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Examensarbete på kandidatnivå **2016**

A Description on How Horses' Jumping Technique Changes Over Time Following "*The Flyinge Model*" in Free Jumping.

Elin Fänge

Uppsala

HANDLEDARE:
Handledare: Astrid Borg, Flyinge
Bitr handledare: Gitte Johansson, Flyinge

Hippologiskt examensarbete (EX0497) omfattande 15 högskolepoäng ingår som en obligatorisk del i hippologutbildningen och syftar till att under handledning ge de studerande träning i att självständigt och på ett vetenskapligt sätt lösa en uppgift. Föreliggande uppsats är således ett studentarbete på G2E nivå och dess innehåll, resultat och slutsatser bör bedömas mot denna bakgrund.

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Examensarbete inom hippologprogrammet, Flyinge 2016
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En beskrivning av hur hästars hoppteknik ändras över tiden då de tränas i löshoppning enligt "*Flyingemodellen*"

En studie gjordes på beskrivningen av hur hästars hoppteknik ändras över tid, då de tränades enligt *Flyingemodellen* i löshoppning, eftersom detta aldrig tidigare hade gjorts. Riksanläggningen Flyinge erbjuder utbildning av unghästar varav ett av momenten är löshoppning. Löshoppning är när hästen hoppar fritt genom en hinderkombination utan ryttare för att visa sin hoppteknik. Sex två och ett halvt-åriga svenska varmblodiga hästar utan tidigare erfarenhet i hoppning tränades sex gånger i sex veckor i löshoppning på Riksanläggningen Flyinge. Hästarnas hoppförmåga beskrevs med två olika metoder; enligt det svenska linjära beskrivningens protokoll, där hästarnas hoppförmåga beskrevs av tre domare från en filmupptagning, samt genom att mäta avståndet från hindren till avsprångs- respektive landningspunkt med en mätsticka. Utvärderingen av hästarna gjordes vid tre tillfällen med två veckors intervall, träningsvecka 2, 4 och 6. Vid varje filmningstillfälle hoppade hästarna löshoppningskombinationen två gånger efter varandra, samt att avståndet på avsprångs- respektive landningspunkt mättes. Domaren beskrev hopptekniken från punkterna 37 till 50 av egenskaperna i 3-årstestets protokoll. Vid andra filmningstillfället, vilket var vecka 4, användes hjälpbommar i löshoppningskombinationen för att se om dessa hade effekt på hästarna egenskaper. All data underkastades variansanalys, GLM- proceduren i statistikprogrammet, Statistical Analysis Systems package 9.4, SAS Institute Inc. Cary, NC, USA, som räknade signifikanta skillnader ut mellan ändringen av hästarnas egenskaper samt avsprångs- och landningspunkt under de tre veckor som dokumenterades. Resultaten i den första utvärderingen visade signifikanta skillnader där hästarnas egenskapers flyttade sig enligt följande: *avsprången: riktning* mot uppåt; *scope* mot stort; *elasticitet* mot mjuk, elastisk; *försiktighet* mot överförsiktig; *taxeringsförmåga* mot säker; *balans* mot balanserad; *inställningen till uppgiften* mot fokuserad och *beteende* mot avspänd. Resultaten i den andra utvärderingen visade signifikanta skillnader i avsprånget på första hoppet mellan vecka 2 till 4 samt 2 till 6. Hästarna hoppade av längre från hindret i vecka 4 och 6 i jämförelse med vecka 2. Landningspunkten på andra hoppet visade signifikans mellan vecka 2 till 4. Hästarna landade närmare hindret i vecka 4 i jämförelse med vecka 2. Samt det visa sig inga signifikanta skillnader på andra hoppets avsprång vid alla tre dokumentationstillfällen.

Slutsatsen är att några beskrivningar av hästens hoppegenskaper ändrades under träningsperioden samt att några av avsprångs- och landningspunkterna ändrades. Huruvida *Flyingemodellen* ändrade hästarnas hoppteknik och/eller avsprångs- och/eller landningspunkt är svåra att dra eftersom studien inte hade en kontrollgrupp och att det bara fanns sex hästar i denna studie.

ABSTRACT

A study was made on how the description of a horses' jumping technique changed over time, when they were trained in free jumping in accordance with *The Flyinge Model*. The problem was that no study had been done to prove that *The Flyinge Model* had effect on horses' jumping technique. The Flyinge Equestrian Center of Sweden offers education to

young horses which one of the elements is free jumping. Free jumping is when the horse jumps freely thought a combination without a rider to display their jumping technique. Six two and half-year-old Swedish Warmblood horses without experience in jumping were trained in free jumping at six separate occasions during a period of six weeks at the Flyinge Equestrian Center of Sweden. Horses jumping technique was evaluated with two different methods; with the Swedish linear protocol, where the horses jumping technique was described by three judges from a film recording of each jump element, and by measuring the distance from obstacles to take off- each landing point with a measuring stick. Filming commenced three times with two-week intervals. In each case of filming horses jumped the free jumping combination two times followed straight after each other, and that the distance of the take off- and landing point was measured. The judge described the jumping technique from traits 37 to 50 in the three-year old test Swedish linear protocol. On the second filming occasion, which was week 4, pole aids were placed in the free jumping combination to see if they had any effect on the horses' description. All data was subjected to analysis of variance, GLM procedure in the Statistical Analysis Systems package 9.4, SAS Institute Inc. Cary, NC, USA that calculated the significant differences between the take off/landing points in jump one and two within the three weeks of documentation. The results in the first evaluation method showed significant differences in the horses' traits, description which changed towards as follows: *take off: direction* towards upwards, *take off: direction towards* upwards, *scope* towards much, *elasticity* towards elastic; *care* towards too careful, *distance estimation* towards secure, *balance* towards balanced, *approach to assignment* towards focused, *behavior* towards relaxed. The results in the second evaluation method showed significant differences in the horses' take off in the first jump between weeks 2 to 4 and 2 to 6. The horses took off further from the obstacle on the first jump in weeks 4 and 6 compared to week 2. The landing point on the second jump showed significance between weeks 2 to 4. The horses landed closer to the obstacle in week 4 compared to week 2. On the other hand, the horses showed the no significant differences with regard to the take off of the second jump.

The conclusion is that some of the descriptions in the horses' jumping technique changed throughout the training period, as did some of the take off and landing points. It is hard to prove that the *The Flyinge Model* changed the horses jumping technique and/or take off and/or landing point. This due to that it did not have a control group and that there were only six horses participating in the study.

Keywords: judge, landing point, linear scoring protocol, take off, young horse

INTRODUCTION

Flyinge Equestrian Center of Sweden

Flyinge Equestrian Center of Sweden has produced a book called "Flyingemodellen – från föl till final" ("The Flyinge Model – from foal to the finals") (Axelsson 2013). With the help of text and illustrations the book gives an overview on how to work with a horse from foal to six years. Every year the Flyinge Equestrian Center of Sweden takes on young horses for training. Flyinge offers students a course in training two and half-year-old horses. The learning block lasts for eight weeks, teaching the students how to train a

two and a half-year-old following the Flyinge Model, which also includes free jumping once a week. Free jump training can be used to prepare the horses for future tests, such as the three-year-old test, performance test for stallions, and auction (Swedish Select Horse Sales 2016).

Swedish Warmblood Association (SWB)

The breeding goal of the Swedish Warmblood Association (SWB) is that horses should be "noble, correct and sound and that its competitive temperament, riding ability, excellent gaits and/or jumping ability is of international quality" (SWB 2016). Their breeding plan for the Swedish Warmblood jumping horse is that it should be/have a natural ability to self find the right point of take off, will to jump, scope, good distance estimation, good technique in the foreleg, haunches and back, balanced, flexible canter, at the jump take off with power, elastic, quick at the take off and brave but still careful (SWB 2015). Sweden hosts young horse tests in form of the three-year-old test and the quality assessment for a four-year-old in order to early be able to judge the offspring and give stallions and mares a solid breeding index (BLUP 2016). The evaluation categories for both the three-year-old test and the quality assessment are conformation, gaits and jumping. In the three-year-old test the horses can be ridden or showed by hand and free jumped. In the quality assessment they must be ridden and have the choice to be jumped with rider or free jumped. (SWB 2014) As stated by Viklund (2016, oral materials) both the individual's genetic make-up and surrounding environment, example feed and training have an impact on the horses' results when being described at the Swedish three-year-old test or the quality assessment. This means that training is an important factor that has an impact on changing the horses' description. According to SWB (2015) the breeding goal in 2015 the jumping horse should be wise with obstacles, jump willingness, have a large jumping capacity and *distance estimation*, have a good front and hind leg technique and a good in the back at the leap. It must also have high ride ability and a balanced, easily adjustable gallop. Jumping horses should at the take off " push off " with power, be flexibility, quick responses and be brave but careful.

The Swedish linear scoring protocol of three-year-old horses

The linear scoring protocol of three-year-old horses is used in countries such as Sweden, the Netherlands and Belgium. One of its description categories is the horses' jumping technique while being free jumped (SWB 2014). The evaluation in the Swedish linear protocol is done with a nine-scale system represented by the letters A to I, which is used to describe the different obvious, extremes, of one trait (Appendix 1; Appendix 2). The horses jump the obstacles as showed on Figure 1. The free jumping ring and distances that *The Flyinge Model* use is slightly different from the three-year-old tests. *The Flyinge Model* has a smaller arena at 18x36 meters whereas for the three-year-old test must have 20x40 meters. Due to this *The Flyinge Model's* distances are shorter between the obstacles.

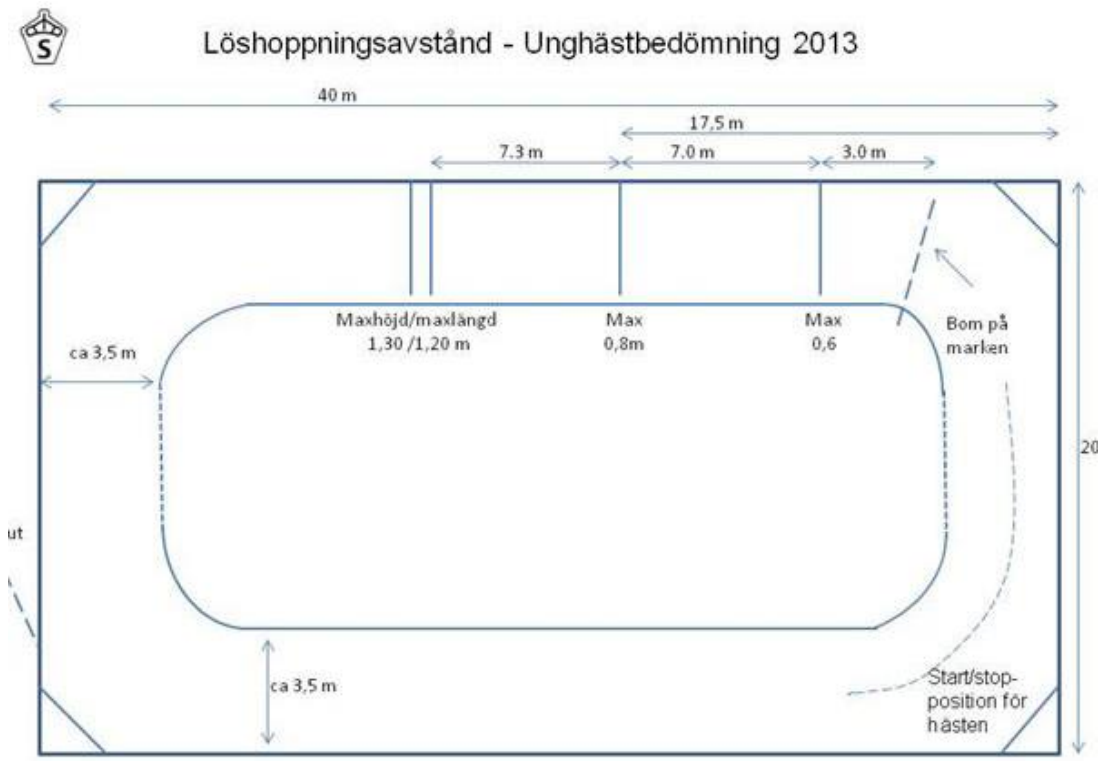


Figure 1. Free jumping distances of the three-year-old test. Anna Cederström 2016.

Earlier Studies

Santamaria, et al. (2005) investigated the effect of early training on the jumping technique of horses. A control group and an experimental group was made out of 30 in total Dutch Warmblood foals. The control group was kept in a stall barn in winter and sent out to pasture over summer. Only the experimental group was trained in free jumping twice a week for 30 months. After the 30 months both groups were trained in riding, free jumping and jumping under saddle until approximately five years old. The horses were then tested on target fence during free jumping at 60 centimeters when the horses were six months old, 1,05 meters at four years old, and 1,15 meters when five years old. The first distance between jumps A and B was 6.4 meters and between jumps B and C it was 7.0 meters. Results showed that the experimental group produced a smaller peak of vertical acceleration meaning that they jumped closer to the obstacle. They also flexed their forelimbs more and landed closer to the obstacle than the control group. Although later, at the age of five, there were no differences between the control group and the experimental group.

Wejer, Lendo & Lewczuk (2013) studied the effect of training on the jumping parameters of inexperienced four to five-year-old Warmblood Wielkopolski horses in free jumping. In this study there was no control group. Under the same rider and trainer, training took place over a four-month period. The horses underwent free jump training twice a week. For data collection the horses performed three sets of three practice trails. Obstacle A and

B were at a height of 80 centimeters and C was a double bar obstacle at 1,05 x 1,05 meters. The first distance between obstacles A and B was 7.0 meters and between B and C was 7.2 meters. This study concluded that haunches, hind limb, technique seemed to be more affected then the forelimb during this training period. They did not get any significant differences in the take off and landing point distance to the obstacle.

Wejer, Bohdanowicz & Lewczuk (2013) studied the changes in the linear traits of the jumping stride during training on the 100-day performance test. Ten stallions were filmed on the 62nd and 92nd day of training. The horses were free jumped on a combination consisting of a groundpole at a distance of 3,5 meters in front of obstacle A which was a cross-pole, B at a distance of 7,1 meters at a height of 80 centimeters being a vertical obstacle and C at a distance of 7 meters being a double bar obstacle at a height and width of 1,05 m. On each occasion the horses were filmed jumping the combination three times. Results showed strong statistical differences in the horses' take off to obstacle C changing from 125.90 centimeters on the 62nd day of training to 92.97 centimeters on the 92nd day. The landing point did not show significant differences throughout the 100-day performance test.

The studies above (Santamaria, et al. 2005; Wejer, Bohdanowicz & Lewczuk 2013; Wejer, Lendo & Lewczuk 2013) only use the obstacles used for the free jumping combination throughout the training periods. Where as *The Flyinge Model* states that different pole aids help the horses learn to stay on a straight line or to effect the apex of the jump. The differences with Santamaria, et al. (2005), Wejer, Bohdanowicz & Lewczuk (2013), Wejer, Lendo & Lewczuk (2013) and *The Flyinge Model* is that the distances between the combinations three obstacles.

Young horses have little experience of being introduced to new surroundings and objects, which can trigger behaviors. The horse would then need to habituate to its new surroundings. (Leiner & Fendt 2011; Clayton et al. 2008)

Leiner & Fendt (2011) investigated different behavioral fear responses when horses were exposed to an unknown object, novel stimulus. Also whether these behavioral responses are correlated with physiological changes. They also investigated whether these changes were reduced after habituation training to the unknown object. They used 18 German Warmblood stallions at two and half years old. They were tested with an umbrella and their heart rate was monitored. The results showed after five days testing that the horses' heart rate decreased. The horses also reduced the distance to the object. There were significant differences in the horses' snorting, snuffling and also avoidance decreased after being exposed to the object for some time.

Clayton et al. (2008) tested placing a lightweight bracelet on a trotters hoof to see if it would become habituated to it after wearing it for a while. The test was only done for one day on eight horses. The study proved that the horses first increased the elevation of the hoofs but after three trials, the horses gradually decreased the elevation. The conclusion was that the horses habituated to the coronets.

Problem

There is no description on the possible effects on horses' jumping technique and/or take off and landing point over time following the free jump training of *The Flyinge Model*.

Aim

The aim of this study was to describe the two and a half-year-old horses jumping technique throughout the time period it followed training by *The Flyinge Model*. The description would be done based on the Swedish linear scoring protocol for three-year-old horses. The study also documented the take off and landing point over the same time period.

Question

Did the horses' jumping technique change after six weeks of training with *The Flyinge Model* in regard of jumping technique evaluated with the Swedish linear scoring protocol for three-year-old horses? Did the measurements of take off and/or landing point change after six weeks of training?

Hypothesis

The hypothesis is that the horses' jumping technique will not change during this training. The horses' take off will not change during the training the period. The horses' landing point will not change during the training the period.

MATERIAL AND METHOD

Horses

In total there were ten horses, seven had parents with dressage pedigree and three had parents with jumping pedigree. There were no records on height and weight of the horses. Seven were geldings and three were mares. The horses were all two and half-year-old and privately owned. The students participating in the learning block to train a two and half-year-old handled the horses. All students were taught the same handling method. Earlier experience in handling and training could not be documented due to that the owner's information could have been unreliable. During the time of the study the horses were kept in stable in boxes, 3 x 3.5 m. All horses were fed with the same hay and hard feed but with different amounts according to their individual requirements. The other four workdays they trained in other such as leading, lounging, breaking in, free running and long-reining. On weekends they rested and only went out in a sand paddock.

Each training session of free jumping, the horse would have a bridle with a bit but without reins. Leg protection was put on the front legs.

Experimental Design

The free jump training procedure and documentation for the horses underwent training once a week for six weeks. They only jumped six times due to a change in the calendar year where as the course is normally eight weeks.

Table 1. Schedule over the horses' training period and documentation

	Dates	Weeks of free jumping training	Weeks pole aids were used for training	Filming documentation	Pole aids used in filming
Week 1	04-11-16	X			
Week 2	11-11-16	X	X	X	
Week 3	25-11-16	X	X		
Week 4	02-12-16	X	X	X	X
Week 5	09-12-16	X	X		
Week 6	16-12-16	X	X	X	

An extra week between filming one and two due to no access to the riding arena therefore the horses did not practice free jumping that week. Pole aids were not used the first week of training due to that it was the first time their horses were free jumped.

Place of Testing

The evaluations were carried out in an indoor arena, 18x36 meter, with surface consisting of fiber sand at the Flyinge Equestrian Center of Sweden. The jumping track consisted of three obstacles placed on one long side. Figure 2 shows that 3 meters before the first obstacle, A, a half round pole was used as a guard-pole, which was placed by the corner. Obstacle A, built as a vertical was placed in a straight line after the guard-pole. The B obstacle was a vertical 6,9 meters after obstacle A and obstacle C a double bar, was 7,0 meters after obstacle B. The equipment needed for the obstacles were twelve round jumping poles, ten cups where two were safety cups, back pole on double bar, four jumping stands, four stands built to hang from the indoor riding wall and one half round pole. Between each jump the horse was restricted to only one canter stride between obstacles A, B and C. A and B, vertical obstacles, were 50 centimeters in height, and obstacle C, double bar, was setup so that it had a length of 70 centimeters with the front pole at 80 centimeters high and the rear pole at 90 centimeters high. All obstacles also had ground poles placed at a distance of 10 centimeters in front of obstacles A, B and C. (Figure 2; Figure 3) Five large white fences, 1,7 x 1,7 meters- eight small, 1,7 x 1 meters, one jumping stand and barrier tape were used to make the ring that held the horse on the track. See Figure 3 for the placement of the material. A wheelbarrow was placed inside the ring. Before letting the horse into the indoor arena all the poles would be on the ground and all cups would be taken off the jumping stands.

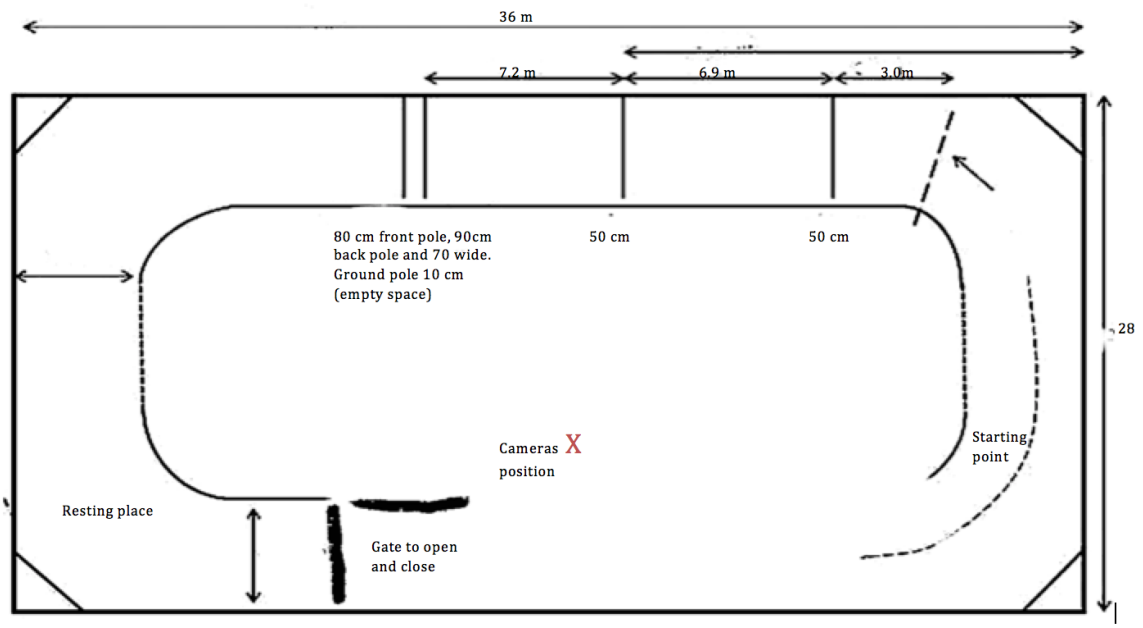


Figure 2. Description of *The Flyinge Model's* placement of obstacles and distances. Elin Fänge 2015.

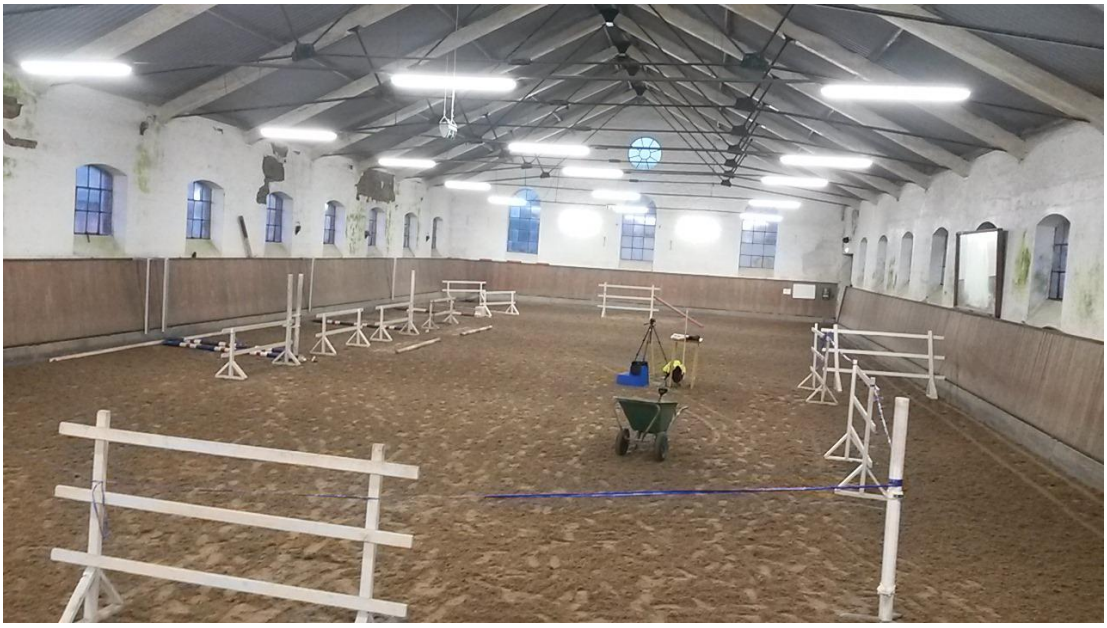


Figure 3. Photograph of the free jumping course at the Flyinge Equestrian Center of Sweden. Elin Fänge 2015.

The study selected the horses that were expected to jump the above combination (Figure 2) throughout the training period starting on the second week of training, week 2 of documentation. The instructor in free jumping, Gitte Johansson (2015, oral materials), decided whether the horses were mentally fit to jump the combination height required. The remaining three to six weeks the horses were more experienced in free jumping. The obstacles could then be built for documentation directly after horses warm up rounds

(Appendix 3). For this the horses would be filmed jumping the course twice and measured by their take off and landing point. After documentation was finished the horse would continue its free jump training. Pole aids could be employed if the horses' technique needed to be improved which was decided by Gitte Johansson (2015, oral materials). A description of *The Flyinge Model's* training method is documented in Appendix 3.

Pole Aids

Ground pole

Ground poles could be moved, making the gap more than ten centimeters on obstacles A, B and C. The purpose was to make the horse take off earlier.

Guard-pole between two obstacles

The pole would be placed in the middle of obstacle B to C at a distance of 3,50 meters behind obstacle B (flat canter and/or half halt).

By placing the pole at 3,10 meters behind obstacle B the horse would have to land earlier and therefore it would create a greater distance to obstacle C (correct the jumping curve).

Side pole

The pole would be placed as follows; one end of the pole on the obstacle just touching it and not sticking out and the other end on the ground facing outward (Figure 4). The pole would be placed on the side that the horse drifted most to in the combination.

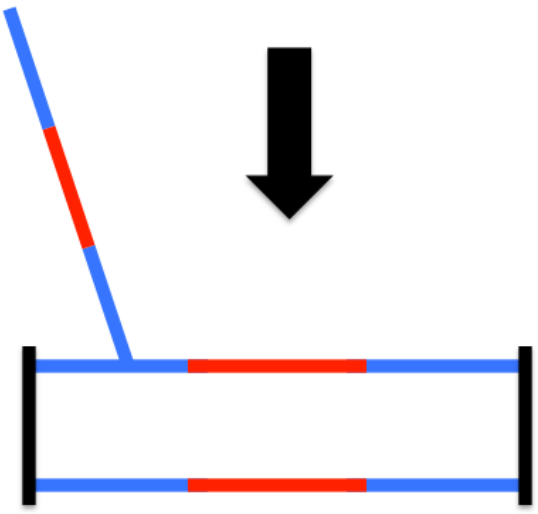


Figure 4. Position of pole aid "side pole". Elin Fänge 2016.

Specific pole aids were used on horses when needed according to *The Flyinge Model*.

Whip Holders

Whip holders were needed during free jumping in order to maneuver the horse in the ring. More detailed description is shown in Appendix 3.

Evaluation method 1; Filming and description of jumping technique

A video camera (JVC model GZ-MG21) on a tripod was placed from the end of the double bar obstacle facing the inside of the ring; two meters towards jump B then turning 90° to the right continuing seven meters towards the center (X). A horse would be filmed from the beginning of their run to the end of its resting place (Figure 2). The camera was positioned on the red X (Figure 2) where free jumping judges usually stand when judging horses in free jumping tests. There was also a bar table placed for note taking.

The horses were filmed when jumping the combination as described above. If a horse would show hesitation or knocked down a pole, it would get another try to jump and be filmed doing so. The horses would be filmed from the point of passing the gate until it reached its resting place (Figure 2). In weeks 2 and 6 of documentation the horses jumped with no pole aids when filmed. On week 4 of training Gitte Johansson (2015, oral materials) decided which horses would need pole aids for training and then be filmed with those aids. On week 4, obstacle A could be built up to 60 centimeters and/or B to 80 centimeters if wished. This because in the three-year-old test the obstacles are allowed to be built up to this height (Figure 2). All documentation, including aid equipment, from every training session was kept if needed for possible conclusions.

A video documentation was sent to three A-level qualified free jumping judges in Sweden. He/she then followed the Swedish linear scoring protocol of three-year-old horses. The judge did not know which week the horse jumped, only the week 4 had pole aids, nor the name or pedigree of the horse. Obstacle C was the target obstacle where the judge would describe the horses' technique. He/she described the jumping technique from traits 37-50 in the Swedish linear scoring protocol following the three-year-old test (Appendix 1; Appendix 2). The traits from numbers 37-50 are as follows; *take off, take off: quickness, take off: direction, technique: foreleg, technique: back, technique: haunches, scope, elasticity, care, distance estimation, balance, reaction, approach to assign. and behavior.* These traits were described with the nine-scale system represented by the letters A to I, which was used to describe the different obvious, extremes, of one trait (Appendix 1; Appendix 2). Detailed descriptions of the traits are shown in Appendix 1.

Evaluation method 2; Measuring of take off and landing point

Two planks with hand written measurements with every fifth centimeter; 5, 10, 15… etc. One was placed in front of the double bar obstacle C and the other behind to be able to measure the take off and landing point of the horse (Figure 5). The measurements of the hoof prints at the take off were taken with a ruler from the front part of the hoof closest to the front pole of the double bar obstacle (0 m). The same plank was also used to measure if a pole was placed between the second upright jump and the double bar obstacle. The plank (blue) behind the double bar obstacle was used for both the length of the back pole

and the landing point on this pole (Figure 5). Measurements of the landing were taken from the back part of the hoof closest to the back part of the back pole of the double bar obstacle (0 m). Before every documented measurement the ground was raked before and after the jump to easier identify the take off and landing points.

Considerations were taken into environmental factors. Adjacent to the indoor arena were sounds from different sources. Extra poles were leaning on into the corner that the horse was jumping towards. A platform was at the resting corner of the horse where people could watch the horses during the free jumping.

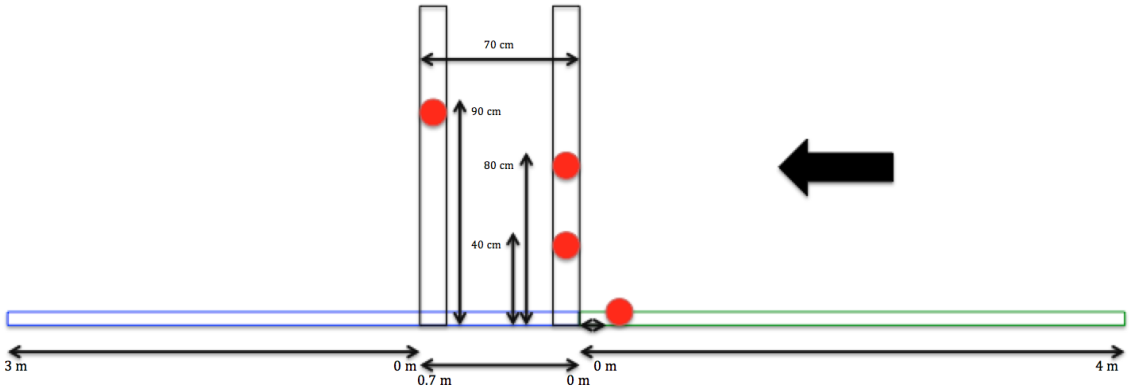


Figure 5. Description of obstacle C. Elin Fänge 2016.

Statistical analysis

All data were subjected to analysis of variance (GLM procedure in the Statistical Analysis Systems package 9.4) (SAS Institute Inc. Cary, NC, USA) using the following model;

$$Y_{i\,j\,k} = \mu + a_i + b_j + g_k + \varepsilon_l + (bg)_{j\,k} + e_{i\,j\,k\,l}$$

Where $Y_{i\,j\,k}$ is the observation, μ the mean value, a_i the effect of horse, b_j the effect of occation, g_k the effect of judge and $e_{i\,j\,k\,l}$ the residuals. Correlations were calculated using SAS 9.4 (SAS Institute Inc., Cary, NC, USA) PROC CORR. The *P* value for significance within and between treatments was < 0.05. Values are presented as means ± standard error of the mean.

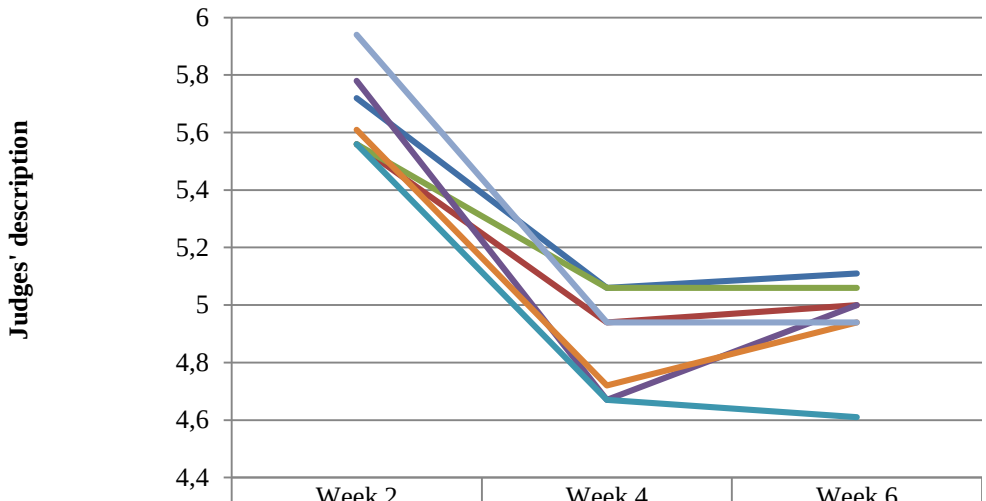
Description letters A-I from the Swedish linear protocol were changed from 1-9 in order for the program to procces the results of test one (Appendix 2).

RESULTS

At the end of the testing period there were only six horses left out of the ten. Three could not start on week 2 due to that they were too tense. One dropped out before the last documentation trail due to fever.
The results from The SAS System are shown in Appendix 4. Test 1 showed significant differences in traits of *take off direction, scope, elasticity, care, distance estimation,*

balance, approach to the task and behavior (Figure 6; Figure 7). The lower the number given on the description from the judges, the more the trait moved towards the left of the obvious (Appendix 2). The traits that changed during weeks 2 to 6 are as follow and can also be seen in Table 2 (Appendix 4; Figure 6); *take off direction* (p=0.0143) changed from 5.72 to 5.11 meaning the obvious moved more towards upwards. *Scope* (p= 0.0298) changed from 5.56 to 5 meaning the obvious moved more towards much. *Elasticity* (0.0415) changed from 5.56 to 5.06 meaning the obvious moved more towards elastic. *Distance estimation* (p=0.0121) changed from 5.78 to 5 meaning the obvious moved more towards secure. *Balance* (p=0.01) changed from 5.56 to 4.61 meaning the obvious moved more towards balanced. *Approach to assignment* (p=0.0048) changed from 5.61 to 4.94 meaning the obvious moved more towards focused. *Behavior* (p=0.0024) changed from 5.94 to 4.94 meaning the obvious moved more towards relaxed. All these traits also showed significant differences between weeks 2 to 4.

The judges' descriptions varied with significant differences in two traits. *Take off: quickness* showed that the judges had 2,39 in spread of numbers giving p=0.0044 in significant difference. *Technique: foreleg* showed that the judges had 2,89 in spread of numbers giving p=0.0019 in significant difference.



	Week 2	Week 4	Week 6
39 Take off: direction (upwards-forwards)	5,72	5,06	5,11
43 Scope (much-little)	5,56	4,94	5
44 Elasticity (elastic-stiff)	5,56	5,06	5,06
46 Distance estimation (secure-insecure)	5,78	4,67	5
47 Balance (balanced-unbalanced)	5,56	4,67	4,61
49 Approach to assignment (focused-unfocused)	5,61	4,72	4,94
50 Behavior (relaxed-tense)	5,94	4,94	4,94

Weeks of documentation

Figure 6. The traits that showed significant differences between weeks 2 to 4 and 2 to 6. The lower the number on a trait, the more the obvious moved to the obvious on the left.

Care (p=0.0137) had significant differences in between week 2 to 4 that changing from 5.33 to 4.5 in average, meaning that the obvious moved more to too careful. (Appendix 4; Figure 7)

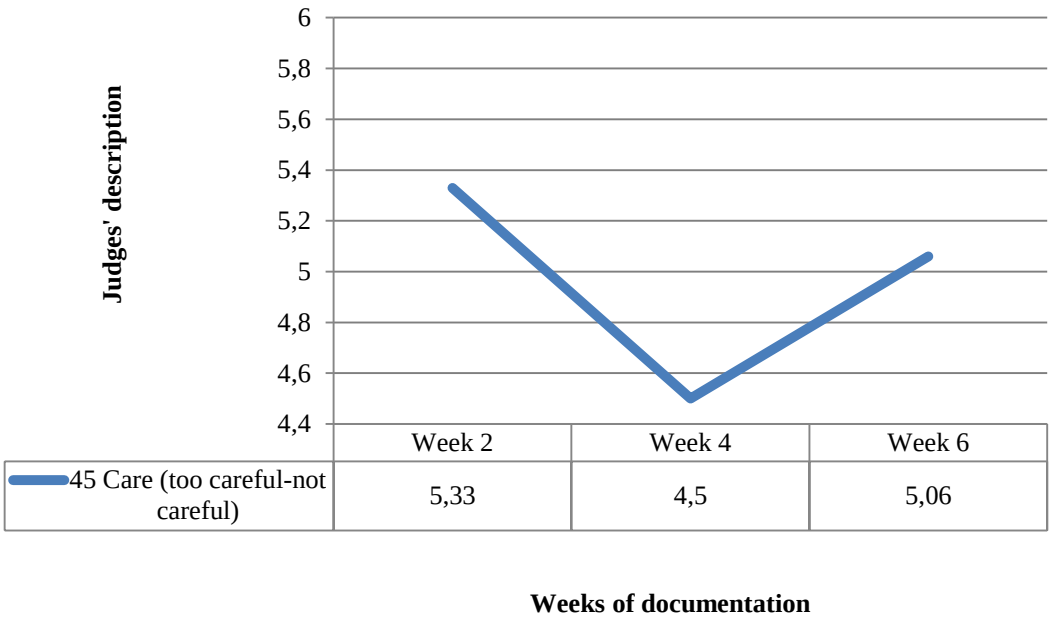


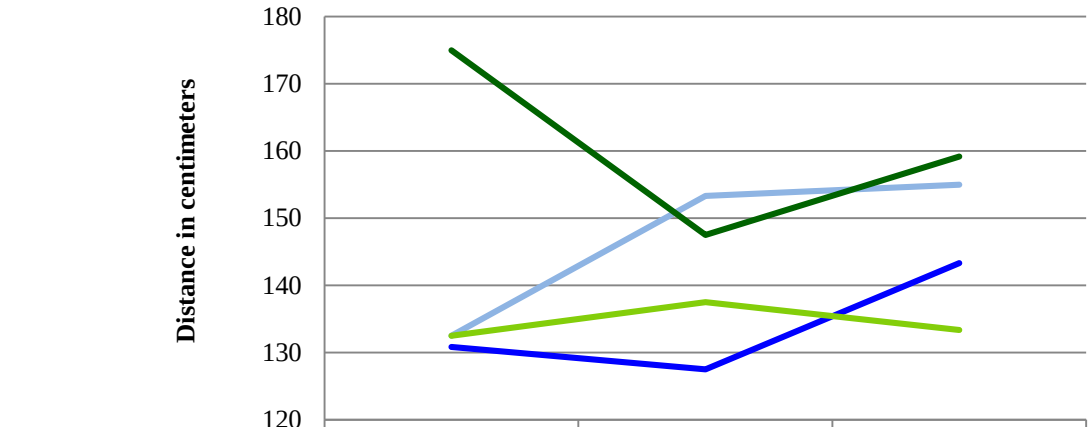
Figure 7 The traits that showed significant differences in the following: *Care* had significant differences in week 2 to 4. The lower the number on a trait, the more the obvious moved to the obvious on the left.

Table 2 shows 15 significant differences that changed in the horses' traits throughout the study. Eight were between weeks 2 to 4, one from weeks 4 to 6 and six from weeks 2 to 6. This showed that most of the differences occurred during weeks 2 to 4 of training. Also horses that participated in this study showed highest significant differences between weeks 2 to 4. Non-significant differences were *take off*, *take off speed*, *technique: foreleg*, *technique: back*, *technique: haunches* and *responsiveness*, as the averages are also shown in Appendix 4.

Table 2. The significant differences of each trait between weeks 2 to 4, 4 to 6 and 2 to 6

Traits	2 to 4	4 to 6	2 to 6
37 Take off: (powerful-weak)	-	-	-
38 Take off: quickness (quick-slow)	-	-	-
39 Take off: direction (upwards-forwards)	0.0079	-	0.0143
40 Technique: foreleg (bent-hanging)	-	-	-
41 Technique: back (rounded-hollow)	-	-	-
42 Technique: haunches (open-tight)	-	-	-
43 Scope (much-little)	0.0174	-	0.0298
44 Elasticity (elastic-stiff)	0.0415	-	0.0415
45 Care (too careful-not careful)	0.0137	-	-
46 Distance estimation (secure-insecure)	0.0005	-	0.0121
47 Balance (balanced-unbalanced)	0.0149	-	0.01
48 Reaction (quick-slow)	-	-	-
49 Approach to assignment (focused-unfocused)	0.0048	-	0.0308
50 Behavior (relaxed-tense)	0.0024	-	0.0024

Significant differences in the take off: jumps one were showed between weeks 2 to 4 and 2 to 6 of training. Between weeks 2 to 6 the horses take off changed from 132,5 to 155 centimeters. Significant difference in the horses landing point: jumps two changed from 175 centimeters week 2 to 147,5 centimeters in week 4 (Appendix 4; Figure 8)



	1	2	3
Take off: Jump 1	132,5	153,33	155
Landing point: Jump 1	130,83	127,5	143,33
Take off: Jump 2	132,5	137,5	133,33
Landing point: Jump 2	175	147,5	159,17

Weeks of documentation

Figure 8. Measurements (centimeters) of the take off and landing point to/from the obstacle. Significant differences showed in the take off: jump one between weeks 2 to 4 and 2 to 6 and the landing point: jump two between week 2 to 4.

DISCUSSION

Significant Differences of Evaluation Method 1

By showing the highest significant differences in evaluation method 1 (0.0005-0.0425) between week 2 to 4 (8/15) could mean that either the pole aids had effect on the horses or that the horses changed most during that time. It is hard to possibly draw a conclusion in the change in traits between weeks 2 to 4 due to that the pole aids were used week 4. Hereby meaning that the free jumping combination was not the same all weeks. Though between weeks 2 to 6 the free jumping combination was set up the same way and thereby one could possibly draw conclusions to changes in the traits. It could hereby be concluded that the horses in the *The Flyinge Model study* changed some of their traits mentioned above. *The Flyinge Model* training method believes that the pole aids help strengthen the horses *balance*, *take off*, landing point, *distance estimation* and *approach to assign*. (Johansson 2015, oral materials). It was hard to find evidence that specific pole aid could have an effect on a certain jumping trait of the horse.

One can possibly confirm the change in behavior of *The Flyinge Model's* significant differences with Leiner & Fendt (2011) study. A conclusion could be drawn that horses that part took in *The Flyinge Model's study* showed more relaxed behavior the longer they had been into training.

There is no study that proves what exactly improves a horses' *scope* nor what exactly *scope* is (Jönsson 2011) and therefore hard to conclude what could have effected the horses *scope*.

It is hard to say that the horses in *The Flyinge Model study* changed their jumping technique traits to the better or worse. This due to that SWB (2015) does not specify where exactly a horse should be marked on the description scale A to I of each trait. They only give a superficial description in the breeding plan (SWB 2015).

Relation of significant and non-significant results

Habituation

Clayton et al. (2008) study can relate to the second largest significant difference which showed that the horses' behavior became more relaxed over time. Also in a study by Santamaria et al. (2005), it was concluded that the experimental group jumped lower over the same obstacle than the horses in the control group. Clayton et al. (2008) study could support that the horses accentuate their movements over the obstacle they are not habituated to. Consequently, a possible conclusion is that after the horse is habituated, it calms down, moves in a more relaxed manner and jumps lower the next time. This might also have an effect on the horses' non-significant differences in *take off*, *take off speed*, *technique: foreleg*, *technique: back* and *technique: haunches*.

Care is defined in Appendix 1 that the horse has a natural ability not to tear the jump. From the documentation the two horses knocked down a pole on the C obstacle on week 2 and none on weeks 4 and 6. With the horse tearing the pole it could have caused the obvious to become more "not careful" (Appendix 2). As for not tearing the pole caused the obvious to move towards too careful. It could be concluded that the horses learnt how not to tear the fence.

Haunches

The study by Wejer, Lendo & Lewczuk (2013) showed significant differences of the horses' bascule angle, haunches, as it decreased 5° during the training period. They suspected this was due to increased elasticity in the back. The results from *The Flyinge Model study* showed that the *technique: haunches* did not give any significant differences. Wejer, Lendo & Lewczuk (2013) study concluded that *technique: haunches* seemed to be more affected than the forelimb during this training period. They had four to five year olds that were jumped with rider and free jumped. They also jumped a higher obstacle. A question could be that the horses' *technique: haunches* only shows result at a higher height and/or age. *The Flyinge Model study* did not confirm Wejer, Lendo & Lewczuk (2013) with regard to this aspect.

Significant Differences of Evaluation Method 2

Take off

In this study there were significant differences in the horses' take off in the first jump between weeks 2 to 4 and 2 to 6. The horses took off further from the obstacle on the first jump in weeks 4 and 6 compared to week 2. The landing point on the second jump showed significance between weeks 2 to 4. The horses landed closer to the obstacle in week 4 compared to week 2. On the other hand, there were no significant differences with regard to the take off of the second jump. One could conclude that the horses corrected themselves already by the second jump or that the whip holders (Appendix 3) had effect on the horses. It is also interesting that *The Flyinge Model study* showed significant difference in that the horses took off further from the obstacle on the first jump between weeks 2 to 4 and 2 to 6. It is hard to come conclusions since the other studies showed either that the take off distance did not change (Wejer, Lendo & Lewczuk 2013) or that they took off closer to the jump (Wejer, Bohdanowicz & Lewczuk 2013) throughout the study.

Landing point

In this study there was a significant difference in the horses landing point in jump two going from 175 to 147,5 centimeters between weeks 2 to 4 (Appendix 4; Figure 8). However, since the results showed no significant differences between weeks 2 to 6 in landing point jump two, one could conclude that the horses did not change their landing point. It is hard to relate to Santamaria et al. (2005) study as results showed that the experimental group landed closer to the obstacle than the control group. In Santamaria, et al. (2005) study the horses had been jumped with a rider and free jumped in difference to *The Flyinge Model study* where the horses were only free jumped. The rider could have had effect on the horses landing point. As for *The Flyinge Model study* there was no significant difference between weeks 2 to 6. One can relate to Wejer, Lendo & Lewczuk (2013) and Wejer, Bohdanowicz & Lewczuk (2013) where their results showed no significant differences in the landing point. It is hard to draw conclusions due to the results in week 6 landing points.

Jumping curve

One interesting result is the difference between jump one and jump two in both take off and landing point together. By looking at the first jump in week 4 and 6 (Appendix 4) the horses took off further from the obstacle and landed closer to the obstacle. By looking on the second jump the same weeks, one can see that the horses took off closer and landed further from the obstacle, meaning that the jumping curve had moved. There is no study done on the optimal jumping curve for a horse when it concerns free jumping. It could also be that the whip holders in *The Flyinge Model study* had effect on these results. The whip holders discussed with the teacher every time between the jumping rounds. They discussed what they could do better. If they were pushing the horse too much or too little. This could have had an effect on the horses' length in stride and thereby ha effect on the jumping technique and/or take off and/or landing point. It is though had to prove due to that this was not the aim of the study. One would have had to have the same system of

pushing on jumps one and two and also maybe the same for all horses during the documentation of filming.

Strengths in study

One strength in this study is that the horses had a standardized environment during the time of the training. This minimizes the risk of the environment having effect on the results of the study (Viklund 2016, personal communication).

Lewczuk (2015) study concluded that five-year-old horses preformed best in free jumping. If a horse owner were to raise a horse to that age in order to sell for the best price this would incur a large cost in housing at training the horse those five years. The two and half year old horses that participated in this study changed eight of their traits in the description from the protocol numbers 37 to 50. Could one save more money if it was to be trained in free jumping with *The Flyinge Model* as a two and half year old and then sold directly after?

The earlier studies that showed most reliability in comparison to *The Flyinge Model study* were Lewczuk (2015), Santamaria, et al. (2005) and Wejer, Bohdanowicz & Lewczuk (2013) had 30 and above horses in their tests. Leiner & Fendt (2011) used eighteen horses in their tests giving them a reasonably high reliability. Santamaria, et al. (2005) was the only study that had a control group. These studies give a higher reliability to the results of *The Flyinge Model study*.

Study limitations

Since this study did not have a control group, one could not eliminate that time had an effect on the horses' results. The reason was that the owners had paid for a service and thereby the horses could not be a control group. It is also hard to rely on the results from this study due to that only six horses were used.

Although some environmental factors were taken into consideration, such as that adjacent to the indoor arena there were sounds from different sources. The noise created may have had an effect on the horses' performance. Objects in the indoor arena were taken into account that it could have an effect on the horses. The sounds could not be controlled, but the objects stayed in the same spot throughout the time of testing. This was due that it was important not to change the environment as supported by Leiner & Fendt (2011). The environmental factors that could not be controlled could have had effect on the results.

All judges commented that it was hard to give an accurate description on the horses only by looking at a video. One could presume that the description would have been more accurate if the judges had been present in the arena.

The young horses were two and half- and not three-year-olds, and the linear scoring protocol used in this study is designed for three-year-old horses. This could constitute a weakness in the study.

On some occasions, the whip holders had an effect on the rhythm and canter stride of the horse between the filming of the two jumping trials. If a horse had too little rhythm and canter stride during the first jump, the whip holders pushed more during the second jump,

and vice versa. This could have had effect on the horses' take off and landing point between obstacles one and two.

In *The Flyinge Model study* the combination distances were shorter than those of Santamaria, et al. (2005), Wejer, Bohdanowicz & Lewczuk (2013) and Wejer, Lendo & Lewczuk (2013). The shorter distance was chosen due to that the riding arena was only 18x36 meters and thought that the horses lost speed on the short side coming into the combination (Johansson 2015 oral materials). This could be a cause to different results between the studies.

The other studies (Santamaria, et al. 2005; Wejer, Lendo & Lewczuk 2013) all had longer traning periods and the horses were older when they showed results with regard to their forelimbs and haunches technique. The same goes for Wejer, Bohdanowicz & Lewczuk (2013) but the age of the stallions is not specified in the study. One could possibly suppose that the six week training period in *The Flyinge Model study* was too short to have an effect, and/or that the judges, as they said, thought it was more difficult to evaluate based on a video clip as compared to a live observation.

Further research

If this study were to be done again, one should preferably have two groups, one being experimental and one being a control group. Both groups would be housed in pasture due to that it needs less maintenance (Nilsson 2009). As Rivera et al. (2002) and Sondergaard & Halekoh (2003) studies showed, horses living in group housing or pastures needed less time to complete a task. Such a study could be linked into the students' course schedule at the Flyinge Equestrian Center of Sweden. After the eight weeks the control group would be enrolled in the next training block. It would be interesting to further research what effects the pole aids could have on the horses' jumping traits. This due to that on the three-year-old test the judge can determine whether the ground pole between two jumps can be used, if so, it is to felicitate the horse in question (Nolin 2016 oral materials). This could then in the future help strengthen the linear protocols manual.

The judges did not agree on the description of traits: *take off: quickness* or *technique: foreleg*. For future research it would be interesting to test the judges on more horses than six and also more judges. This to improve the judges so they become more united when describing the traits.

For future studies one could test the relevance of *The Flyinge Model* on the other judging items 22 to 36, of the Swedish linear scoring protocol of three-year-old horses (Appendix 2). And then also ask the judges to come to the testing place and give a description on the spot.

One could also test the effect a whip holder has on a horse while it is free jumped. This due to the reasons mentioned above in "Flaws of Study".

Testing these six horses again after a certain time period to see if the changes occurring in this study has a long or short term effect.

An interesting result in *The Flyinge Model study* is the result of *behavior*. The horses' *behavior* changed significantly between weeks 2 to 4. Meaning that it took approximately four weeks for the horse to get used to its new surroundings. It would be interesting to see

how much effect the horses' *behavior* played on the other trait descriptions given by the judges. If so, would an owner of a horse want to house his/her horse in the place where the tests will take place four weeks before testing in order to get better results? And therefor get a more desirable description on the traits.

It would be interesting to do the same study once again without adding the pole aids in week 4 or training. This, to see if the traits description would have more of a straighter line through out weeks 2, 4 and 6 instead of a larger change between weeks 2 to 4.

CONCLUSION

One could possibly conclude that the horses in this study changed the description of some of their traits in jumping technique, take off and landing point during the time they followed training of *The Flyinge Model*. Significant differences were shown in traits of *take off: direction, scope, elasticity, care, distance estimation, balance, approach to the task* and *behavior*. Significant differences were also shown in the take off between weeks 2 to 6 as the take off distance became longer. Significant differences in the horses' landing point changed between weeks 2 to 4 as the distance became shorter. Interestingly the horses showed no significant results between the weeks on the second jump. It is hard to draw a conclusion that *The Flyinge Model* training had an impact on the horses jumping technique and/or take off and/or landing point. This due to the fact that there was no control group and only six horses were used. The hypothesis is rejected due to that changes did occur.

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REFERENCES

Literature

Axelsson, S., Axelsson, L., Engström, K. & Österlund, E. (2013). *Flyingemodellen: från föl till final.* Sportförlaget i Europa.

Clayton, HM., White, AD., Kaiser, LJ., Nauwelaerts, S., Lavaginino, M. & Stubbs, NC. (2008). Short-term habituation of equine limb kinematics to stimulation of the coronet. *Vet Comp Orthop Traumatol,* vol. 21, pp. 211-214.

Jönsson, Y. (2011*). Svenska unghästdomare och tränares definition på hopphästens teknik.* Sveriges lantbruksuniversitet. Hippologenheten/hippologprogrammet. (Examensarbete på kandidatnivå 2011: 15)

Leiner. L, Fendt. M. (2011) Behavioural fear and heart rate responses of horses after exposure to novel objects: Effect of habituation. *Applied Animal Behaviour Science,* vol. 113, pp. 104-109.

Lewczuk, D. (2015). Effect the the age on the performance tests in Warmblood horses in Poland. *Journal of Veterinary Behavior,* vol. 10, pp. 413-418.

Nilsson, T. (2009) *Different housingsystems and how they affect the horses.* Fakulteten för Landskapsplanering, trädgårds- och jordbruksvetenskap, LTJ

Rivera, E., Benjamin, S., Nielsen, B., Shelle, J. & Zanella, A.J. (2002*).* Behavioral and physiological responses of horses in initial training: the comparison between pastured versus stalled horses. *Applied Animal Behaviour Science*, vol. 78, 235-252.

Santamaria, S., Bobbert, M.F., Back, W., Barneveld, Ab. & van Weeren, P.R. (2005). Effect of early training on the jumping technique of horses. *American Journal of Veterinary Research*, vol. 66, pp. 418-424.

Sondergaard, E. & Halekoh, U. (2003). Young horses' reactions to humans in relation to handling in social environment. *Applied Animal Behaviour Science*, vol. 84, pp. 265-280.

Wejer, J., Bohdanowicz, A. & Lewczuk, D. (2013). Changes in stride parameters of a horse's jump during the second part of training in the 100-day performance test. *Roczniki Naukowe Polskiego Towarzystwa Zootechnicznego*, vol. 9, pp. 83-88.

Wejer, J., Lendo, I. & Lewczuk, D. (2013). The Effect of Training on the Jumping Parameters of Inexperienced Warmblood Horses in Free Jumping. *Journal of equine Veterinary Science*, vol. 33, pp. 483-486.

Internet

BLUP (2016). *SWEDISH WARMBLOOD.* http://www.blup.se [2016-04-13]

SWB (2014-05-09). *Manual – Linjärbeskrivning, SWB.* http://www.swb.org/storage/ma/1c48da17e1a144a4a6d79f6d843673d6/996e2fa611e84a7484dad63653bce2ac/pdf/96D8742D261F7211DBEB8A0176C8743D3000FBB7/Manual%20alla%202015.pdf [2015-11-19]

SWB (2015-11-03). *SWBs Avelsplan 2015.* http://www.swb.org/avel/avelsplan-2015 [2016-05-20]

SWB (2016-01-01). *SWB Bedömningsreglemente 3-årstest.* http://www.swb.org/storage/ma/ed1b9d03a75240cea8723a7d967f4525/fb27d1a6a0da4c42850f94b35f2cf6f2/pdf/8AF741EE98E57606F48CFE23E05377AD09D22C1A/Reglemente_3-arstest_2016_publ.pdf [2016-03-22]

Swedish Select Horse Sales (2016). *Swedish Select Horse Sales.* http://selecthorsesales.se [2016-04-12]

Oral materials

Gitte Johansson, Stable manager and instructor. The Flyinge Equestrian Center of Sweden, 2015.

Mikael Nolin, Swedish qualified A-judge in free jumping, Swedish Warmblood Association, 2016-04-29. Email

Åsa Viklund, Senior lecturer, horse breeding and genetic evaluation of performance traits. Contact person in horse related matters, Department of Animal Breeding and Genetics, 2016-04-21. Email.

APPENDIX

Appendix 1. Translation from the manual of linear description

The point from freejumping are:

37 Take off: (powerful-weak)
The force that the horse uses to push off the ground in the take off.

38 Take off: quickness (quick-slow)
The time between the horse puts down the front hoofs and hind hoofs in the final gallop leap and the moment when the horse leaves the ground.

39 Take off: direction (upwards-forwards)
The horse's ability to jump up to the withers in upward movement of the jumping phase.

40 Technique: foreleg (bent-hanging)
How well the shoulder with the upper arm, forearm and tibia are carried. Checkbox: lower body, outstretched.

41 Technique: back (rounded-hollow)
How well the neck and back following the moving curve.

42 Technique: haunches (open-tight)
How well the haunches open up during the latter part of the projection.

43 Scope (much-little)
The horse's ability to jump both upwards and forwards with force.

44 Elasticity (elastic-stiff)
How well the horse's total leap (including landing) demonstrates smoothness by the elasticity of the body.

45 Care (too careful-not careful)
The horse's natural ability to jump without tearing.

46 Distance estimation (secure-insecure)
The horse's natural ability to self find the right point of take off.

47 Balance (balanced-unbalanced)
The horse's natural ability to canter, jump in balance and after the landing.

48 Reaction (quick-slow)
The horse's ability to respond quickly to a given situation, as well as the ability to correct itself.

49 Approach to assignment (focused-unfocused)
Horse's natural approach to obstacles.

50 Behavior (relaxed-tense)
The horse's degree of stress physically and mentally

(SWB 2014)

Appendix 2. Swedish linear protocol for three-year-old horses

Place/Date/……

Name: ID-no: Gender:

Sire. Dam. Color:

Breeder:

Owner:

Linear profile **Height of withers _____**

	CONFORMATION	**Obvious**	**Average**	**Obvious**	**Comment**
			A B C D E F G H I		
1	Type	refined (i.e. light)	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	heavy	☐ good proportions
2	Body: shape a	long	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	short	
3	Body: shape b	long legged	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	short legged	
4	Body direction	uphill	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	downhill	
5	Length of neck	long	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	short	☐ wide connection
6	Position of neck	vertical	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	horizontal	☐ low connection
7	Shape of neck	arched	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	straight	☐ heavy head-neck connection
8	Withers	high	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	low	
9	Position of shoulder	sloping	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	straight	☐ deep chest
10	Line of back	straight	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	swayback	
11	Loins	long	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	short	☐ roached back
12	Shape of croup	sloping	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	straight	
13	Length of croup	long	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	short	
14	Foreleg	over at knee	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	back at knee	☐ tied in ☐paral.displ.can ☐ misplaced cannon bone
15	Foreleg	toed in	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	toed out	☐ thin legs in prop.to body ☐outward rotated forelimb
16	Pastern, front	upright	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	weak	☐ long ☐ short
17	Hind leg	sickle	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	straight	☐ tied in
18	Hind leg	cow hocked	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	bowlegged	
19	Pastern, hind	upright	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	weak	☐ long ☐ short
20	Correctness in movement	winging	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	paddling	
21	Hoofs	big	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	small	☐ uneven ☐ low heels
	MOVEMENT	**Obvious**	**Average**	**Obvious**	**Comment**

			A B C D E F G H I		
22	Walk: cadence	even	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	uneven	
23	Walk: stride length	long	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	short	
24	Walk: suppleness	supple	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	stiff	
25	Walk: elasticity	elastic	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	unelastic	
26	Trot: length of stride	long	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	short	☐ irregular
27	Trot: elasticity	elastic	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	unelastic	☐ movement tight to the ground
28	foreleg activity	shoulder free	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Short	
29	Trot: hind leg position	under the body	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	behind the body	
30	Trot: hind leg activity	active	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Inactive	
31	Canter: rhythm	even	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Uneven	
32	Canter: stride length	Long	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Short	
33	Canter: action	round	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Flat	
34	Canter: elasticity	elastic	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	stiff	
35	Canter: balance	well balanced	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	unbalanced	
36	Movement: direction	uphill	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	downhill	

Place/Date/……

Name: Reg nr:

	JUMPING	**Obvious**	**Average**	**Obvious**	**Comment**
			A B C D E F G H I		
37	Take off	powerful	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	weak	
38	Take off: quickness	quick	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	slow	
39	Take off: direction	upwards	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	forwards	
40	Technique: foreleg	bent	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	hanging	☐ under the body ☐ stretched out
41	Technique: back	rounded	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	hollow	
42	Technique: haunches	open	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	tight	
43	Scope	much	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	little	
44	Elasticity	elastic	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	stiff	
45	Care	too careful	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	not careful	
46	Distance estimation	secure	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	insecure	
47	Balance	balanced	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	unbalanced	
48	Reaction	quick	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	slow	
49	Approach to assign.	focused	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	unfocused	
50	Behaviour	relaxed	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	tense	

Scores

	Comment	**Movement**	**Jumping**
Type:			
Head-neck-body:			
Legs:			
Walk:			
Trot:			
Canter:			
Jumping: technique & ability:			
Jumping: temperament:			
OVERALL SCORE			

CLASSIFICATION MOVEMENT	**CLASSIFICATION JUMPING**
Diploma ☐ **Class 1** ☐	**Diploma** ☐ **Class 1** ☐
OTHER:	

RIDING (separate protocol)	**Approved** ☐	**Not approved** ☐	**Didn't participate** ☐

Signature judge	Signature judge

Anna Cederström 2016.

Appendix 3. Description of the Flyinge Model

The goal for the horse is to prepare them for the three-year-old test from beginning to end of training to make them move in a relaxed way and feel enjoyment as they canter and jump over the obstacles. *The Flyinge Model's* training track during training was set up with an open area on the opposite long side of the combination (Figure 2). This was used as an opportunity to train the young horses to respect boundaries and to keep him/herself on the track. Large and small white fencing and barrier tape are used to make the ring that held the horse on the track. Small fencing was also used to scale off the corners in order to motivate the horses to move forward. Three obstacles were placed on a long side on the outside of the ring. Using small fencing a corridor structure was built before and after the obstacle combination. This was so that the horse learned to keep a straight line before and after the obstacles. No barrier tape was used along the A, B and C jump. This due to that it would be faster to build the obstacles in-between the training session. Safety cups were used on the back pole of jump C.

The two and half-year-olds were trained in free jumping once a week on Wednesdays for six weeks. The other four workdays they trained in other disciplines from leading, lounging, breaking in, free running or long-reining. On weekends they rested and only went out in the sand paddock. Each training session of free jumping the horse would have a bridle with a bit but without reins. If the horse was not used to having a bit in the mouth it would then have a halter over the bridle as well. Leg protection was put on the front legs.

Before letting the horse loose for free jumping there would always be at least three people in the ring holding a driving whip; these would push and stop the horse if needed. One would have the main responsibility, telling the other two to push or stop the horse. If there were more helpers in the ring then they could build the obstacles throughout the lesson. Before letting the horse into the indoor arena all the poles would be on the ground and all cups would be taken off the jumping stands. The gate would be open.

Warming up phase one; as a warm-up the horses were led around the ring in both directions walking over the poles from obstacles A, B and C that were on the ground. Behind the leader and horse there would be a person driving from behind if needed to move the horse forward with a driving whip. Other ways to encourage the horse to move forward would be with their body language and voice. The students were only allowed to push from behind the horse.

Warming up phase two; the student leading the horse would line the horse up facing clockwise on the starting point (Figure 2). A whip holder would then stand in front of the horse stopping it from moving forward. The leader would let the horse loose and quickly walk past the whip holder to minimize an accident from occurring. The whip holder would then push towards the horse by slightly raising the whip in the air. This forced the horse to turn around and trot or canter anticlockwise two to four times around the ring until it showed good forward thinking in canter. Then a whip holder would block the horses' path by placing him/herself in the way. By this forcing the horse to turn around. Then the horse would canter clockwise two to four times. It was important not to let the horse run more than needed. Since they were fresh horses they did not have much condition and needed to save their energy for the obstacles.

Free jumping phase; every jumping session was different due to that the horse would during the time of training become more trained and gain a greater understanding of its assignment. This would then result in that the first times when training the horse it would jump smaller obstacles. As at the end of the six-week training period it would jump larger obstacles if the horse showed capacity for it. In the two first weeks after warm up phase one and two, jump C was built up to an obstacle on 50 centimeters. While the poles from obstacles A and B would still be on the ground, the horse would then jump this once. The horse would repeat this set up four to five times or until it had understood the meaning of the exercise, which was; forward-jump-forward. The second jumping session the young horse began with warm up phase one and two and then started jumping jump C on about 80 centimeters with the poles from obstacles A and B still on the ground. Being successful, obstacles A and B would both be built to 50 centimeters as a vertical obstacle. The horse would then jump. If the horse showed desire to jump more, obstacle C would be put up to an ascending double bar obstacle (80 centimeters front pole, 90 centimeters back pole).

The horses needed to build confidence and show forward-thinking towards the obstacles as this would be done by easy workouts. The goal was that the horse would go through the combination by itself so it would not need to be chased around the ring. When the horse showed that it felt secure in jumping the obstacles and progressing through the course by itself then pole aids could be employed if its technique needed to be improved. The different help equipment was mostly used with pole aids to improve the horses jumping phase and/or canter.

In between every time a horse had jumped the combination it was left alone while waiting for its next task, and was able to do so quietly with no one disturbing. Praising was only done on the resting place (Figure 2).

Whip holders position

At all times there were least three people (in this case students) that held whips. Person 1 had the main responsibility to lead the free jumping, making sure that everyone was in starting position before opening the gate to let the horse begin jumping. Person 1 would push the horse forward if needed on the blue line (Figure 9). Person 2 prepares the horse’s speed before coming to obstacle A; also marked in red. Person 3 takes over from Person 1 after the horse has jumped also marked as green. Person 3 then lets the horse rest in the resting place (Figure 2). There was always a person holding the gate to open and close it. After being told by Person 1 to open the gate Person 2 would then raise the long whip from behind the double bar obstacle and push the horse to go in an anti-clockwise direction following behind and leaving it by Person 2.

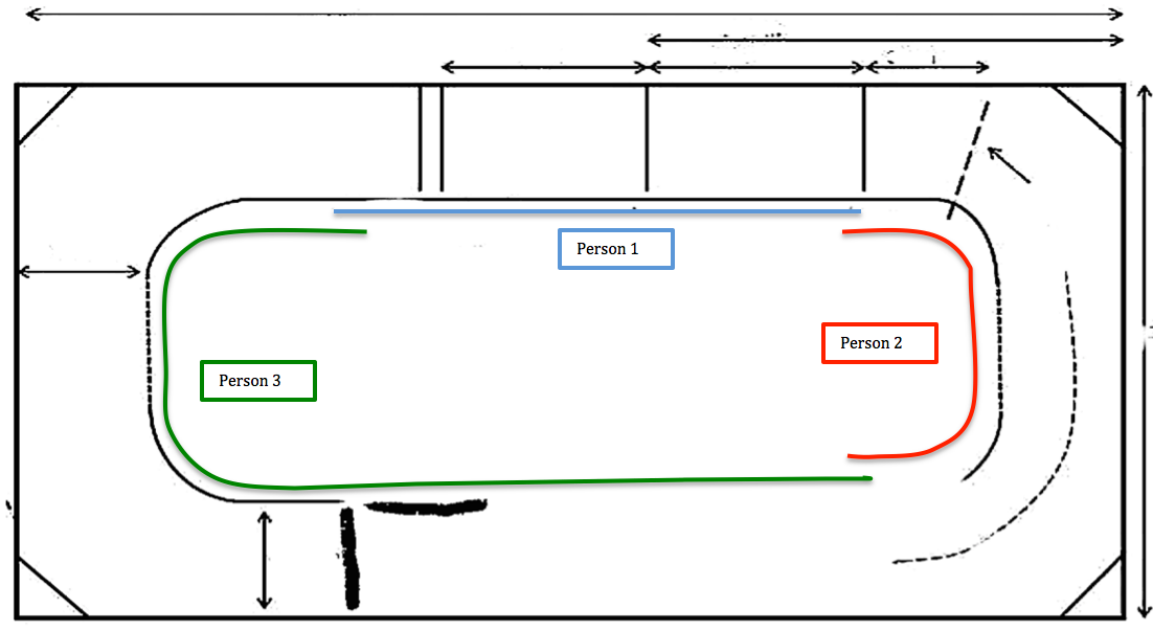

Figure 9. Color-coded positions of the whip holders.

It was important that these people worked well together and communicated with each other so that they did not always smack or whip towards the horse. A calm *behavior* allowed the horse to think on its own and learn. Having the same routine by the aid of the teacher helped the horse to learn how it worked.

Whip aids

The aid was used on horses that behaved carefully and/or did not think ahead which could have led them to jump off too early or maybe even taking two canter strides between the obstacles when it was supposed to take only one. The three whip holders in the ring would take turns in encouraging the horse from behind to think forward. They would raise their whips after the horse had passed them and if the horse did not respond to this it would get a touch of the whip on its hindquarters. Thereafter teaching the horse to take only one canter stride between the obstacles, which was desired.

The whip holder could also be used only in certain areas to push the horse forward. For example on horses that lost energy/speed in the corners before the jump but had no problem with obstacles A, B and C. The whip holder would then only push the horse through the corner and then stop driving to let the horse jump for itself.

This aid could also be used when the horse refused to complete a jump when it became shocked by something it was not habituated to, such as help equipment placed on the course. Having a whip holder ready to push the horse forward at the right moment would help the horse to learn that not all new things are dangerous.

Pole Aids

Ground pole

Ground poles were placed making the gap more than ten centimeters on obstacles A, B and C. This ground pole could be moved outward making the gap more than 10

centimeters. This was used to help horses which had a tendency to come too close to the obstacles which resulted in it not having enough space to lift its shoulders and front legs, which affected the results in traits 37 to 42 in the Swedish linear protocol for three-year-old horses. Making the horse jump off earlier to give it more space to elevate the foreleg.

In the beginning of training the ground poles were moved out to approximately 15 to 20 centimeters. The poles were to encourage the horse to jump off further away from the jump. This also to help the horse learn to take one canter stride instead of two between two obstacles. By moving the pole outwards approximately 20 centimeters it made the space between obstacles B and C look too small a place to take two strides.

The ground pole could also improve the horses' jumping curve. The pole controlled where the horse was supposed to jump off due to that the horse used it to see the distance to the obstacle. *The Flyinge Model* state that the pole changes the apex of the jump.

Guard-pole between two obstacles

Some horses could have a flat canter thus letting the apex of their jump become flat and risking that it would knock down a pole. A flat canter had more movement going forwards than upwards. In order to encourage the horse to adopt a round canter the pole would for example be placed between obstacles B to C at a distance of 3,50 meters behind obstacle B. This desired movement would give a moment of suspension, a more upward motion instead of a forward motion while at the same time activating their *technique: haunches*, making more *elasticity* in its movement and therefore making a better apex over the jump. It was also important that the whip holder was ready to move the horse forward from behind so the horse did not lose its forward momentum. This could occur the first few times when new equipment was introduced, or if the horse was weak and/or lazy since these movements required more energy from the horse.

The pole could also be used on a horse with a lot of energy and would just "race" through the obstacles without hesitation. Such poles could be placed between the obstacles A to B and B to C and be used as a half halt. It was then important that the whip holder did not push the horse forward but let it solve its own problem, but to be there as help if it stopped. It was then good to use the pole the first time with the C double bar obstacle not higher than 90 centimeters.

The pole could also be used to correct the jumping curve for example a horse that landed too far away from obstacle B and then would come in too close to obstacle C (or obstacle A to B). This meant that the jumping curves over obstacle B and C would be moved backwards along the combination. By placing the pole at 3,10 meters behind obstacle B the horse would have to land earlier and therefore it would create a greater distance to C. This also helped the horse to have more time and space to lift its shoulders and forelimbs higher. This pole was used for the correction of the jumping curve when a ground pole was not effective on the horse.

Side pole

The pole would be placed as follows; one end of the pole on the obstacle just touching it and not sticking out so it would not hurt the horse and the other end on the ground facing outward (Figure 4). The side pole was used on a horse that drifted over to one side of the jump. One example could be that a horse drifts to the left, this occurred because it was

more powerful in its right hind leg and as it jumped at the take off it pushed more with its right hind leg then its left leg. This then resulted in it jumping and landing more to the left. Some horses with a lack of balance would drift to the right and thereby not jumping in the center. The pole would be placed on the right side to direct the horse towards the center of the obstacle.

Appendix 4. Least mean square

The numbers in the table represent the least mean square in the different tests in the assessment point given by the judges for each week of documentation

Traits	Average week 2	Average week 4	Average week 6
37 Take off: (powerful-weak)	5.78	5.17	5.39
38 Take off: quickness (quick-slow)	5.17	5.22	5.11
39 Take off: direction (upwards-forwards)	5.72	5.06	5.11
40 Technique: foreleg (bent-hanging)	4.83	4.83	4.5
41 Technique: back (rounded-hollow)	5.78	5.39	5.39
42 Technique: haunches (open-tight)	5.1	4.89	4.72
43 Scope (much-little)	5.56	4.94	5
44 Elasticity (elastic-stiff)	5.56	5.06	5.06
45 Care (too careful-not careful)	5.33	4.5	5.06
46 Distance estimation (secure-insecure)	5.78	4.67	5
47 Balance (balanced-unbalanced)	5.56	4.67	4.61
48 Reaction (quick-slow)	5.33	5	5.17
49 Approach to assignment (focused-unfocused)	5.61	4.72	4.94
50 Behavior (relaxed-tense)	5.94	4.94	4.94

The numbers in the table represent the least mean square and significant differences in the first jump preformed by the horse for each week of documentation

Average jumping distances	Jump one week 2	Jump one week 4	Jump one week 6
Take off	132.5[a]	153.33[b]	155[b]
Landing	130.83	127.5	143.33

Means with the same superscript ([abc]) within row and weeks of documentation.

The numbers in the table represent the least mean square and significant differences in the second jump preformed by the horse for each week of documentation

Average jumping distances	Jump two week 2	Jump two week 4	Jump two week 6
Take off	132.5	137.5	133.33
Landing	175[a]	147.5[b]	159.17

Means with the same superscript ([abc]) within row and weeks of documentation

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