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AN ANALYSIS OF PERFORMING A MOTOR TASK OF ASKING FOR CANTER AS AN EXAMPLE OF A TEST THAT ALLOWS THE OPTIMISATION OF THE TRAINING PROCESS

Olga Grabowska, Anna Albera-Łojek, Jacek Łojek

Warsaw University of Life Sciences, Animal Breeding and Production Department, Ciszewskiego 8, 02-786, Warszawa, Poland

Bazując na materiale wizualnym w postaci nagrań przejazdów programów ujeżdżeniowych, wykonywanych podczas rozgrywania Halowego Pucharu Polski w kategoriach juniorów i młodych jeźdźców, dokonano analizy sposobu realizowania zadania ruchowego „zagalopowanie". Podstawą oceny prawidłowości wykonania zadania przez 33 pary jeździec – koń, było określenie stopnia zgodności kolejności stawiania kończyn z regułą ustaloną wzorcem prawidłowości chodu. Dokumentowano ruch zagalopowanie wykonywany z kłusa i ze stępa. Sposób i prawidłowość zrealizowania zadania ruchowego skonfrontowano z informacjami o wysokości not przyznawanych za jakość jego wykonania przez sędziów dyscypliny ujeżdżenie. Niezależnie od faktu czy zagalopowanie poprzedzał stęp czy kłus nie odnotowano przypadku wykonania charakteryzującego się występowaniem wszystkich sześciu, zgodnych z wzorcem faz, w tym także fazy lotu. W większości przypadków w pierwszej foulé galopu zaobserwowano brak obecności fazy lotu. Przyczynami zaburzeń wzorcowego szyku kroków wydaje się być zbyt mała wartość prędkości pionowej, szczególnie w przypadku zagalopowania ze stępa, uniemożliwiająca zarówno rozpoczęcie galopu, jak również pojawienie się fazy lotu pomiędzy pierwszą a drugą foulé galopu oraz brak przemieszczenia środka ciężkości w kierunku zadu powodujący jego niedostateczne podstawienie i zaangażowanie kończyn tylnych. Zaobserwowano także, że zadziałanie pomocy jeźdźca w nieodpowiedniej fazie stawało się dla konia bodźcem do przyjęcia dodatkowej, wykraczającej poza schemat pozycji ale umożliwiającej wykonanie żądania. Stworzenie karty oceny zadania ruchowego, obrazującej kolejności stawiania kończyn podczas ruchu, może stanowić podstawę dokonywania porównań sposobu realizowania zadania przez różnych zawodników i różne konie, jak również przedyskutowania sposobów rozwiązywania pojawiających się problemów podczas spotkań szkoleniowców.

Słowa kluczowe: konie sportowe, zagalopowanie, zaburzenie ruchu, dokumentacja treningu

The perfect training of the rider and the possession and exhibition of characteristics, such as coordination of movement, involvement and control of its own body, by the horse are required to take part and achieve satisfactory results in any of the Olympic horse riding disciplines. The effect of the work performed by the rider-horse pair results from the level of training of both the human and the animal. The horse education process focuses on the improvement of its natural balance, maintaining the flexibility of its movements and

developing the obedience and willingness to cooperate with the rider, which makes it possible for the rider to demonstrate the horse's innate motor potential. The most important characteristics that a riding horse should have as well as the order of learning and working steps aimed at improving them are determined by the training scale. In some disciplines which can be classified as "artistic" sports, the rider must focus on the beauty of the movement and the "quality" of its performance (Czajkowski, 2002). As these attributes are developed and perfected through strength, endurance and dressage exercises (D'Orgeix, 1986), it is important to define the strategy for the horse's process of education and consolidation of the acquired skills.

One way to improve the training process for athletes practicing different sports is to verify the training cycle based on collecting physical fitness test results. Test-based control fulfils the information functions needed to conduct the training process without being its autonomous element, and the obtained information enables its optimisation (Sozański et al., 1999a). In horse riding, competition report sheets are the only document form used for recording data about the results achieved in the competitions and comparing these results. However, there are no objective tests for evaluating the level and quality of the execution of individual motor tasks which form the basis for correcting the work patterns and formulating conclusions for the purpose of improving subsequent training stages and create a plane for the exchange of experience between trainers. The widespread use of video cameras which can be operated without any special qualifications makes it possible to document dressage tests during competitions and daily training, providing a basis for the development of evaluation tests and assumptions as well as a progress analysis based on objective measurements of qualitative characteristics. The development of tests based on a video documentation analysis can allow riders and trainers of technical equine disciplines to continuously monitor the training level and facilitate the confrontation with emerging problems and their verification methods.

A time-lapse analysis of the video material also makes it possible to indicate the qualitative differences in the performance of the motor task, which consists in, for example, different positioning of the horse nose in relation to the ground or discrepancies in the stride length of the first and second foulée of the canter when the horse's diagonal leg pair is touching the ground. This information is relevant in view of the fact that trainers and judges limit their observations only to qualitative assessment since they do not have the measuring instruments necessary to perform a quantitative assessment.

In this paper, an analysis of the performance of the motor task of asking for canter was carried out in two variants: in the first one, the preceding gait was the walk, and in the second one the preceding gait was trot.

The aim of the paper was to create documentation of the aforementioned motor task and analyse the correctness of its execution in terms of its compliance with established canter patterns. The completed procedures can be

used as an example of a test which provides the trainer with information and guidelines for the verification of the training process and optimisation of the training results for both riders and horses based on the interpretation of the causes of the errors observed during the test.

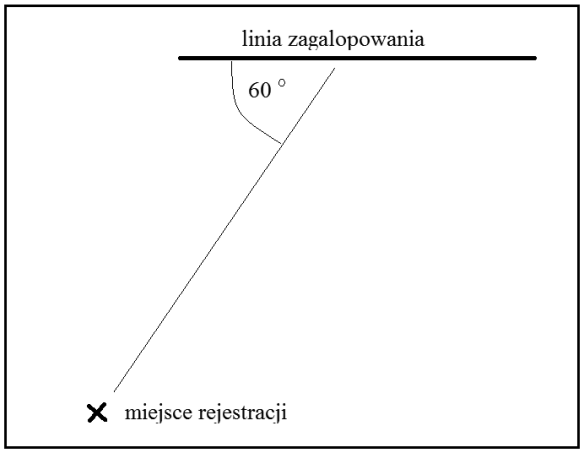
Material and methods

The visual research material included recordings of the performance of the motor task of asking for canter, which is a component of dressage programmes presented as part of HPP (Polish Indoor Cup) competitions by competitors in the categories of juniors and young riders. The rank of the event translates into the level of training of its participants, so the recorded tests were performed by a group of the best-trained athletes in the above-mentioned age categories.

The analysis of the research material also used the information about the scores awarded by the judges for the correctness of the performance of the motor task in question. For this reason, only these dressage discipline programmes were selected for the observation in which the task of asking for canter was an independent element that was subject to assessment, i.e. N-6, N-8, N-9 and C-4 programmes. The choice of the motor task of asking for canter as the basis for the analysis was dictated by the following premises:

– its proper performance is a basic technical skill of horses taking part in both dressage competitions and other equestrian disciplines;

– restricting the observations to the selected programmes made it possible to determine to what extent the scores awarded by the judges reflect the correctness of the performance of the gait defined by the pattern.



linia zagalopowania – canter line
miejsce rejestracji – place of registration

Fig. 1 Diagram showing the motor task registration

The analysed material included 33 observations recorded with the Sony Cybershot DSC H10 camera and processed in Movie Maker software, which enabled the analysis of the recorded material with the accuracy of 0.2 seconds (30 frames per second). The distance between the place of recording and the competitor was 25 m and the angle of recording, which resulted from the fact that the material was recorded during competitions, was about 60° (Fig. 1). The angle measure did not affect the error of the obtained results, since the basis for their development was the sequence of horse strides.

The process of evaluating the task was based on the determination of the level of compliance of the sequence in which the horses put their legs on the ground with an established pattern of the correct gait. Asking for canter from trot and walk was documented in order to record any dependencies of the correctness of performance of the motor task on the characteristic features of the preceding gait (its speed and the presence or lack of the suspension phase). The moment of suspension over the ground when no horse leg is in contact with the ground is referred to as the suspension phase. It only occurs when the horse is moving at a high vertical speed. There are two suspension phases in the trot and one in the canter (Clayton, 2001).

Custom-built tables were used to determine the sequences of strides by recording the order of their execution. The recorded sequences were compared to the gait pattern (Tab. 1) in the Judges' Guide (Przewodnik dla sędziów, 2016), which made it possible to determine the intermediate phase. The intermediate phase was defined as the presence of strides or behaviour of the animal that is incompatible with the pattern of both the gait preceding the transitioning to canter and the canter itself, performed by the horse between the last stride of the preceding gait and the first stride that starts the canter sequence.

The beginning of the canter phase was defined as the position where only the hind leg starting the movement touches the ground, followed by the two diagonal legs and finally the last fore leg hitting the ground. The gait is not symmetrical, so the movement performed by the right and left sides of the body changes (Leach, 2012; Starke et al., 2009). In non-symmetrical gaits, the horse can move in two ways, and in each variant, the right- and left-side legs perform different movements, which require a certain level of coordination for the correctness (Robbiliard et al., 2007). The lack of coordination may be manifested by the horses' preference for cantering on one of the sides. The asymmetry of the gait also translates into varied loading mainly on the fore legs. The fore leg which is last to strike the ground is loaded most heavily (Ratzlaff et al., 1987).

The research material included only these dressage programmes whose performance met the following conditions:

– the canter depart took place without any sign of horse's resistance;
– the route that the horse followed was a straight line.

Table 1. Left (L) and right (R) lead canter position

L – canter on the left lead R – canter on the right lead

Position number	Leg				Suspension phase	Number of supporting legs	Position number	Leg				Suspension phase	Number of supporting legs
	right fore	left fore	right hind	left hind				right fore	left fore	right hind	left hind		
1			x			1	1				x		1
2	x		x	x		3	2		x	x	x		3
3	x			x		2	3		x	x			2
4	x	x		x		3	4	x	x	x			3
5		x				1	5	x					1
6					x	0	6					x	0

Table 2. Left (L) and right (R) lead canter position without the suspension phase

L – canter on the left lead R – canter on the right lead

Position number	Leg				Suspension phase	Number of supporting legs	Position number	Leg				Suspension phase	Number of supporting legs
	right fore	left fore	right hind	left hind				right fore	left fore	right hind	left hind		
1			x			1	1				x		1
2	x		x	x		3	2		x	x	x		3
3	x			x		2	3		x	x			2
4	x	x		x		3	4	x	x	x			3
5		x				1	5	x					1
6		x	x			2	6	x				x	2

The collected material was analysed for the correctness of its performance within four canter parameters:

– the number of positions in the 1st foulée;
– the number of positions in the intermediate phase (which "falsifies" the pattern) if the performed gait included the suspension phase;
– the number of positions in the intermediate phase if no suspension phase was recorded in the performed gait;
– the presence of the suspension phase.

Results

It was found through the observations that, in the case of a transition to canter without the suspension phase, the sixth position in the reference stride sequence, which is assigned to the suspension phase, was substituted by the horses with the inner fore leg and outer hind leg simultaneously touching the ground (Tab. 2). For the purposes of this paper, this position sequence in the canter is called a canter order without the suspension phase.

The results of the observations are summarised in Table 3 to illustrate the values taken by the motor task parameters, such as the number of positions in the 1st foulée, the presence or absence of the suspension phase, the number of positions of the intermediate phase (given in two options: the degree of compliance with the pattern of the canter with the suspension phase, thus determining the number of its successive positions in accordance with the above-mentioned pattern, and based on the same principle of degree of compliance with the canter order without the suspension phase).

The recorded numbers of canter positions performed in the first foulée had values between 6 and 8, and their median was 7. This fact indicates the existence of gait irregularity. There were no cases of a reduced number of canter positions compared to the reference number defined by the pattern. This suggests that the primary reason for the loss of gait regularity may have been that the horse's vertical speed was too low at the moment immediately preceding the transition to canter, which resulted in an insufficient use of the potential of the hind leg that propels the animal's body forward and is responsible for the "quality" of its performance. The difficulty in achieving the right vertical speed, which translates into the correctness of the performance of the transition to canter, may have been clearer in the cases of transitions to the canter from walk, which is the slowest horse gait.

In the sixteen observations which were in line with the gait pattern in terms of the number of recorded positions, the suspension phase appeared only 2 times and was present only in cases where asking for canter was preceded by trot. The sequence in which the legs hit the ground was compliant with the pattern of the canter with the suspension phase in 8 observations and with the order of the canter without the suspension phase in 23 observations. Regardless of whether

or not asking for canter was preceded by walk or trot, no case was recorded where all six positions compliant with the position pattern, including the suspension phase, were present. In 2 observations, the horse did perform 6 positions and the suspension phase, but the compliance with the pattern was limited to the position number only, since one of the positions was "modified" by the horse (two hind legs were in contact with the ground instead of three legs). Probably, the cause of the difficulty in the correct transitioning to canter was not a loss of balance, but rather insufficient involvement of and putting down the hind legs underneath.

25 observations revealed the occurrence of an intermediate phase preceding the start of the canter, resulting from the gait irregularity, i.e. the reference sequence in which legs hit the ground, unchanged regardless of the length of the stride (Przewodnik dla sędziów, 2016). The irregularity occurring at the highest frequency consisted in:

- omitting or adding a gait position;
- a complete change of the sequence of strides;
- the change of the stride immediately preceding the first canter position.

The presence of an intermediate phase may indicate that the horse is not correctly positioned and balanced, which are conditions for the performance of the transition to canter. The rider's aids introduced in the wrong gait phase may be a stimulus for the horse to assume an additional position that did not correspond with the pattern but enabled the horse to perform the task. For this reason, it seems important in the development of rider's technique to create kinesthetic experiences that constitute the highest level of coordination abilities. The rider who not only feels the movement but also understands it deeply can set conditions necessary to perform the movement (Starosta, 2011). It is ideal to have such "feel" for the horse movement that can replace the need for the visual assessment. The signal time on the kinesthetic analyser circuit is several times shorter than that on the visual analyser circuit (Sozański et al., 1999 b).

The knowledge of gait characteristics makes it possible to attempt to make conclusions about the causes of the irregularities. Below presented are examples of recorded disturbances in the correct execution of the analysed motor task, along with an attempt to justify the causes of the stride sequence changes.

1. Gait irregularity consisting in omitting a phase during the transition to canter on the left fore lead from walk

After the performance of the two successive phases typical of the walk pattern, i.e. phases where two fore legs and one hind leg are on the ground at the same time, followed by the left fore leg and left hind leg hitting the ground, the horse is supported on a diagonal pair (left fore and hind right), which is present in the gait pattern but does not occur immediately after two previously mentioned movements.

Table 3. Selected parameters subjected to observation

Observation number	Programme	Canter's side (1 – right 2 – left)	Preceding gait (1 – walk 2 – trot)	Number of positions in the intermediate phase		Number of positions in the first foulée	Presence of the suspension phase (0 – none 1 – present)	Average score of three judges
				according to the pattern with the suspension phase	according to the order without the suspension phase			
1	C-4	2	2	3	0	6	1	5.67
2	C-4	2	2	3	0	6	1	6.33
3	C-4	2	2	5	1	6	0	6
4	C-4	2	2	14	8	7	0	5.67
5	C-4	2	2	0	0	7	0	6
6	C-4	2	2	2	0	7	1	7
7	C-4	2	2	3	1	7	1	7
8	C-4	2	2	2	0	6	0	6
9	N-6	2	1	0	0	7	0	7
10	N-6	2	1	1	0	7	0	6.67
11	N-6	2	1	1	0	6	0	6.67
12	N-6	2	1	0	0	6	0	7
13	N-6	2	1	0	0	6	0	6
14	N-6	2	1	3	2	8	0	6
15	N-8	1	1	4	3	8	0	5.33
16	N-8	1	1	2	0	6	0	6.67
17	N-8	1	1	1	0	6	0	5.67

18	N-8	1	1	1	0	7	0	6.67
19	N-8	1	1	7	6	6	0	5.33
20	N-8	1	1	1	0	6	0	6
21	N-8	1	1	0	0	6	0	6
22	N-8	1	1	0	0	6	0	6.33
23	N-8	1	1	1	0	8	0	5.67
24	N-9	1	1	7	7	7	0	5.67
25	N-9	1	1	1	0	6	0	6
26	N-9	1	1	1	0	8	0	6.67
27	N-9	1	1	0	0	7	0	6.67
28	N-9	1	1	2	0	7	0	6.67
29	N-9	1	1	5	3	7	0	6.33
30	N-9	1	1	0	0	6	0	4.33
31	N-9	1	1	6	1	7	0	6.33
32	N-9	1	1	2	1	8	0	6
33	N-9	1	1	2	0	6	0	6
AVERAGE				2.42	1	6.67	0.12	6.16
RANGE OF VALUES			MIN.	0	0	6	0	4.3
			MAX.	14	8	8	1	7

The irregularity may have been caused by the necessity to increase the speed necessary to transition to canter. With a lower number of supporting legs, maintaining balance requires a higher movement speed. The horse changed the walk stride sequence by omitting the position where three legs are in contact with the ground (both hind legs and the left fore leg), thus reducing the number of supporting legs to two. It can be assumed that since there was no loss of balance, the speed was increased to allow for the transition to canter.

2. Asking for canter from trot on the left lead where the sequence of strides does not correspond to any of the gait patterns

The optimum moment for the change of the gait when transitioning from trot to canter while maintaining the stride sequence compliant with the pattern occurs in the position where the right hind leg, which starts the first canter stride, is on the ground. The preceding phase, where the diagonal pair (right hind leg and left fore leg) touches the ground, is a common position for both trot and canter.

The movement sequence of the example in question starts with the suspension phase and the diagonal pair (right fore leg and left hind leg) on the ground. While both of these positions belong to the trot pattern, the three consecutive positions (both fore legs and the left hind leg touching the ground, followed by the left fore leg only and finally the left fore leg with the right hind leg) do not reflect the order of any gait patterns. There is some resemblance to the pattern of canter strides, but the absence of the suspension phase after using the left fore leg as the sole support point is non-compliant with the pattern.

Just like in the first example, the horse intuitively tries to increase the speed to enable the transition to canter. It performs a neck swing, which results in a shift of the centre of gravity towards the croup when the hind leg is added the fore leg acting as a support. As a result of the shift of the centre of gravity, the hind leg starting the canter becomes the supporting leg. The mass of the horse's neck and head is relatively large, as it is approx. 10% of the total body weight of the horse (Leach, 2012). Its movements cause the body's centre of gravity to shift (Clayton and Sha, 2006), which helps to load or unload the fore leg. It can be inferred that the intermediate phase of the above-mentioned example corresponds to the canter without the suspension phase.

3. Asking for canter from walk on the right fore lead during which the change of the stride that directly precedes the first canter phase occurred

The first two phases of the gait were typical of the walk pattern: the horse simultaneously puts both fore legs and the right hind leg on the ground, followed by the right fore leg and the right hind leg. The gait regularity was distorted by the diagonal pair of right fore left and left hind leg being put on the ground in the next stride. The cause can be seen in the gait speed being too low to be able to transition to canter or the lack of coordination between the action of the rider's aid and the walk phase of the animal. The horse's reaction was triggered by the desire to respond to the rider's signal as quickly as possible. The phase immediately preceding the first canter stride (when only one of the hind legs is in contact with the ground) is always being diagonally supported on the hind leg

and the fore leg. The horse, wanting to execute the command, modified the order of the strides.

The collected research material in the form of video recordings of the performance of the motor task of asking for canter was confronted with the information about the scores awarded by the judges for the quality of performance of the analysed movement. According to the dressage discipline regulations (PZJ, 2012), the performance of collected canter as a gait without the suspension phase can, in the judge's opinion, get the maximum score of 5 out of 10. The research material showed that although the suspension phase did not occur in any case of transitioning to canter from walk, the average scores awarded by the judges were more than 6 points (6.15 point) and the maximum scores were 7 points.

Discussion

Regardless of the type of the gait preceding the performance of the motor task of asking for canter, in most cases, the absence of the suspension phase typical of the gait pattern was observed in the first foulée of the canter.

As stated in PZJ (2012) regulations, the leg support phase in trot is divided by the suspension phase. Therefore, the body of the horse has a certain level of kinetic energy before the start of the canter, which makes it possible for the suspension phase to be present already in the first canter stride. The absence of the suspension phase in some of the performed transitions to canter preceded by trot suggests that the energy potential is not the only and sufficient condition for its appearance.

The causes of the observed irregularities of movement were associated with a too low vertical speed that made it more difficult to both start the canter and execute the suspension phase between the first and second foulée of the canter and/or the lack of the shift of the centre of gravity toward the croup, causing the horse to involve and bring its hind legs propelling it forward more underneath itself.

A visual confirmation of the degree of involvement of the croup during the movement may be the angle measure of the working jock joints. The task of a rider is to maximise the horse's movement potential. This is possible at the moment of transferring the body weight to hind legs and their bending, which creates conditions for full use of the muscle strength. Strides become shorter, more elastic and elevated, and the horse is "collected" (Skulicz, 1992).

Moghaddam & Khosravi (2008) suggested identifying the jump over an obstacle with the suspension phase in the canter, thereby unifying the conditions for proper performance of the jump with the conditions necessary for the suspension phase to occur. By analysing the effect of the vertical and horizontal speeds on the jumping technique of young, inexperienced horses, Powers et al. (2012) found that horses with lower horizontal speed and higher vertical speed did not make mistakes while jumping over obstacles. Achieving a lower vertical speed relative to the horizontal speed causes an inefficient use of the energy of elasticity of the hind legs, resulting from an insufficient transfer of the centre of gravity to the animal's hindquarters.

The absence of the suspension phase due to the insufficient involvement of the hind legs can be a consequence of the current level of training of the horse, the acquisition of only some components of the training scale, the incomplete development and degree of training of the muscular system or the lack of perfection in animal's balance and coordination. Therefore, it seems acceptable in the early stage of horse training to transition to canter from walk in which the first stride of the canter is a sequence of strides without the suspension phase. The deviation from the movement pattern should only apply to the change of the last position of the canter in which the suspension phase is replaced by putting the legs on the ground in a manner typical of the last position of the first foulée and the first position of the second foulée. Any other modification or introduction of additional phases, which indicate the lack of coordination of movement, should be considered errors.

Recording training sessions to analyse the order in which legs are put on the ground in cases of deviations from the sequence described by the pattern should provide trainers and riders with a basis for drawing conclusions about the causes of the errors and make it possible to answer the question whether their cause is the loss of balance, the lack of rider's professionalism in using aids or too little croup muscle involvement.

Recording progress in the training process as well as performing a qualitative assessment of the way the task is performed seems justified and useful (Powers & Harrison, 1999). Creating a motor task performance evaluation sheet which will reflect the order in which legs touch the ground during the movement can be a source of information that makes it possible to make comparisons between different competitors and different horses, as well as present and discuss common ways of solving emerging problems during trainers' meetings.

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OLGA GRABOWSKA, ANNA ALBERA-ŁOJEK, JACEK ŁOJEK

An analysis of performing a motor task of asking for canter as an example of a test that allows the optimisation of the training process

SUMMARY

On the basis of the recordings of dressage tests performed during HPP (Polish Indoor Cup) in the categories of juniors and young riders, an analysis of executing a motor task of asking for canter was prepared. The process of evaluating the task completed by 33 rider-horse pairs was based on determining the level of compliance of the sequence in which the horse puts its legs on the ground with an established pattern of the correct gait. The documented movements included asking for canter from trot and walk. The method of completing the task was confronted with the information concerning the scores awarded by dressage judges for the quality of the performance. Regardless of whether the transitions to canter occurred from walk or trot, neither of the performances contained presentations of all six phases, including the suspension phase. In the majority of cases there was no suspension phase in the first fouleé of the canter. Presumably, one of the main reasons for not following the established gait pattern is low vertical speed and kinetic energy which make it impossible to pick up canter or introduce the suspension phase between the first and second fouleé of canter. The second reason is not shifting the centre of gravity towards the croup causing the horse to bring its hindquarters more underneath himself. Moreover, it has been observed that the rider's aids introduced in the wrong phase were a stimulus for the horse to assume an additional position that did not correspond with the pattern but enabled the horse to perform the task. Creating a motor task evaluation form that would illustrate the order in which the horse puts its legs on the ground could prove very useful for comparing the ways of performing the task by different competitors and their horses, as well as for finding ways of solving the problems that appear during the instructors' meetings.

Key words: sports horse, asking for canter, movement disorder, training documentation