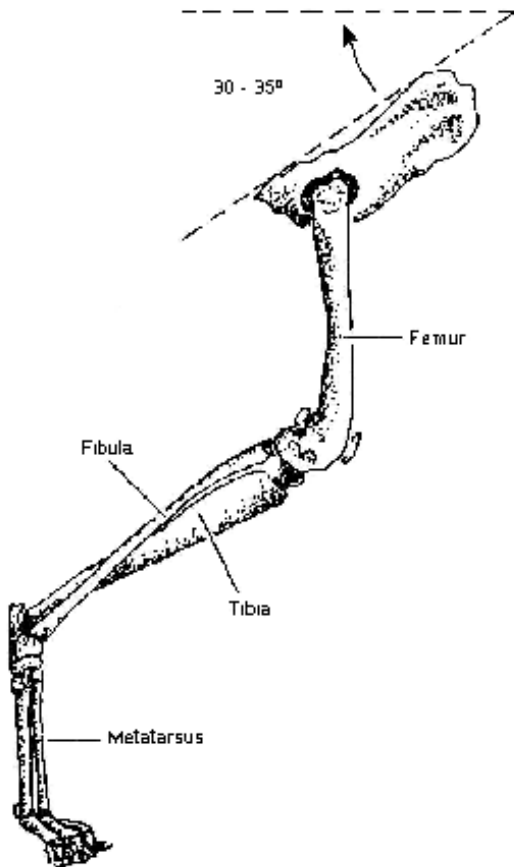


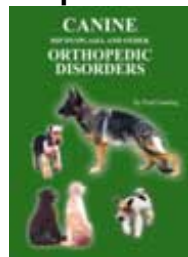
Figure 6 Rear Angulation. This is defined as the angular relationships between croup (pelvis), femur, lower thigh, and metatarsus. The term is erroneously used by rank novices to describe slope of topline.

Fred Lanting is an internationally respected show judge, approved by many registries as an all-breed judge, has judged numerous countries' Sieger Shows and Landesgruppen events, and has many years experience with SV. He presents seminars and consults worldwide on such topics as Gait-&-Structure, HD and Other Orthopedic Disorders, Anatomy, Training Techniques, and The GSD. He conducts annual non-profit sightseeing tours of Europe, centered on the Sieger Show (biggest breed show in the world) and BSP. Check out his website: www.MrGSD.com



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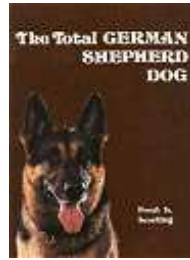
Canine HD and Other Orthopedic Disorders by Fred Lanting.



It covers all joints plus many bone disorders and includes genetics, diagnostic methods, treatment options, and the role that environment plays. This new Hip Dysplasia and Other Canine Orthopedic Disorders\' book

is a comprehensive (nearly 600 pages!), amply illustrated, annotated, monumental work that is suitable as a coffee-table book, reference work for breeders and vets, and a study adjunct for veterinary students, for the dog trainer and the general dog owner of any breed.

The Total German Shepherd Dog by Fred Lanting



This is the expanded and enlarged second edition, a "must" for every true GSD lover. It is an excellent alternative to the "genetic history" by Willis, but less technical and therefore suitable for the novice, yet very detailed to be indispensable for the reputable GSD breeder. Chapters include: History and Origins, Modern Bloodlines, The Standard, Anatomy, The German Shepherd in Motion, Shows, Showing, and Training, The Winners, Nutrition and Feeding, General Care and Information, Health and First Aid, Parasites and Immunity, Diseases and Disorders, The Geriatric German Shepherd, Breeding, Basics of Genetics, Reproduction, Whelping, The First Three Weeks, Four to Twelve Weeks, Trouble-shooting Guide

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