Note on the lumbosacral junction

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"Nothing that exceeds

the proper measure

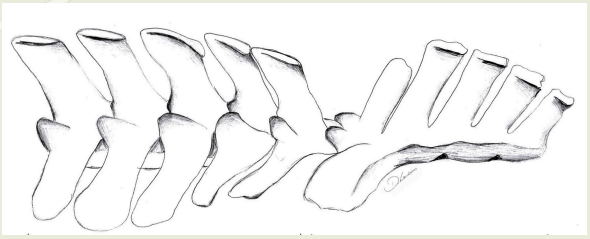
is ever pleasant, neither for the horse nor for the human."

Xenophon, Peri Hippikes 10,4

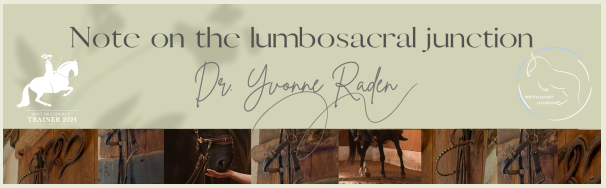
Abstract

Since there is recently a lot of criticism with respect to the lumbosacral junction (LSJ) towards the manner of collected work especially done in the Academic Art of Riding, we should try to understand as well as possible, how the spine and pelvis are physiologically moving in the horse's locomotion. A so called „opened" LSJ provides many unwanted and harmful effects for the horse's body. Hence it is very important to be able to decide, if — or when — things are going wrong in our work with the horse and when — or if — we are mistakenly accused.

Therefore, in this short note, I introduce three relevant angles that could be observed in the area of the loin. One of these angles tells us wether a LSJ is „opened" or not, while the other two angles are completely useless with respect to this particular question. Particularly, as a result, we see that the commonly regarded angle in social media does not tell us anything about the LSJ in contrast to assertions. That means things are not as easy to judge as people think — or claim.



The LSJ is the junction between the last lumbar vertebra and the sacrum. (Sometimes it is also called lumbosacral *joint*.) First, we have to agree about the notion of a so called „opened" LSJ:



Definition. We call the LSJ *(isolated) opened*, if lumbar spine and sacrum — and thereby spine and pelvis — form a certain angle at the LSJ such that a regular transmission of power from the hind legs through the pelvis into the spine is no longer possible.

Remark 1. Think about reversing with a horse trailer set and what occurs when the steering wheel is turned too sharply: At a certain point, the wheels no longer roll on the ground, but are pushed sideways. In this case, there is obviously no proper transmission of power from the drawing vehicle via the coupling device towards the trailer.

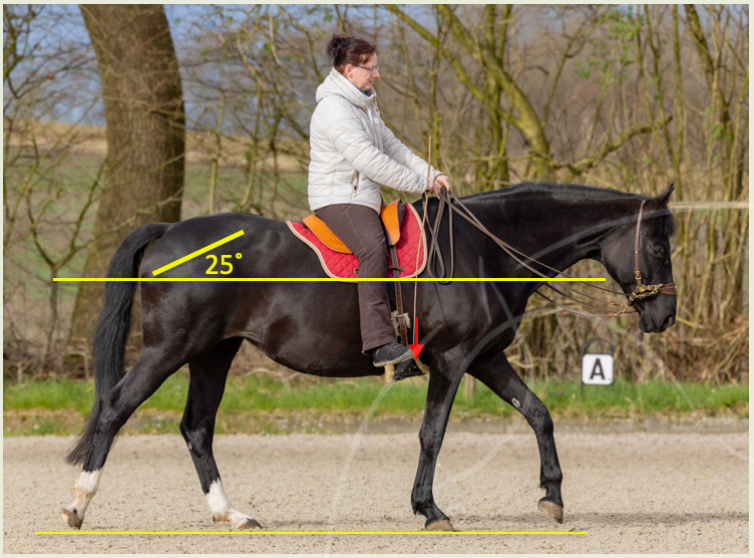
Remark 2. Note that, due to this definition, not *every* change of angulation at the LSJ is to be classified as an opened one! Solely the power transmission makes the difference.

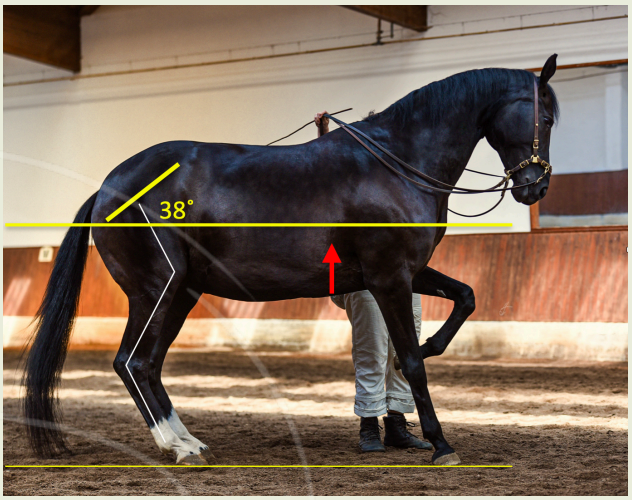
Now we come to the three angles of the lower spine/pelvis area. First, there is the *croup-loin angle*, then we have the *pelvis-horizontal angle* (or *pelvis-ground angle*), and the third one is the *pelvis-spine angle*. The following pictures show my Trakehner mare Hala (Photo credit: Karlotta Lindenau and Stefanie Pöpken) in both more collection and more forward. The red arrow marks the *relative* position of the chest: *rather* lifted in a schoolhalt on the one hand, and *rather* not lifted in a forward walk (but not pushed down).

1. Croup-loin angle: This angle is certainly most often chosen by critics to assess, whether a horse shows an *opened LSJ*/*„tilted pelvis“*/*„catback“* or not. Here we find none of the three phenomenons in this schoolhalt, as I will give reasons for in the following: The chest is lifted (red arrow), the topline is lengthened, the haunches are bent (see the thin white lines). (Nevertheless, this schoolhalt is very near to the limit.) Hence, this croup-loin angle is not only *not useful* for our purpose, but *susceptible for misjudging*.

Note, that here and further down the drawn-in degree numbers are only for demonstrating the difference between more forward and more collected movement. The numeric values shall not be taken as absolute and pure truth.

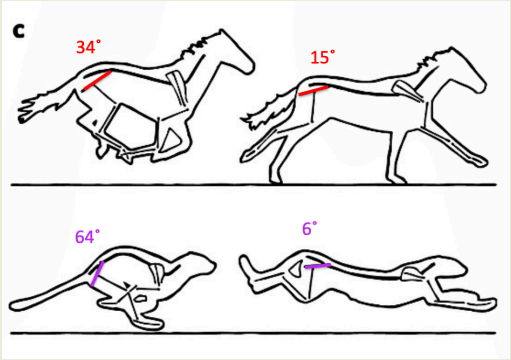
2. Pelvis-ground/horizontal angle: This is that angle people are usually using for evaluating, whether there is an opened LSJ or not. (Note that critics usually identify an opened LSJ with a tilted pelvis.) Since the angle between pelvis and ground, here yellow marked, is relatively steep in this schoolhalt compared to that angle in more forward walk,





one might come to the conclusion, that Hala is showing an opened LSJ. As I have already implemented above, this does not apply for this snapshot. Some people describe Hala's pelvis posture here as „tilted" — which is true *in the sense* that the pelvis-ground angle is definitely steep. And from this, falsely indeed!, they conclude that the LSJ must necessarily be opened as a result. As I have already mentioned, that is not true. I will give a proof in the following section. So, either this pelvis-ground angle does not help us for LSJ assessment.

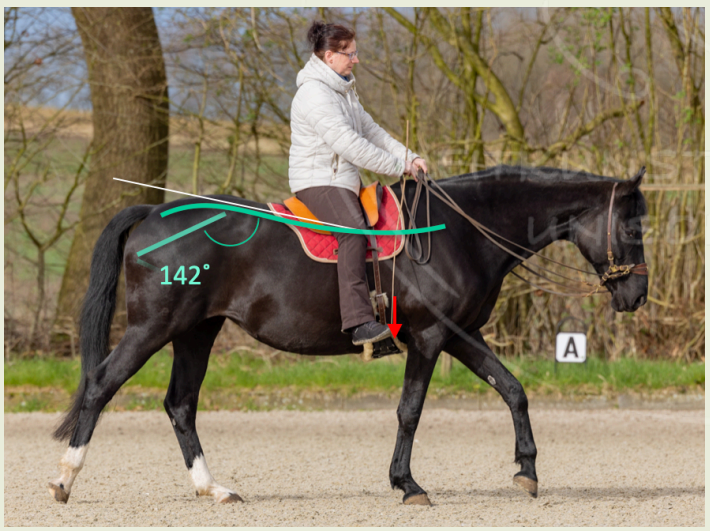
Since pelvis and sacrum are relatively stiff connected via the sacroiliac joints, the pelvis posture indeed helps us for assessment, but it is the *angle between pelvis and spine*, which must be considered:



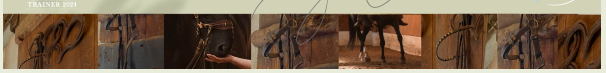
3. Pelvis-spine angle: The LSJ is a junction between two parts of the vertebral column, thus we obviously have to consider the vertebral column for LSJ assessment. As trivial and evident this statement is, as remarkable is the fact, that none(?) of the critics obeys this! At least I have not seen a single line of reasoning including the spine.

Here I have drawn in the spine in addition to the pelvis (turquoise). In the schoolhalt, there is a clear flexion of the spine upwards, while the haunches are bent and the pelvis-ground angle is steeper (see yellow lines and degrees in section 2.). Note, that this flexion of the spine is *physiological in the horse's movements*: Flexion upwards and extension downwards are alternating movement patterns. For instance, this is shown by M. Hildebrand in 1959, from which article the drawing on the right is been taken.

Hildebrand contrasts the so called „dorsomobile" runner cheetah and the „dorsostable" runner horse with respect to the question, why cheetahs are so fast on the short distance and horses are so enduring on the long. Thereby, *dorsomobile* running means, that the relatively sharp flexion and extension of the spine give a relevant contribute to the stride length, while *dorsostable* means, that there is no relevant contribution. Nevertheless, even *the spine of the dorsostable horse is not stiff* but is moving up and down in a certain amount. This is, why we can consider the form of the spine/topline as physiological in both pictures.



I have added the tangent line (white) on the crooked spine *approximately* where the LSJ is located. Then I *sketched* the angle between the pelvis and the tangent line. *Accidentally* the resulting angles are somewhat „identical"… Let me mention, that this numeric identity truly happened by chance, which is quite remarkable, since I have first guessed the tangent



line and then measured the angles — and not the other way round! My presumption was finding a numerical difference in the range of ± 5° due to inaccuracy of drawing.

Now, if one solely considers the *pelvis-ground angle*, he or she would classify the right picture mistakenly as an opened LSJ. Despite of this impression, the identity of the *pelvis-spine angles* in forward walk and collection shows, that *spine and pelvis act as a unit* and therefore the *changing in the pelvis-ground angle (yellow) is a consequence of the flexion upwards of the spine* — and is physiological. Thus the LSJ is not opened in this case.

Concluding remarks. Considering only the pelvis-ground angle or the croup-loin angle does not provide any information about the status of the LSJ — in contradiction to common practice and opinion —, since this ignores the role of the spine in the horse's movements.

As LSJ assessment in real time *by means of spine bending* is not such practicable, one should observe several points — and therefore the ***whole, entire horse as a unit***:

- Is the top line shortened or lengthened?
- Is the chest lifted?
- What about the lower neck? Extruded or not?…

For more details with respect to the locomotion types „dorsostable" und „dorsomobile" and the contribution of spine bending to locomotion, see:

- Hildebrand, M.; *Motions of the running cheetah and horse*; J. Mammal. 40, 481- 495 (1959)

Also for a broader discussion of dorsostable locomotion and exterior reciprocity, see my article „Geometry of movements" in Vol. 8 of the book series „Academic Art of Riding", to be released in autumn 2024.

„Thus, there is no uncomplicated or simple way
of riding (or assessment; addition by YR),
for the nature of a horse is not simple,
and humans should respect and understand
this nature to avoid violating it."

Gustav Steinbrecht

Photo credits: Karlotta Lindenau, Stefanie Pöpken