2025-01-13

Final report

It’s all about the timing - teaching equestrian feel in practice

Ryttarkänsla i praktiken - hur man undervisar ryttare

Project number: H-20-47-567

Project period: 2021-2023

Main applicant:

Anna Byström, Dept. of Anatomy, Physiology and Biochemistry, Faculty of Veterinary Medicine and Animal Science, Swedish University of Agricultural Sciences

anna.bystrom@slu.se

Co-applicant(s):

Agneta Egenvall, Swedish University of Agricultural Sciences

Maria Terese Engell, Norwegian University of Life Sciences

Marie Eisersiö, Swedish University of Agricultural Sciences

Susanne Lundesjö-Kvart, Swedish University of Agricultural Sciences

Sigrid Lykkjen, Norwegian University of Life Sciences

The project has been financed by:

STIFTELSEN HÄSTFORSKNING

Part 1: Summary

Att instruera ryttare är komplext, eftersom ridläraren samtidigt måste vara uppmärksam på både häst och ryttare, instruera ryttaren och strukturera lektionen. Syftet med projektet var att studera hur ridlärare instruerar ryttare under övergångar. Hypotesen var att kommunikationen mellan häst och ridlärare under lektioner, inklusive vilka aspekter ridläraren valde att fokusera på, skulle ha mätbara effekter på hästens och ryttarens rörelsemönster. En ytterligare hypotes var att intervjuer med ridlärare och ryttare skulle fördjupa förståelsen av olika skeenden under lektionerna.

Studien inkluderade tio ryttare, fem i Sverige och fem i Norge, samt fyra ridlärare, två från varje land. Varje ryttare red två lektioner för varje lärare (40 lektioner totalt). Ridlärarna intervjuades om sin undervisning, och ryttarna om sin förståelse av instruktionerna samt hur de uppfattade hästarnas rörelser. Lektionerna videofilmades och kvalitativ analys kombinerades med objektiv mätning av hästens och ryttarens rörelsemönster samt tygelspänning. Datainsamlingen kunde genomföras som planerat, förutom att en häst var halt dag två i Sverige och fick bytas ut mot en annan häst. Studieprotokollet fungerade väl som helhet, och gick lätt att genomföra på motsvarande sätt i de båda länderna, vilket innebär att det också bör vara lätt att samla in jämförbara data i framtida forskning.

De insamlade data och den tvärvetenskapliga analysen gav en fördjupad helhetsbild av lektionerna. Resultaten visade på systematiska skillnader i hästarnas och ryttarnas rörelsemönster och även nivå av tygelspänning mellan ridlärare. Det kunde relateras till hur ridlärarna valde att lägga upp lektionerna och vad instruktionerna fokuserade på. Det visade sig att om ridläraren lade mer tid på att förbereda häst och ryttare för övergångarna så klarade ryttarna att genomföra övergångarna med lättare tygelhjälper. Resultaten tyder alltså på att god lektionsplanering kan förbättra kommunikationen mellan häst och ryttare. Det fanns också systematiska skillnader i data beroende på hur positiv ridlärarens feedback var för olika övergångar. En fördjupad analys antyder att det inte finns något omedelbart samband mellan specifika instruktioner under en pågående övning och vad hästen och ryttaren gör under just den instruktionssekvensen.

Projektet visar på både möjligheter och ansvar för ridlärare att säkerställa lektionshästarnas välfärd under ridlektioner genom att instruera och lägga upp lektionerna på ett sätt som ger hästar och ryttare bästa förutsättningar. Ökad reflektion och feedback kring hur olika lektionsupplägg påverkar häst och ryttare kan stärka ridlärares kompetensutveckling. Genom att kommunicera till verksamma och blivande ridlärare till exempel hur lektionsplaneringen kan påverka hoppas vi motivera ridlärare att reflektera mer över sina val och sin undervisning. Förutom mätningar kan även analys av videofilm vara ett hjälpsamt verktyg i detta sammanhang. Det är överhuvudtaget viktigt att skapa utrymme för diskussion och reflektion, även tillsammans med eleverna.

De preliminära resultaten har presenterats vid utbildningar och fortbildningar för ridlärare, exempelvis den Ridlärare IV kurs som genomförts på Wångens i samverkan med Svenska Islandshästförbundet. Studenterna på Hippologprogrammet har också fått ta del av resultat, som underlag för diskussion under seminarier. Artiklarna från projektet kommer ingå som litteratur i olika kurser inom framförallt Hippologprogrammet. En annan effekt som projektet har haft är att det har initierat en diskussion bland riksanläggningarnas lärare, dvs. några av de som utbildar blivande ridlärare, omkring de olika faktorer som påverkar lektionsupplägg och hur man kan förbättra ridlektioner samt instruktioner till ryttare. Denna diskussion ser vi som ett steg i utvecklingen av ridlärares arbete med ridundervisning på Sveriges ridskolor.

The project has been financed by:

STIFTELSEN HÄSTFORSKNING

Part 2: Main report

Introduction

When learning how to ride or striving to achieve certain training goals, the vast majority of riders seek advice from a riding teacher or trainer. This means that riding teachers and trainers will influence the interactions taking place between horse and rider to a substantial extent. For optimal welfare of riding horses, as well as for rider safety and sports performance, it is crucial that the rider communicates requests to the horse in a way that is easy for the horse to interpret and learn (Starling et al. 2016). When training horses it is common to use negative reinforcement, i.e. pressure signals that are released when the horse does what we want (McLean & Christensen, 2017). It has been shown that releasing pressure at the horse's first attempt leads to fewer conflict behaviours, compared to releasing only at correct response (Egenvall et al. 2012). This means that optimal timing of pressure signals is key both for efficient learning and from a welfare perspective. The term equestrian feel refers to the rider's ability to turn the sensory perception of the horse moving beneath into an understanding of the horse's quality of movement, and finally into an embodied knowledge about when and how to apply aids in order to influence the horse in an effective way. Developing equestrian feel is considered a central part in rider education (e.g. Dashper 2016, Zetterqvist Blokhuis 2019).

During riding lessons, there are moments, limited in time and space, when the riding teacher and individual students together create what Lundesjö Kvart (2020b) calls *instructional spaces*. The collaboration between teacher and rider is crucial to establish instructional spaces, within which *instructional sequences* can be performed. An *instructional sequence* in educational settings normally includes instruction, instructed action, and an evaluation of the instructed action, also defined as an Initiation-Response-Evaluation (I-R-E) sequence (cf. Mehan 1979). Timing and the participants' interaction in the mobile activity prove to be important when the participants co-create instructional spaces (Lundesjö Kvart 2020b). For example, an instructional space may be created when a student pass close to the instructor and the instructor gives an instruction to that particular student.

Riding is indeed a complex task, which also makes it challenging for the riding teacher to select the most important instructions, and structure the lesson content in a helpful way. Further, the needs of the horse and the pedagogical conditions the rider need may not always fully align, especially in the riding school situation. Lundesjö Kvart (2020a) found that during riding lessons, the riding teachers interpret the horses' wishes and actions, and riding teachers are generally concerned with equine welfare. However, prior to the current project the immediate influence of the riding teacher on horse and rider movements or horse behaviour was undocumented.

The aim of the project was to investigate the interactions between horse, rider, and riding teacher within short-time windows (instructional spaces) where the rider performs a change of gait (transition). The aim was, further, to explore to what extent the horse - rider - riding teacher interactions could be understood on a deeper level if quantitative and qualitative methods were combined to view the same sequence/instructional space from multiple angles. Our hypothesis was that the communication between teacher and rider, including what aspects the riding teacher was focusing on, is associated with variations in horse and rider movements and rein tension levels. We further hypothesised that interviews with the riding teachers would be helpful for understanding the background for their actions during the lessons, including their teaching philosophy and their thoughts on the riders' progression during the lessons.

The project has been financed by:
STIFTELSEN HÄSTFORSKNING

Material and methods

The study included ten adult riders at intermediate level and four riding teachers. Five riders and two teachers were from Sweden, the remaining from Norway. The riders were students at the riding teacher educational programs at Strömsholm, Sweden and Starum, Norway. The riding teachers worked as instructors at the respective program. The riders rode lessons with both riding teachers from the same country, but on different days (one week apart in Sweden, two days apart in Norway). Each rider rode two horses each day (40 lessons in total in the study), one horse they usually ride and one horse that they had ridden once or twice at the most. The unfamiliar horse was ridden regularly by one of the other riders. Hence, the design was a partial crossover with one arm for each country.

During each riding lesson, the riders were asked to perform transitions between walk and trot, and between trot and canter. The teachers were asked to instruct the riders as they would during any normal lesson. The lessons were audio and video-recorded (using two cameras, one at the long side capturing a side view and at the corner capturing a frontal/rear view). Synchronised measurements of horse and rider movements were obtained using an inertial measurement unit (IMU) system, (EquiMoves, sampling rate 200 Hz), and rein tension were obtained using calibrated rein tension meters (with Forsentek FSSM-500N load cells, measuring range 0-500 N, sampling rate 100 Hz).

In advance of the riding lessons, each teacher was interviewed regarding the aids to be used for transitions, their opinions about how to instruct riders, and what they put emphasis on when teaching. After the riding lessons, the riding teachers were interviewed using stimulated recall (showing recorded movie clips on a tablet) to find out how they perceived each recorded instructional sequence. They were asked to describe what specific horse and rider movements and actions that they payed attention to and explain their thoughts behind the instructions they gave. The riders were also interviewed after the lessons. They were asked to reflect on their experiences during the lessons, and if they understood the instructions. On the second day, stimulated recall was used, with selected video clips from the rider's lessons on the first day.

The interaction between riding teacher and rider during the lessons was explored using ethnomethodology and conversation analysis (Goodwin 2000; Schegloff 2007). Conversation analysis pays close attention to the sequential and temporal organisation of the participants' actions (Schegloff, 2007), and on how participants interact on a turn-by-turn basis. The riding lessons were thereby analysed as a situated practice, including how instructions were given and the instructional interaction between the participants. In addition, each instructional space was rated on a 1-5 scale based on the type and focus of the feedback that the rider received.

Analysis of objective data and biomechanical variables

Raw IMU data were processed to yield vertical displacement and rotational data (roll, pitch, and yaw) for each sensor, as well as limb protraction-retraction (forwards-backwards swing) angle (as described in Bosch et al., 2018). Ground contact times for all four limbs were determined based on a previously validated algorithm (Tijssen et al., 2020). The difference between ground contact times for the hind limb and the diagonal forelimb (diagonal advanced placement – DAP) and the ipsilateral forelimb (lateral advanced placement – LAP) were calculated and expressed in percentage of stride duration. Each stride was then classified as walk, trot, left canter or right canter, or undefined if the pattern was not consistent with any of these gaits (e.g. transitional strides when changing gait). Transitions between gaits were labelled automatically by comparing gait classification labels between consecutive strides. Up to eight strides immediately before and after each transition were labelled as preparation and

The project has been financed by:
STIFTELSEN HÄSTFORSKNING

post-transition, respectively (less than eight if fewer were available, e.g. if the next transition was close in time). Post-transition and preparation phases were allowed to overlap (e.g. during walk in between transitions to and from trot). Transitions performed on the long side in view of the cameras were then selected based on the video log.

Discrete variables were calculated from IMU and rein tension data on a stride-by-stride basis. Protraction-retraction range of motion (ROM) was determined along with maximum and minimum (maximum retraction). Additionally, hind limb maximum protraction difference between consecutive strides was calculated, and the absolute value of this difference was used as a measure of hind limb protraction consistency. The relative phase between the vertical displacement the withers and the croup were calculated and expressed relative to the stride duration (±0-50%, positive value if withers peaks and troughs precede the croup). From the sensor located at the rider's sacrum, ROM for roll (transversal plane rotation, i.e. side-to-side tilt) and for pitch (sagittal plane rotation, i.e. forwards-backwards tilt) were calculated. From rein tension data, minimum, maximum and median were calculated for each rein, and then averaged for left and right reins. Additionally, left–right rein difference of the median rein tension was determined.

Statistics

Mixed models were developed in SAS (version 9.4, TS1M6), using stride-by-stride data (proc mixed SAS). Down-and up-transitions were analysed in separate models. Dependent variables were the discrete rein tension and horse and rider movement variables described above. The independent fixed effects were transition phase (preparation, transition, post-transition), riding teacher, and the 2-way interaction between these factors. In a second set of models, progression level was added as a fixed effect along with all possible 2-way and 3-way interactions. Random effects were horse, rider, and transition serial number nested in lesson serial number. Models were backwards reduced to remove non-significant terms ($p>0.05$).

For privacy reasons, the riding teachers will be referred to using a letter-number combination indicating country and order (first or second day) or nicknames: Anna (S1), Bella (S2), Cecilia (N1) and Diana (N2).

Results and discussion

Reflections on the study design, experimental setup and data collection

Data were collected from all 40 lessons. The same horses and riders participated on both data collection days in each country, except that in Sweden one horse was found to be lame on the second day and was replaced by another school horse. The biomechanical data were complete, except that with one rider, the rider sensors fell off halfway through and the protraction-retraction algorithm failed for one lesson. All riding teachers were able to work through the planned lesson content with each student within the allocated timeframe (20 min/lesson). However, while one teacher felt that 20 minutes was generous, another teacher expressed that she felt a bit stressed by the time limit. Interviews with the riding teachers were conducted as planned. The interviews with the riders were sometimes cut a bit short, especially on the first day for each rider, since the interviewer also needed to watch all lessons in order to have a common ground for discussion with riders and riding teachers. On the second day for each rider, they knew what was expected from them, and video clips from the first day were used as "stimulated recall" to help the rider remember situations during the lessons on the first day. In this way, the interviews with the riders on the first and second day combined gave a lot of information about the riders' perception of the riding lessons.

The project has been financed by:
STIFTELSEN HÄSTFORSKNING

In summary, the experimental setup was feasible, easily portable (enabling identical setup on two different locations) and efficient. This means that it will be easy to collect comparable data in future studies. The equipment and setting did not seem to disturb the horses, riders or teachers to any substantial extent. However, it is important to consider that the riding teachers, and riders, may feel scrutinised knowing that they are being recorded and that the recordings will be analysed. For that reason, it is probably preferable that particularly the riding teachers participating in this type of study are relatively experienced, and thus more confident in their role. Another aspect to consider in the analysis is that since the teachers were provided a lesson outline as part of the experimental setup, they may not have held the lesson in exactly the way they would have if not being in the study.

The setup and interdisciplinary approach gave a lot of information that can be used intertwined to give a full picture of the interactions between horse, rider and riding teacher. When starting to analyse the collected material, we chose to prioritise the walk-trot transitions, and the primary focus was to identify general patterns to get an overall picture of the lessons. Going further from this, analysis of relationships between measured data during walk-trot transitions and the riding teachers' feedback (predominantly corrective vs positive), as well as teachers' and riders' thoughts on progression during the lessons, is currently ongoing. Some examples from this analysis are provided below. In addition, a zoomed-in analyse is underway, four chosen lessons with the same horse and the three riders who rode this horse will be analysed in detail concerning instructions given and specific movements measured that the instructions focused on. A goal in this analysis is to reveal how effective instructions can be on actual change of behaviour when it comes to position in the saddle during one lesson. It will also be interesting to extend the current analyses to include the trot-canter transitions, and to review the recorded interactions during the lessons against established frameworks for learning, especially equine learning theory (McLean & Christensen, 2017) since this was included in the interview questions with riders and teachers.

Riding teacher interviews

The four teachers had mostly similar ideas about their role during riding lessons and general thoughts related to giving instructions. According to the teachers, the most important task is to give the riders the tools they need to attain the right feel. To be clear and quick to assess and recognise when a movement is performed correctly is of essence. All the riding teachers emphasised the importance of quick and timely feedback to the student. They expressed that feedback on completed movements is most crucial for the rider's development of properly timed signals to the horse. The riding teachers also emphasised that it is very important to provide this feedback in relation to the performance of each repetition of an exercise. "*So you manage to time it, so that I have time to give the feedback so that the rider understands that it must do the same next time to get a good transition. So that they recognise which part of their body they used to make a good transition*." (Cecilia). The teachers also described that they looked at the horses' performance to, for example, evaluate the rider's ability to give correct aids or if the rider had understood and could perform a certain exercise. The horse was, in this sense, considered a partner in the education of the rider.

All teachers expressed that it is important to make room for dialogue and to establish a mutual understanding with their students. Dialogue, communication, discussion and mutual understanding were keywords mentioned by all. "*For me, it is quite important that you should have a communication and understanding with the person who rides and know that you are on the same level.*" (Diana). One of them even said that understanding *what* and *why* are among the most important things for the rider. Another teacher said that she would have liked to have more time during the lessons to explain in more detail what and why to do this or that.

The project has been financed by:
STIFTELSEN HÄSTFORSKNING

Interviews with the riders

So far, three interviews with riders have been analysed in-depth, as part of the zoomed-in analysis of four lessons with the same horse. During the interviews, all three riders express a balanced and well-reflected view on their performance and themselves as riders, as opposed to focusing on any shortcomings of the horse. For example, one rider said: *"I'm very unequal-sided as a rider and that's a problem I'm working on. Normally, I find it easier to ride in right direction, but I also find it easier to work with the right side as the outside because I'm more efficient with the right leg and rein"*. Another rider expressed: *"It's difficult with my left arm, I pull it backwards. I think I want more contact /…/ when* [the horse's neck] *is actually straight, I feel like I'm sitting super straight arms* [reaching to] *just behind the horse's ears"*. Both teachers also commented on this rider's problems. One of them said; *"She has a problem with her left arm and hand. She always begins with her left hand instead of using her left leg. I think she needs to find her own balance first."* Interestingly, these postural problems were less discussed during the lessons. The instructions focused more on the horse. This suggests a gap in knowledge on how to instruct riding technique effectively and how to guide a rider to correct position in the saddle. There is also very little research available on human learning in the context of riding and horse-rider communication.

Instructions during the lessons

During lessons with S1 ('Anna') the students performed a total of 93 walk-trot transitions on the long side in view of the cameras and got 120 different instructions during those transitions (Table 1, bottom row). The corresponding numbers for S2 ('Bella') were 91 transitions and 112 instructions, N1 '(Cecilia') 83 transitions and 111 instructions and N2 ('Diana') 66 transitions and 74 instructions. There were substantial differences in lesson structure between the riding teachers despite that they were teaching the same exercises (walk-trot and trot-canter transitions). Anna (S1) asked the riders to circle around her during the first transitions, and during some lessons, the rider never left the circle. Similarly, Diana (N2) used a long warm-up in walk and began with walk-halt transitions before she let her students begin with transitions between gaits along the long side. Bella (S2) and Cecilia (N1), on the other hand, began with transitions along the long side more or less directly.

Table 1. Number of instructions per topic for each riding teacher.

FOCUS	Anna (S1)	Bella (S2)	Cecilia (N1)	Diane (N2)	Total
rider's seat	21	18	19	16	74
rider's hands	18	18	19	12	67
rider's thighs			14	1	15
rider's gaze			10	1	11
straight horse	21	23	26	8	78
more energy	46	18	3	6	73
slower tempo	3	3	7	11	24
count walk strides	4	25	5	1	35
transition precision	1	6	5	10	22
horse's rhythm	6	1	3	8	18
Total all topics	**120**	**112**	**111**	**74**	**417**

There were also differences in instruction focus between the teachers. This is reflected in the number of times various aspects were addressed by each teacher (Table 1). Anna asked for *more energy* - better engagement and more impulsion from the horse. For example, she would

The project has been financed by:
STIFTELSEN HÄSTFORSKNING

tell the rider to have “a little more energy”, or to “ride a little bit more forward”, and wanted the horse’s gait to be “short and quick” or “short and energetic” in the transitions. Bella (S2) was the teacher that most clearly focused on *counting walk strides* between down- and up-transitions. She asked almost all riders to ride exactly four or five strides in walk and she often helped the rider by counting the strides out loud. Cecilia (N1) often addressed multiple different aspects of the horse’s and rider’s performance during her lessons, with a broader focus compared to the other teachers. She gave about the same number of instructions regarding the riders’ seat and hands as the other teachers, but she additionally addressed a number of other aspects during each transition. Anna, Bella and Cecilia all instructed that it was important to keep the *horse straight* in the transitions. For example, Anna gave the following instruction (to a rider trotting in left direction): “*then you have to have him straight and sort of close the outer door and ride him forward to the left so rather a little open left rein, yes like that, and find the left hind leg*”. Diana (N2) focused less on the straightness of the horse compared to the other teachers and more on *precision in the transitions.* She asked the rider to perform the transitions at a specific point, “*we must have it on that letter*”. She also addressed the *horse’s rhythm in walk* more frequently than any of the other teachers.

The substantial differences in lesson structure and focus between the riding teachers reveals the gap of knowledge in the best way to give a riding lesson (e.g. Dashper, 2016) and shows that there is not one common ground for teaching riding. Rather, a substantial part of a riding teacher’s professional knowledge is based on individual experience. We believe that the current study, and future similar research, are important, both for documenting riding teachers’ existing knowledge, and to stimulate discussions on best practices.

Rein tension and horse and rider movements

Fig 1 shows an example of rein tension, horse and rider movement data and footage from one transition sequence as an example. Differences in horse and rider movements and rein tension during lessons with different riding teachers appear to reflect differences in the lesson structure and instruction focus. Anna (S1) and Diana (N2) spent a third or more of their lessons preparing the students for the given task, and when their students subsequently performed trot-walk transitions on the long side, maximum rein tension just before and during down-transitions was lower, compared to the other teachers. In preparation for down-transitions, the difference in maximum rein tension between Bella and Anna was 20 N per rein on average, which corresponds to approximately 4 kg of extra load in the horse’s mouth. A similar but smaller difference was observed comparing Cecilia to Diana. This may suggest that the riders struggled more in their communication with the horse during the transitions when these were less prepared. Teachers Bella (S2) and Diana (N2) had a relatively greater focus on the walk, in comparison with Anna (S1) and Cecilia (N1), who focused more on the horse to be quick, energetic and attentive, ready to transition back to trot after only a few walk strides. These differences also seem to be reflected in the measurements. Bella’s students achieved walk with a phase shift (relative timing within the stride cycle) of 16-17% between the up-down movement of the withers and croup, closer to the ideal 25% than for any other riding teacher. During Diana’s lessons, the average stride-to-stride difference in hind limb retraction in walk was 1.2-1.3°, compared to 1.5-1.7° for the other teachers, which suggests that the walk was more symmetric and regular. Confirming our hypothesis, these results show that an experienced riding teacher can have a consistent influence across an entire group of riders, at least if the riders have a similar skill level.

The project has been financed by:
STIFTELSEN HÄSTFORSKNING

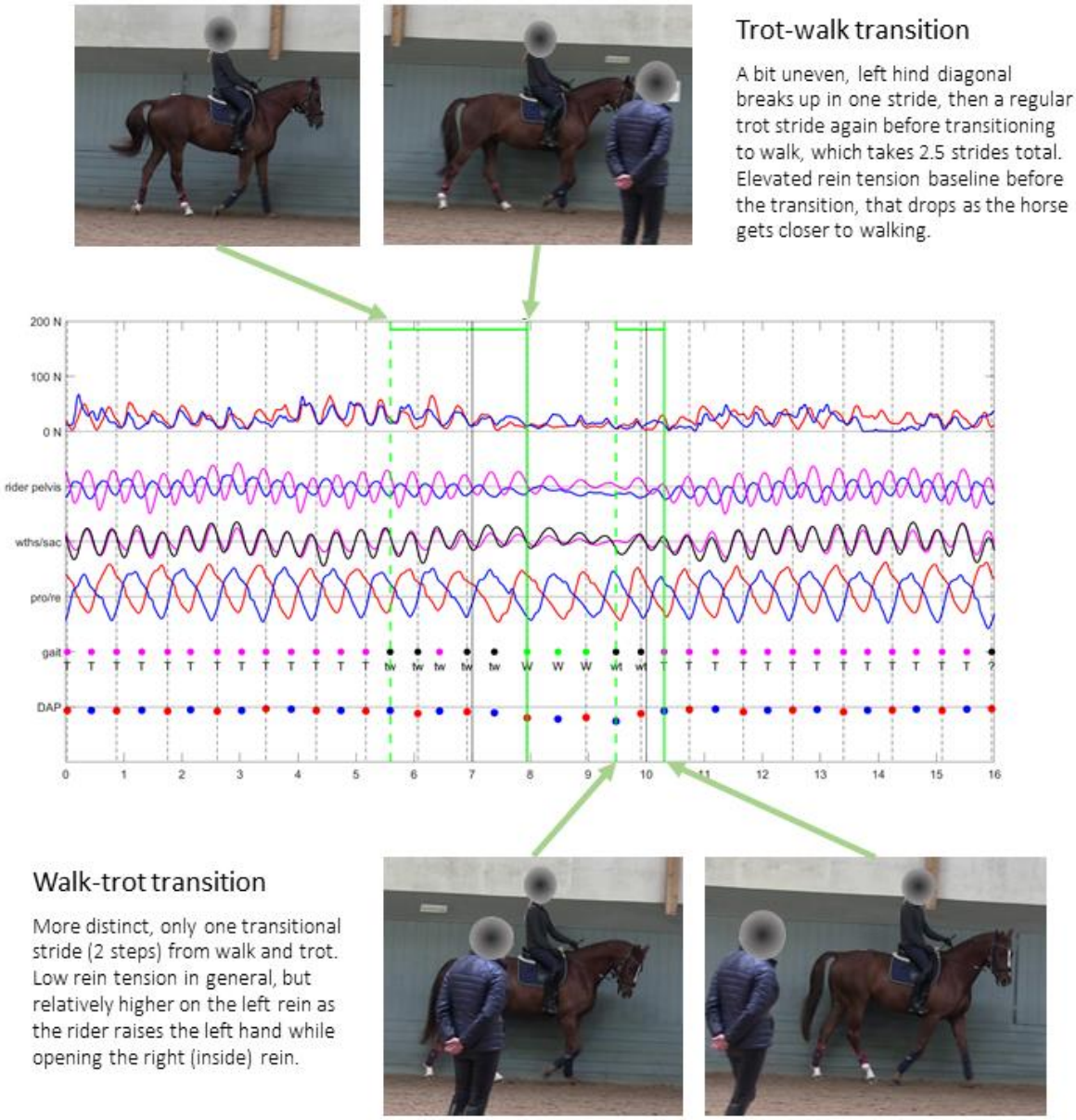

Fig 1. **Rein tension, horse and rider movement data and images from synchronised video from one example transition sequence**. Top row: rein tension (blue right rein, red left rein). Second row: rider pelvic forward-backward rotation (magenta) and vertical transition (blue). Third row: vertical translation of the horse's withers (magenta) and croup (black). Fourth row: protraction-retraction of the hind limbs (blue right, red left), positive for forward reach. Fifth row: gait classification based on limb timing (magenta trot, black undefined/transitional stride, green walk) and letters to indicate transitions (tw trot-walk, wt walk-trot). Bottom row: hind limb diagonal advanced placement relative the diagonal forelimb (time delay at hoof on, blue right hind, red left hind). Vertical green lines indicate transition phases identified from the biomechanical data, grey solid lines when transitions were visually perceived to occur, and interrupted lines touchdowns of the left hind limb. X-scale in seconds.

Progression and learning

Learning can be defined as a change in behaviour and has been studied using conversation analysis (e.g. Melander 2009). In the current study, this was addressed by categorising the feedback given by the riding teacher, corrective versus positive, and relating this to horse and

The project has been financed by:
STIFTELSEN HÄSTFORSKNING

rider movements and rein tension. A common pattern during the lessons was that the riding teacher asked the rider to repeat the transitions in the same direction until the rider was able to reach the intended goal, at least to some extent, which was acknowledged through positive feedback. However, there were some differences between riding teachers in how many transitions that were followed by corrective or neutral versus by positive feedback, particularly comparing teachers S1 and N1 (mean 2.8 vs 2.0, Table 2). This likely relates to that N1 had a broader focus and strived to improve several different aspects of the horse's and rider's performance, whereas the other teachers often focused on one or a few aspects with each student. Adjusting for riding teacher feedback in the statistical models had no substantial effects on the differences in horse and rider movements and rein tension levels between riding teachers. This suggests that the horses' and riders' performance was still relatively comparable across teachers. However, several associations were found between corrected versus positive feedback and the biomechanical measurements. For example, when the feedback was more positive median rein tension in preparation for trot-to-walk transitions was lower for both N1 and N2. It is more difficult to evaluate whether this change in behavior reflects actual learning. This is in part due to the fact that horses and riders were started on a single day. However, preliminary in-depth analysis of the interactions between rider and teacher shows that there is no direct correlation between specific instructions given during the transitions and actual change of behaviour in horse and rider. It seems the whole lesson design and context is more important than directly given instructions. One reason for this might be that riding is an embodied and practical skill that is difficult to teach, where language and terminology becomes a limitation, and that riders have to develop over time, during multiple lessons together with well-educated horses.

Table 2. Progression level based on riding teacher feedback. Grade levels were defined as follows. 1: corrections, 2: no correction but no or neutral evaluation, 3: mildly positive evaluation, e.g. "okay" or "better", 4: positive evaluation (e.g. "good"), 5: strongly positive evaluation (e.g. "great", "brilliant").

A) Trot-walk transitions

Teacher	Mean	Std Dev	Min	Median	Max
S1	2.8	1.30	1	3	5
S2	2.6	1.07	1	2	5
N1	2.0	1.04	1	2	4
N2	2.4	1.02	1	2	5

B) Walk-trot transitions

Teacher	Mean	Std Dev	Min	Median	Max
S1	3.0	1.28	1	3	5
S2	2.6	1.08	1	2	5
N1	2.0	1.04	1	2	4
N2	2.4	1.01	1	2	5

The project has been financed by:
STIFTELSEN HÄSTFORSKNING

Conclusions

The current study found, in accordance with our hypothesis, that riding teachers have an influence on the movement pattern of the horses and riders they teach, as well as the levels of rein tension. Further, the results highlight the importance of lesson planning: it is not only about what you ask the students to do, or how, it's also about the order and relative difficulty of consecutive exercises. The design of the whole lesson, and probably series of lessons, needs to be considered and can be leveraged.

Given the setting and that the riding teachers were studied for just one single day, the results of the current study should not be viewed as indicative that one teacher is better than another. Rather, the current results highlight the importance of preparation and lesson design. It seems that thoughtful chaining of exercises during the lesson can be equally or more important for achieving less conflict between horse and rider, as opposed to instructions given during the exercise, at least within the context of a single lesson.

From the collected material, it appears that the teachers did not always consciously intend to achieve the specific measurable effects that were seen. In general, increased reflection and feedback on the effects and consequences of certain choices could be supportive to riding teacher's professional development.

The identified gap in knowledge on how to instruct riding technique effectively and how to guide a rider to correct position in the saddle needs to be followed up on. Learning more about how to give easy-to-understand instructions and how to design pedagogical riding lessons is both an opportunity and a responsibility to safeguard and improve welfare for riding horses while also achieving good performance and effective learning.

Relevance for the practical horse sector incl. recommendations

- Proper preparation for each exercise, avoiding of steep increases in the level of difficulty, appears to be an effective approach to reducing conflict between horse and rider, at least within the context of a single lesson.
- Increased reflection and feedback on the effects and consequences of certain choices could be supportive to riding teacher's professional development. Review of video recordings from lessons is likely useful for this purpose, in addition of measurements of horse and rider movements or rein tension.
- It is important to make room for and create a more allowing climate towards communication and discussion during riding lessons. Maybe plan for extra time in beginning or in the end of lessons to enable dialog between teacher and rider.
- Continued research in close connection with practitioners and participants to expand the field of knowledge about how to instruct riders regarding seat and position in the saddle is warranted, in order for riders to effectively learn how to give timed and correct aids to the horse.

The project has been financed by:
STIFTELSEN HÄSTFORSKNING

References

Bosch, S., Serra Bragança, F., Marin-Perianu, M., Marin-Perianu, R., van der Zwaag, B.J., Voskamp, J., Back, W., Van Weeren, R., Havinga, P. (2018) Equimoves: A wireless networked inertial measurement system for objective examination of horse gait. *Sens Switz*. 18. doi:10.3390/s18030850

Dashper, K. (2016) Learning to communicate: The triad of (Mis)Communication in horse riding. In Davis, D.L. & Maurstad, A. (Eds.) *The meaning of horses: Biosocial encounters* (pp.87-101). New York: Routledge.

Egenvall, A., Eisersiö, M., Roepstorff, L. (2012) Pilot study of behavior responses in young riding horses using 2 methods of making transitions from trot to walk. Journal *of Veterinary Behavior* 7, 157-168.

Goodwin, C. (2000) Action and embodiment within situated human interaction. *Journal of Pragmatics 32*, 1489 - 1522.

McLean, A.N., Christensen, J.W. 2017. The application of learning theory in horse training. *Applied Animal Behaviour Science*, 190, 18–27.

Mehan, H. (1979) *Learning lessons: Social organization in the classroom*. Cambridge MA: Harvard University Press.

Melander H. Trajectories of Learning: Embodied Interaction in Change. Doctoral dissertation, Uppsala Studies in Education 124. Acta Universitatis Upsaliensis 124. 2009. Available: http://www.diva-portal.org/smash/get/diva2:212141/FULLTEXT01.pdf

Lundesjö Kvart, S (2020a) *Konsten att undervisa ryttare – En studie om ridlärares pedagogiska praktik.* Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Educational Sciences 18. Uppsala.

Lundesjö Kvart, S. (2020b) Instructions in horseback riding – The collaborative achievement of an instructional space. *Learning, Culture and Social Interaction* 25, 100253.

Schegloff, E.A. (2007) *Sequence Organization in Interaction. A Primer in Conversation Analysis*. Cambridge: Cambridge University Press.

Starling, M., McLean, A., McGreevy, P. (2019) The contribution of equitation science to minimising horse-related risks to humans. *Animals*, 6, doi:10.3390/ani6030015.

Tijssen, M., Hernlund, E., Rhodin, M., Bosch, S., Voskamp, J.P., Nielen, M., Serra Braganca, F.M. (2020) Automatic hoof-on and -off detection in horses using hoof-mounted inertial measurement unit sensors. *PLoS ONE*, 15. doi:10.1371/journal.pone.0233266

Zetterqvist Blokhuis, M. (2019) *Interaction Between Rider, Horse and Equestrian Trainer – a challenging puzzle*. Södertörn doctoral dissertations 162. Elanders, Stockholm.

The project has been financed by:

STIFTELSEN HÄSTFORSKNING

Part 3: Results dissemination

Scientific publications, ***published***	Anna Byström, Agneta Egenvall, Marie Eisersiö, Maria Terese Engell, Sigrid Lykken, Susanne Lundesjö Kvart: The impact of teaching approach on horse and rider biomechanics during riding lessons. (2025) *Heliyon, e41947, doi.org/10.1016/j.heliyon.2025.e41947.*
Scientific publications, ***submitted***	
Scientific publications, ***manuscript***	Susanne Lundesjö Kvart, Agneta Egenvall, Marie Eisersiö, Maria Terese Engell, Sigrid Lykken, Anna Byström: What can be achieved in 20 minutes? Progression during riding lessons with a focus on walk-trot transitions.
	Susanne Lundesjö Kvart, Marie Eisersiö, Agneta Egenvall, Maria Terese Engell, Sigrid Lykken, Anna Byström: The gap between riding teachers' professional vision and behavioural change.
Conference publications/ presentations	Susanne Lundesjö Kvart, Anna Byström, Maria Terese Engell, Marie Eisersiö, Agneta Egenvall, 2022, oral presentation, It's all about the timing – teaching equestrian feel in practice, ON HORSES, Hervas, Spain, 20221111-20221113.
	Susanne Lundesjö Kvart, Marie Eisersiö, Maria Terese Engell, Agneta Egenvall, Anna Byström, 2023, Preparation and understanding are required to learn an embodied skill like riding, accepted poster presentation, European Conference for Sport Science (ECSS), Paris, France 20230704-20230706.
	Anna Byström, Agneta Egenvall, Marie Eisersiö, Maria Terese Engell, Sigrid Lykken, Susanne Lundesjö Kvart. 2024, Riding teachers can affect horse and rider biomechanics in the design of their lesson, European Federation of Animal Science (EAAP), Florence, Italien, 20240901-20240905

The project has been financed by:
STIFTELSEN HÄSTFORSKNING

Other publications, *media etc.*	
Oral communication, *to horse sector, students etc.*	Ridundervisning sett med “nya” ögon. 2023-04-28, Presenterat av Susanne Lundesjö Kvart vid ”Digital hippologdag” med 60 anmälda alumner.
	Föreläsning av Susanne Lundesjö Kvart inom ramen för kursen ”Didaktik för ridlärare” som ges för åk 3 Hippologprogrammet vid SLU. 20230418 samt 20230420
Student theses	Matilda Lundqvist, Handledare Susanne Lundesjö Kvart, 2023, Ridlärarens instruktioner på väg mot ryttarkänsla, Hippologiskt examensarbete 15 hp, Hippologenheten, SLU
Other	

The project has been financed by:
STIFTELSEN HÄSTFORSKNING