THE VIEW OF THE HORSE

Equine Assisted Coaching from the horses' point of view

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A study about the stress horses undergo during Equine Assisted Coaching

Bachelor Thesis - Equine Management

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Declaration of Independence

Hereby we, Helena Hollenhorst and Ronja Wagenknecht, declare that we have authored this bachelor thesis independently, that we have not used other than the declared resources, and that we have explicitly marked all material which has been quoted either literally or by content from the used sources.

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"Silent gratitude isn't much use to anyone."
(G.B. Stern)

The research is dependent on the support of coaches offering Equine Assisted Coaching.
We found those coaches in the Netherlands and Germany:
Deborah Smulders (Be&Become),
Coby van Beets-van der Hoeff (Kifungo) and
Siglinde and Joachim Bender (LeadingRein) -
Thanks for inviting us to observe your horses and welcoming us with open arms!
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thank you very much for all your commitment and always helping us with words and deeds!
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Preface

"Horses don't lie. They don't separate how they feel and how they act."
(Chris Irwin)

This bachelor thesis is part of the study programme Animal Management at the VHL, University of Applied Sciences, in Leeuwarden the Netherlands. All the knowledge and competences obtained in the four years of studying are used for this thesis.

The idea for a research about stress behaviour of horses during Equine Assisted Coaching (EAC) came up after we found out that there is much research done in the field of the positive effects of EAC on the client, but that there is almost no research done that deals with the horse itself. Because we specialised in Animal Welfare Quality Management during our study, it seemed interesting for us to conduct a study about stress in horses during EAC. As a result of our internships and handling horses in our free time, our special interest lies in the natural behaviour of horses. Therefore we chose to observe the behaviour of the horses to investigate the level of stress they experience during EAC sessions. It became apparent very quickly that there was much interest in such a study on the side of coaches when we sent emails to organizations in the Netherlands, Germany and Belgium.

We contacted a lot of organizations and professionals that offer EAC to have a broad variety of participants. However it was a challenge to find organizations that were willing to work with us. In the end we had several people that helped and encouraged us to proceed with the study despite the difficulties. These organizations were:

EQ-Pferd
This is an organization in Germany that is led by Detlev Lindau-Bank. It is a union for the development of quality criteria and standards for horse assisted personnel development interventions, training concepts and further education.

Be&Become
The mission of this Dutch organization is to give people the possibility to discover their core qualities and to apply them in the organization they work for. Leader of the organization is Deborah Smulders. She offers leadership trainings, workshops for communication, advice, teambuilding and individual coaching's with the horse.

Kifungo
Under the direction of Coby van Beets-van der Hoeff coaching with horses such as leadership training or personal and systematic training are offered in Lunteren, the Netherlands. She uses the body language of the horse to reveal the feelings and attitude of the human. Van Beets-van der Hoeff also trains future coaches.

These people are separately mentioned in the acknowledgements because we want to give special thanks to them.

We want to encourage the readers to think more about the welfare of the horses and critically think about their trainings and horses as coaches. An additional benefactor of this study would be the participation of more professionals in further studies.

Leeuwarden, January 2015, Helena Hollenhorst and Ronja Wagenknecht

Abbreviation

AICC	The corrected Akaike information criterion for small sample sizes.
EAC	Equine Assisted Coaching
EAHAE	European Association of Horse Assisted Education
HAE	Horse Assisted Education
LMM	Linear Mixed Model
PDA	Personal Digital Assistant
SPSS	Statistical Package for the Social Sciences

Abstract

Equine assisted coaching (EAC) is a new technique to make people aware of their body language with the help of the horse. The benefits of this training concerning the people have been researched before. However, there is no indication how the horse is experiencing these trainings in any studies. Therefore this study was conducted in order to provide an insight into the level of stress horses experience during EAC. As an indicator for stress, physical parameters such as heart rate, breathing rate, blood pressure and the behaviour of the horse can be taken as a measurement. This study concentrated on the behaviours, which were observed with the help of a beforehand made ethogram during different EAC sessions. Several factors could have had an influence on the horses' behaviour and were considered. The information for these factors was collected with the help of questionnaires. The factors can be divided into three groups: horse related (age of the horse, experience of the horse in EAC, breed and character), client related (experience in handling horses, previous experience EAC) and environmentally related (position of the trainer, kind of exercise). Concerning the gathered information the following research questions were formulated: In how far show horses stress behaviours during an equine assisted coaching session and which factors to which extent have an influence on the stress behaviours? A total of 12 horses and 15 clients were subjects in six different exercises (free, lunge line, lead rope, trail, round pen and systematic coaching) used in EAC. Not all horses participated in all exercises and with every client. Two observers looked at the body language of the horse with the help of an ethogram and recorded all behaviours continuously for 5-minute intervals with a one-minute break in between. During a session several intervals had been recorded and the observations of both observers were averaged as well as the multiple observations of one session. This meant that all sessions had a length of five minutes that were analysed. A total of 33 sessions, which equals to four hours and 50 minutes observation time, were observed and used in the data analysis. The results showed that in 3,10 % of all sessions, stress behaviours were demonstrated. These were significantly depending on the kind of exercise ($p=0,032$). However, the stress shown was not significantly dependent on the age of the horse ($p=0,140$). Moreover, all other factors could not be proven as significant. Analysis showed that during the exercise 'Lunge line' stress was demonstrated the most followed by 'Free' and 'Round pen'. The exercises 'Lead rope' and 'Trail' had respectively low stress in comparison to the former mentioned exercises. 'Systematic coaching' had the lowest amount of stress of all exercises. The results suggest that the horse is showing stress during EAC and that it is related to the different kind of exercises. Knowing that the exercises have an impact on the stress level of the horse can be a factor for trainers in deciding which exercises they use for sessions. Furthermore, it is essential that there will be more research into this topic with respect to the client and the difference in horses.

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Introduction

"Horses don't speak, but they communicate through body language. If you look very closely, you'll find out your horse has been trying to talk to you every day."
(Sheikha Hissa Hamdan Al Maktoum)

Nowadays horses are usually used for sport and recreational purposes but since the early nineties a different aspect is used for further education with the horse, also known as Equine Assisted Coaching[1] (EAC). It focuses on vocational training. This includes coachings and trainings for personnel and managers (also see figure 1). In this context people can acquire, broaden or improve the competences that are necessary in their job by working with horses. Social and personal competences, so-called soft-skills[2], form the initial point. The ability to work in a team, leadership quality, assertiveness, creative thinking and conflict management are just a few examples. (Lindau-Bank, 2012; Riedel, 2011)

What is the role of the horse in EAC? Horses are very sensitive living beings. They are social animals that live in a herd and mainly communicate via their body language. (Mills & Nankervis, 1999; McGreevy, 2004) In terms of EAC it is assumed that horses recognize inconsistencies in the behaviour of a human and become insecure if there are discrepancies between the inner and outer behaviour. So the horse used in EAC is a medium and serves as a mirror of the human's behaviours. (Stempel, 2011) Communication[3] is the keyword in this interrelation. Here it is important to think about the consequences for the relationship between horse and human because the horse constantly reads the humans' body language[4]. The human is a predator, whereas the horse is a prey animal. As a result the body language is very different. The human, as a predator, has his eyes in front of the head, making it easy to focus on prey. The horse, as a prey animal, has its eyes at the side of the head with an almost 360° vision, enabling it to see almost everything around it. The predator has a tendency to go forward and attack in straight lines whereas the prey makes circles and curves when fleeing. Prey animals rarely focus on things, but rather are aware of everything that goes on around them. (Irwin & Weber, 1999) Actually, through the eyes of the horse, the human is a threat. (Hollinger, 2008)

A study of Chamove et al. (2002) looked at the relationship between the behaviour of the horse and the confidence of a person. The participants should lead a horse through a predetermined course. Beforehand their confidence level when interacting with animals was determined by a questionnaire. Further the questionnaire comprised questions about the attitude and experience of the participant. The researches assessed the humans as well as the horse behaviour. It came out that a positive attitude towards horses could be associated with less ear movement from the horse, which suggests

[1] Consists of team building, self–esteem and leadership exercises with the help of horses as a personal mirror.
[2] Soft skills, also often called social skills, are the management of relationships as well as individual abilities to work on relationships. These skills include, but are not restricted to, intuition, judgement, communication, leadership and interpersonal interactions. (Carvalho & Rabechini Junior, 2014)
[3] As a keyword in the interrelation between horse and human, it is important to understand the meaning of the term communication. It comes from the Latin word 'communicare' and means to share, to receive, to join with. When communication takes place a message is sent by a sender to a recipient via a communication channel. (Böckem, 2006) Referring to EAC it means that the human sends a message to the horse and vice versa. This can happen via different channels just like the voice or the body language.
[4] "Non-verbal, mostly unconscious communication made by an individual through facial expressions, gestures, movements and postures." (Eggert, 2010)

a more relaxed and comfortable horse. The lead tension also had an influence on the horses' reaction. High lead tension could be associated with resistance from the horse and low lead tension with a low head position. (Chamove et al., 2002)

The human may assume that the horse knows what he wants (anthropocentrism) (McGreevy & McLean, 2010). But if he sends out unclear cues, the horse does not respond in the desired way (Brandt, 2004); humans among themselves sometimes communicate at cross purposes as well (Hollinger, 2008). Gina Bode (2007) analyzed the effects of non-verbal leadership behaviour of humans on horses' reaction. The study is based on the fact that horses communicate with minimal body movements and facial expression. The participants were recorded while they went through a course with two obstacles together with a horse to assess the leadership behaviour and the reaction of the horse. Therefore different variables were considered such as the level of the hand and eye contact of the human or the ear position and speed of the horse. It demonstrated that persons with adequate non-verbal leadership behaviour evoke an adequate reaction from the horse. People with negative leadership behaviour acted troubled when the horse did not what they wanted and adapted themselves to the horse. They tried to avoid a confrontation. (Bode, 2007)

Miscommunication between horse and human can lead to frustration and/or stress[5] on both sides (McGreevy et al., 2009; Brandt, 2004). Trainers do not want the horses they use in EAC exposed to stress too often. Because they are prey animals, horses are very sensitive to stress (Mills & McDonnell, 2005). Stress is a physical response of the animal to a stressor[6]. A stressor can be emotional or physical and also be acute or chronic. The latter has a bigger impact on the welfare[7] of the animal because of the possible pathological changes in the animal. (Moberg & Mench, 2000) However, in the end both are an intense emotional experience. (Wiepkema, 1986)

It is difficult to note the difference between an acute and a chronic stress response[8] when watching the body language of the horse. In both cases the horse shows an increased muscle tonus and body tension but may also be bucking, flipping over, shying, rearing, bolting or rushing backwards (McGreevy & McLean, 2004). Acute stress is linked to increased alertness, increased blood pressure as well as increased breathing rate and heartbeat (Reece et al., 2011). The behaviour, such as the ear and tail movement and the head position, can indicate whether the horse has stress or not (McGreevy, 2004). Chronic stress leads to increased blood volume and blood pressure, increased blood glucose and partial suppression of the immune system (Reece et al., 2011). Stereotypic behaviour is a typical consequence of chronic stress (Mills & McDonnell, 2005; McGreevy, 2004). A certain amount of stress is not always negative, for instance stress can be important to stay alive and

[5] There is a difference between acute and chronic stress:
Acute stress entails a response to an emergency situation with redirecting the cognitive, behavioural and physiological processes accordingly to the stressor. (Moberg & Mench, 2000)
Chronic stress mostly is long-termed and continuous. It often is a result of a series of acute stressors which can entail a pathological condition. (Moberg & Mench, 2000)

[6] The threat to an animals' homeostatis, which leads to a stress response. (Moberg & Mench, 2000)

[7] The welfare of animals is defined as "its state in its attempts to cope with environmental challenges". (Fraser & Broom, 1997)

[8] The stress response can be divided into three stages. First a stressor is recognized, which in the second stage is followed by a biological defence and ends in the consequences of the response. Actually the last stage gives an indication about the impact on an animals' welfare. That means whether the animal is suffering or not. (Moberg & Mench, 2000)

serve as a protector and adaptor. Moreover, it is sometimes necessary to be able to cope with difficult situations. (McGreevy & McLean, 2010; The Lupus Support Network, 2005) For this reason it is important to consider not only *if* horses undergo stress but to what extent. The previous mentioned indicators could all be used for measuring the level of stress horses undergo during an EAC session. However, in this study the heart and breathing rate as well as the blood pressure are not measured because this would interrupt the coaching sessions. Due to this only the behaviour of the horse is used to determine the level of stress.

There are different variables, which may cause stress during EAC, including the different body language of horse and human due to the predator-prey relationship, which can lead to miscommunication. (McGreevy & McLean, 2010; Irwin & Weber, 1999) Next to this the experience of the coached person in handling horses (Visser et al., 2008), the experience and character of the horse (Mills & McDonnell, 2005; Chamove et al., 2002; Fraser, 2010) as well as the horse's age (Baragli et al., 2014) may have an influence on the stress level. Moreover, different types of exercises can have an impact as well, also known as exercise stress (Hinchcliff et al., 2008). Such exercises can be carried out with or without the help of an object, think of a lunge line or lead rope. During some exercises the client has to go through a trail with the horse or has to lead the horse in loose contact (exercise description see chapter 1.2.1). Training can be attended through several organizations all over the world. This research was focused on organizations in the Netherlands, Germany and Belgium.

Currently there is nearly no scientific literature and research that give information on the impact of EAC sessions on the horse, especially dealing with stress. There have only been numerous studies about the positive effects on people while working with horses, amongst others by Majewski (2013). A study of Bogner (2011) showed that there is an interest in knowledge of the stress level of horses during EAC. She reviewed 21 scientific papers dealing with Horse Assisted Education (HAE). Just one of those researches was equine-related. The others in particular had a pedagogical, social or other non-equine focus. Furthermore, there were different research impulses given which also included the investigation of the horse's point of view, horse experience vs. no experience and horse knowledge vs. no horse knowledge. So all in all the study of Bogner showed that there is interest in further research in the field of Horse Assisted Education referring to the horse. (Bogner, 2011)

While contacting several EAC trainers for this study, they expressed interest in the effects of EAC on the horse. Because there was a clear demand for scientific research, the aim of this study was to provide insight into the level of stress that horses experience during EAC. This may attract attention for further, more detailed research. There are a number of variables which may cause stress in the horses that will be analyzed, so further research could concentrate on one specific variable. A comparable study was conducted by Meinzer (2008) about horses used in therapeutic riding. She analyzed the behaviour of horses to investigate how much therapy influences the mental state of the horse. She looked at whether the horses paid more attention to the client or to the environment and investigated whether the horses showed behaviour that suggested dissatisfied, relaxed or excited sensitivities. To do so she made an ethogram with different behavioural categories and observed the horses during therapy sessions. It came to light that horses which are housed in a box showed more dissatisfaction than horses from an open stable. Furthermore, horses showed more dissatisfaction when they were alone in comparison to when there were one or more persons present. (Meinzer, 2008) Her research shall serve as an orientation for the execution of this study. Meinzer only used one stress category ('Dissatisfaction'), whereas in this study there are three ('Dissatisfaction',

'Apprehension', 'Fear') which indicate different stress levels. 'Dissatisfaction' is the first stress category that has a negative impact on the horse. 'Apprehension' is the next level of stress, followed by 'Fear' which is the escalation of stress and therefore is the highest stress level in this study.

Because the impact of the mentioned factors formed the focus in this study, it shall be found out *in how far horses show stress behaviours during an equine assisted coaching session and which factors to which extent have an influence on the stress behaviours*. Answering these questions shall help to gain an insight into the impact of EAC on the stress level of horses.

Next to the main questions some sub questions were formulated. The answers of the sub questions will lead to the answer of the main questions.

Which stress behaviours do the horses show during the trainings?

Which of the following factors influence the stress behaviour?

- Character of the horse
- Breed of the horse
- Age of the horse
- Experience of the horse
- Experience of the client in handling horses
- Previous experience of the client with EAC
- Position of the trainer
- Kind of exercise

What is the stress level when referring to the duration of the stress behaviours and the kind of stress behaviours?

The following chapter provides an insight in the field of EAC. Furthermore, the methods used during this study followed by the results show what the horses' view of the trainings was. In the end the discussion and conclusion finalize the report with some critical statements concerning this subject.

Equine Assisted Coaching

"Employers are like horses — they require management."
(P.G. Wodehouse)

EAC belongs to a set of horse assisted interventions, which also comprises therapy and sport with the horse. Figure 1 gives an overview over the wide field of these different interventions. Whereas therapy mainly has a beneficial factor for the health, EAC aims at extra-educational encouragement.

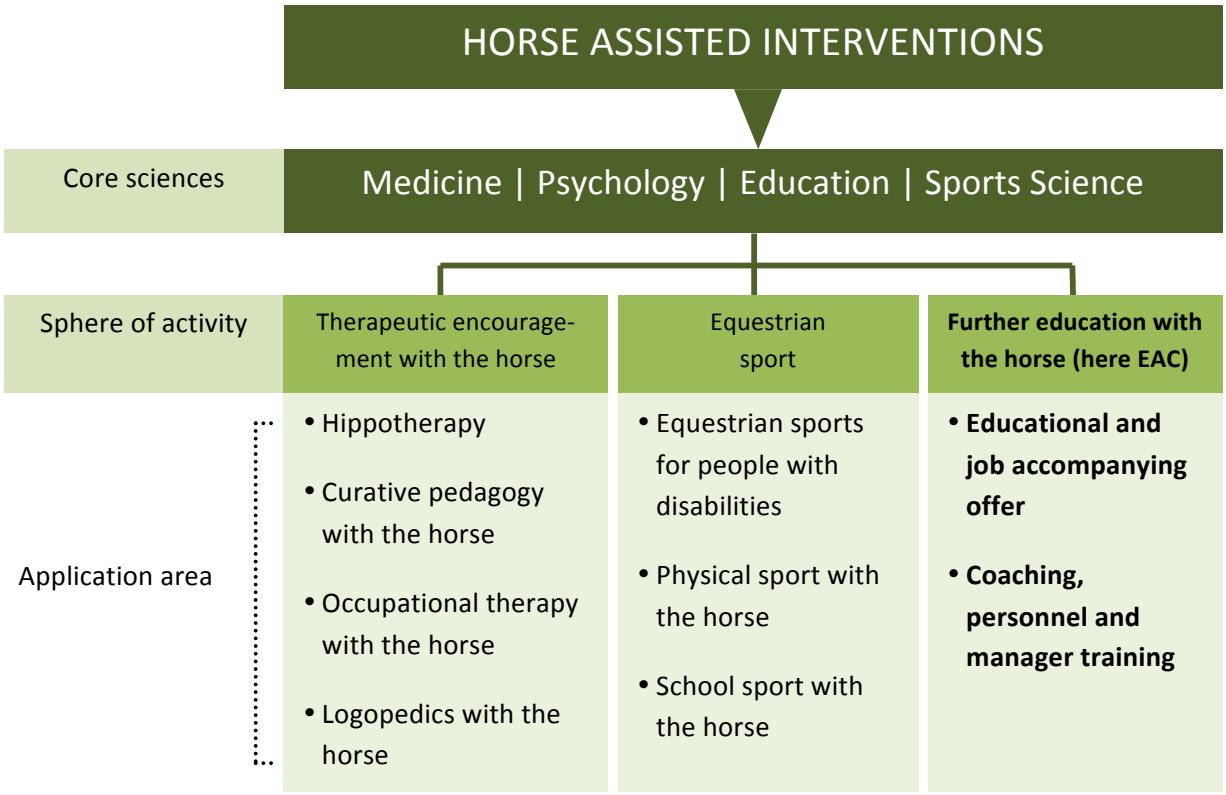


Figure 1 Horse assisted interventions as described by Riedel (2011)

As mentioned before the initial point of EAC is to train soft-skills. This includes the ability to work in a team, empathy, flexibility, leadership quality, assertiveness, creative thinking and conflict management. In addition methodical skills like giving feedback, behavioural observation and evaluation can be trained. Generally coaching is offered for small groups or individuals. It is important to understand that participants learn how to assert themselves and to be a leader. Executive managers are also mediator and designer of business processes and personnel has to be encouraged in its entrepreneurial responsibility. (Lindau-Bank, 2012) The horse can be seen as a co-facilitator or a colleague. It can stimulate specific activities or adds certain elements to already existing ones. A goal of every session is "that the client forms a close and long lasting relationship with the horse" (Hallberg, 2008).

Not every horse is suitable for EAC. The mental and physical stability of the horse is important to consider when choosing one. It should be watched whether the horse enjoys the work and it should get appropriate breaks from its work. (Hallberg, 2008)

1 Methods

This chapter presents the materials and methods used during this study. Not only the research design of the study, but also the set up, the population that was used as well as the data collection and the data analysis will be described.

1.1 Research design

Regarding this study an explorative research design was used including observation for the data collection to determine the stress behaviours, horses show during EAC. An ethogram of equine behaviours was created and horses were observed during EAC sessions.

To analyse the behaviours correctly, literature helped in understanding the different ways of communication of the horse through body language. The information gathered during the literature research was structured in a short overview with the most important behavioural characteristics shown in Appendix I. Meinzer (2008) indicated in a study of therapy horses, six different categories of behaviour during training sessions. These categories were the base of the ethogram used in this study. In chapter 1.4 the full explanation of the used ethogram can be found.

For the purposes of this study the behaviour of the horses was recorded continuously for five minutes in each session. The sessions had different length, which was unknown beforehand and therefore multiple recordings were taken during longer sessions. After each five-minute interval a one-minute break was taken before starting the next five minutes. The multiple observation intervals were averaged to five minutes per session. Two observers registered all behaviours simultaneously; these were merged per interval for analysis.

To measure the observer reliability the two observers underwent training with the ethogram. It was important to have a high intra observer reliability, which meant that one observer kept a high consistency of his own scores while scoring the same video. Furthermore, the inter observer reliability had to be taken into account and be sufficient, which meant that between the two observers the scores of the same video had to be consistent with each other. (Martin & Bateson, 2007) The training was done with the help of video sequences of EAC that were found on Youtube as well as the program Match and Mismatch of the Groene Kennis Coöperatie (2010). The observers also trained during a live session of therapeutic coaching that was conducted in Germany.

The observations were made with the help of a personal digital assistant (PDA) with the program pocket observer that was programmed beforehand in the program Observer XT 11.5 (Appendix II) After the observations were concluded the data was then uploaded to Observer XT 11.5 again and prepared for the analysis within the program and also the help of Excel 10 and SPSS 22.

1.2 Set up

Observations were conducted during the study, to find out the stress behaviours of the horses in EAC. Two observers stood at the side of the indoor arena where the coaching took place. A client figured out a task with a horse in the arena under supervision of the trainer, who could either stand outside or inside the arena. The other participants stood outside the arena as well (figure 2).

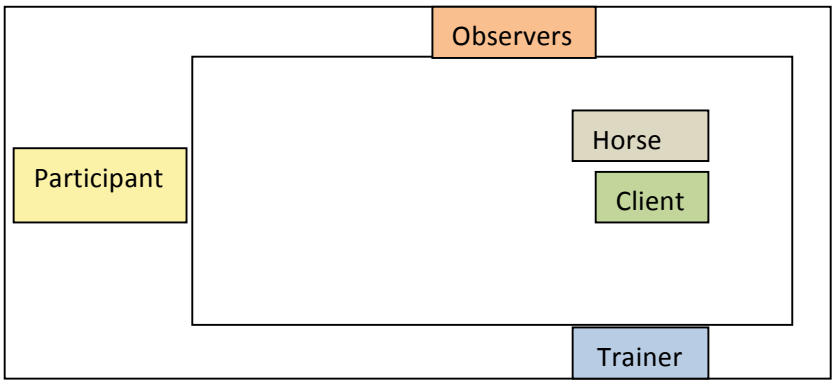


Figure 2 Set up of observation during an EAC session

1.2.1 Exercises

During the different coaching sessions at the locations a variety of exercises were used in the trainings. In total six different ways of working with the horses were observed. These included working with a free horse, a horse on a lead rope or the lunge line, going with the horse through a trail or working in a systematic coaching with multiple people as well as working in a round pen.

Free

Working with a free horse included the horse being loose in the whole arena or a part that was set apart for the exercise. However, the horse was not chased away like in the round pen and no props were used by the client. The client was supposed to make contact with the horse and lead it in different directions.

Systematic coaching

During a systematic coaching session, the horse was free in the arena with the client and the trainer. During a session more and more people came into the arena representing certain aspects the client was working on. Therefore, the horse had a lot more people around than during a one on one session. In contrast to the other exercises the client had no interaction with the horse. The trainer used the behaviour of the horse to interpret what the client had to work on.

Lunge line

The lunge line was also attached to the horse's halter and the client could send the horse out on a circle to lunge it. This meant the horse was moving in a circle around the client in all three gates. The client was not working with a lunging whip, just with the line.

Lead rope

The lead rope was attached to the horse's halter and the client could go with the horse on a loose lead rope or have more contact with the horse and have a tighter grip on the lead rope.

Trail

A trail could be a number of different obstacles in the arena. These could include jumping poles and stands, chairs, plastic tape and cones. These obstacles were built into a trail where the client had to go through with the horse either free or on a lead rope during an exercise to challenge certain competences.

Round pen

In the round pen the horse was also loose and the client was standing in the middle. The client had different props like a lunging whip or lead rope to keep the horse moving around. The horse was supposed to run in all three gates and the client had to make that happen. Once this task was finished the client asked the horse to come in and follow him or her around the round pen.

1.3 Population

All horses and humans that work together in EAC were the population of this research. Out of this population a sample was taken that provided the data for this research. This sample was taken out of the trainers that are located in the Netherlands, Germany and Belgium.

In total 62 organizations were asked to help with the study. They were found by research on the internet. The radius, in which organizations were contacted, was defined by a maximum travelling time of six hours by car. All organizations that responded were taken for the study. The horses as well as the clients were predetermined by the respective organizations where the observation took place. This means that only the horses of the organizations that were asked to participate in this study were seen as the population.

In total three out of the 62 organizations agreed in participating in the study. At three locations, ten trainers worked with 15 clients and 12 horses. The locations, trainers, clients and horses were assigned to a number (table 1). The horses underwent several coaching sessions with different trainers and clients. Therefore, more than one number can be found in these columns.

Table 1 Overview of the sample size of trainers, clients and horses that participated in this study as well as the exercises that the horses performed in.

				Exercises (Number of sessions)						
Location	**Trainer**	**Client**	**Horse**	**Free**	**Systematic**	**Lunge Line**	**Lead Rope**	**Trail**	**Round Pen**	**Total**
1	4,5	6,2	1	2						2
	1,3,6	5,4,3	2	3						3
	1,2	5,6	3	1				1		2
	3,4,6	2,3,4	4	1				2		3
	5	1	5	1						1
2	7,10	7,14	6	1	3					4
	8,10	8,15	7	1	3					4
3	9	8,10,13	8			1		2		3
		12	9					1		1
		10,12,13	10			1			2	3
		9,12	11	1			1			2
		9,10,11,12,13	12	1			1		3	5
				12	6	2	2	6	5	33

1.4 Data collection

While observing the sessions, an ethogram (table 2) was used. This ethogram was based on the study of Meinzer (2008) and contained the behavioural categories 'Neutral', 'Attention to the client', 'Attention to the environment', 'Dissatisfaction', 'Relaxation' and 'Excitement'. However, the category 'Dissatisfaction' was the only indicator for stress in this ethogram, therefore this category was divided into three categories 'Dissatisfaction', 'Apprehension' and 'Fear'. Furthermore, literature showed that there were more indicators of horse behaviour for several categories. Therefore additional behaviours were placed in the categories.

Moreover, there was a category 'None' that could be scored if the horse could not be seen or the shown behaviour was not defined. To keep track of the trainer during the observations, two categories were also used (Position Trainer, table 2). The first indicated that the trainer was with the horse and client in the arena and the second that the trainer was away from the horse and client and was standing outside the arena.

Table 2 The ethogram according to the study of Madeleine Meinzer (2008) and the literature review

	Behaviour categories	
Abbreviation	**Display**	**Corresponding behaviour patterns**
n	None	Horse is not in view, behaviour does not belong to any category
N	Neutral	Head, tail, ears and mouth in neutral position; walking in a normal speed, making no sounds
C	Attention to the client	Head turned to client, one or both ears are focused on client
S	Attention to the environment (The trainer also counts to the environment) (S=Surroundings)	Head and/ or ears are focused to trainer or object, investigating or making contact with object or trainer
D	Dissatisfaction	Swishing of the tail, head toss, pinning the ears, biting or thread to bite, making sound of dissatisfaction, doesn't want to stand still kicking (McGreevy & McLean, 2004), bucking (McGreevy & McLean, 2004)
A	Apprehension	Stiff tail, pointing to the floor, head high, wrinkled nose, starring eyes (McGreevy, 2004; Mills and Nankervis, 1999; Irwin and Weber, 1999; Gage, 2013)
F	Fear	Eyes wide open, tail clamped, running away with a tight hindquarter (McGreevy, 2004; Mills and Nankervis, 1999; Irwin and Weber, 1999; Gage, 2013)
R	Relaxation	Head low, ears v-shaped and floppy, blowing out
E	Excitement	Head high, moving on one spot, walking faster or getting stiff, tail is getting stiff and sticking straight out, making sounds of excitement
Abbreviation	**Position Trainer**	**Description**
Th	Trainer with horse	Trainer is inside the arena
Ta	Trainer away	Trainer is outside the arena

The head trainers had to fill out an informed consent (Appendix III) in order to participate in the study. Furthermore, the horses' owner and the clients that were observed filled out questionnaires (Appendix IV) that were made beforehand. The compiled data was then used to help with the data analysis and served as different stress factors for the horses.

1.5 Data Analysis

The data analysis was done with Observer XT 11.5, Excel 10 and SPSS 22. The kappa coefficient determined the intra and inter reliability of the two observers whereas a Linear Mixed Model (LMM) was used to show the dependency of the stress behaviours. Several steps had to be taken into account for this data analysis. To have a better overview figure 3 shows the predominant steps of the data analysis.

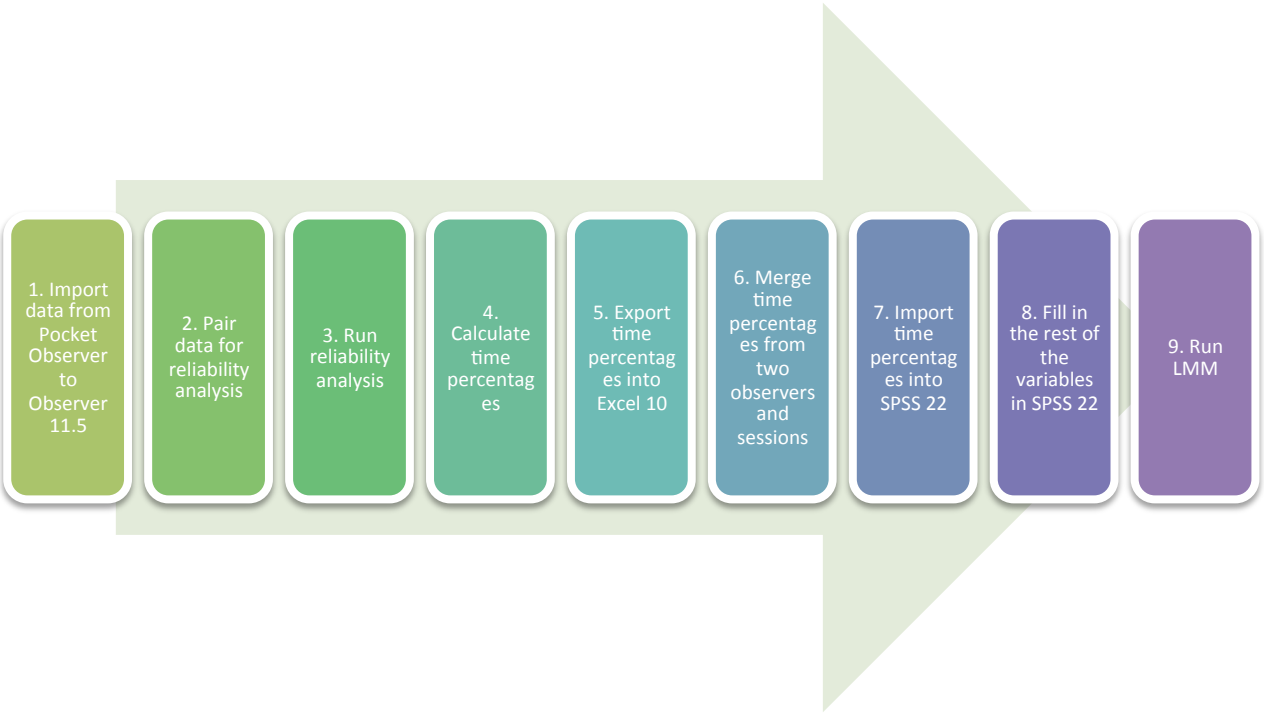


Figure 3 The nine steps taken during the data analysis

The two analyses are described in the following paragraphs to get a better understanding of the procedures.

1.5.1 Reliability Analysis

Within the program Observer XT 11.5 there were several possibilities to transform and analyse data. Hence the kappa coefficient for the inter reliability of the two observers was calculated from all obtained data during the observation. The observations that were conducted at the same time were paired for this analysis (Appendix V) and the program gave the minimum kappa, maximum kappa and mean kappa for each pair as well as the average kappas for the whole set of data.

Moreover, the two observers trained on two video sequences twice to get a result for the intra reliability. Therefore the two observations of each video were paired (Appendix VI) and the kappa was calculated for each observer.

1.5.2 Linear Mixed Model (LMM)

In order to use the data obtained during the observations the multiple intervals for one session were averaged and the duration of the behaviours was set into a time percentage within Observer 11.5 (Appendix VII). The simultaneously observed sessions were merged and the average was calculated within Excel 10 (Appendix VIII). The final set of data was then transferred into SPSS 22 (Appendix IX). To start with the LMM it was important to have a normally distributed dependant variable. The three stress categories ‘Dissatisfaction’, ‘Apprehension’ and ‘Fear’ were the dependant variables, therefore the model had to be run three times.

Within the LMM several fixed factors and covariates were entered to find the best possible model. In order to work with covariates it was required that they had a linear dependency with the dependent variable (Appendix X). To assure the reliability of the model the residuals and predicted values were

calculated as well. The residuals had also to be normally distributed (Appendix XI); also the predicted values and residuals had to be independent from each other (Appendix XII).

Once all the assumptions of reliability and validity were met, the model could be built. Therefore, the horses were used as the subjects and one of the dependent variable was taken into the model. As factors the variables 'Character', 'Breed', 'Exercise' and 'Previous experience EAC' and as covariates 'Experience handling horses', 'Age horse', 'Trainer away', 'Trainer with Horse' and 'Experience horse' were entered into the model. All were entered as fixed factors and the model was run without interactions (Appendix XIII). The variable with the highest significance was then taken out to get a better model. The model was run until the lowest corrected Akaike information criterion for small sample sizes (AICC score) was found; this score is an indicator for a reliable and valid result with a small sample size of sessions (Hurvich & Tsai, 1989).

Interactions can also be important within the model. That is why they were added and the model was run again until the lowest AICC score was found.

2 Results

A total of 33 sessions, which equals to 4 hours and 50 minutes, were observed during this study. The sessions had different purposes and therefore different set ups. These set ups were previously described as the exercises in chapter 1.2.1. Of these 33 sessions there were 12 free, 6 systematic, 2 lunge line, 2 lead rope, 6 trail and 5 round pen sessions. In all sessions only one horse and one client were observed. In table 3 and 4 the results of the questionnaires from horse and client are shown.

Table 3 Overview of the sample of horses that participated in the study regarding their age, experience, breed and character

Number Horse	Age in years	Experience in EAC in years	Breed	Character
1	9	1	x	Sensitive
2	14	1	x	Calm
3	x	0	x	Calm
4	10	1	x	Calm
5	7	4	x	Sensitive, dominant
6	4	2	Frisian	Sensitive, Calm Alert
7	13	6	Frisian	Sensitive, Calm, Alert
8	14	0	Frisian	x
9	6	0	Frisian	x
10	5	0	Frisian	x
11	11	0	New Forest Pony	x
12	21	0	KWPN	x

The age of the horse varied between four and 21 years. Most of the horses had no previous experience in EAC, just three of them had more experience than one year. The information about breed and character is not complete; therefore it was not taken into analysis.

Table 4 Overview of the sample of clients that participated in the study regarding their experience in handling horses and EAC

Number Client	Experience in handling horses in years	Previous experience in EAC
1	23	Yes
2	10	Yes
3	25	Yes
4	24	Yes
5	15	Yes
6	35	Yes
7	5	No
8	31	No
9	0	No
10	0	No
11	0	No
12	0	No
13	15	No
14	17	Yes
15	38	Yes

The experience from the client in handling horses differed from none to 38 years. Eight clients had experience in EAC, the others did not.

The following chapter includes the results of the reliability tests of the two observers as well as the overall percentages of the shown behaviours in this study. Furthermore, the results of the LMM are demonstrated.

2.1 Reliability analysis

The kappa coefficient for observer 1 is minimum 0,85, maximum 0,89 and therefore has a mean kappa of 0,87; whereas the intra reliability for observer 2 has a minimum kappa of 0,83 and a maximum kappa of 0,91, which leads to a mean kappa of 0,87. (Appendix XIV)

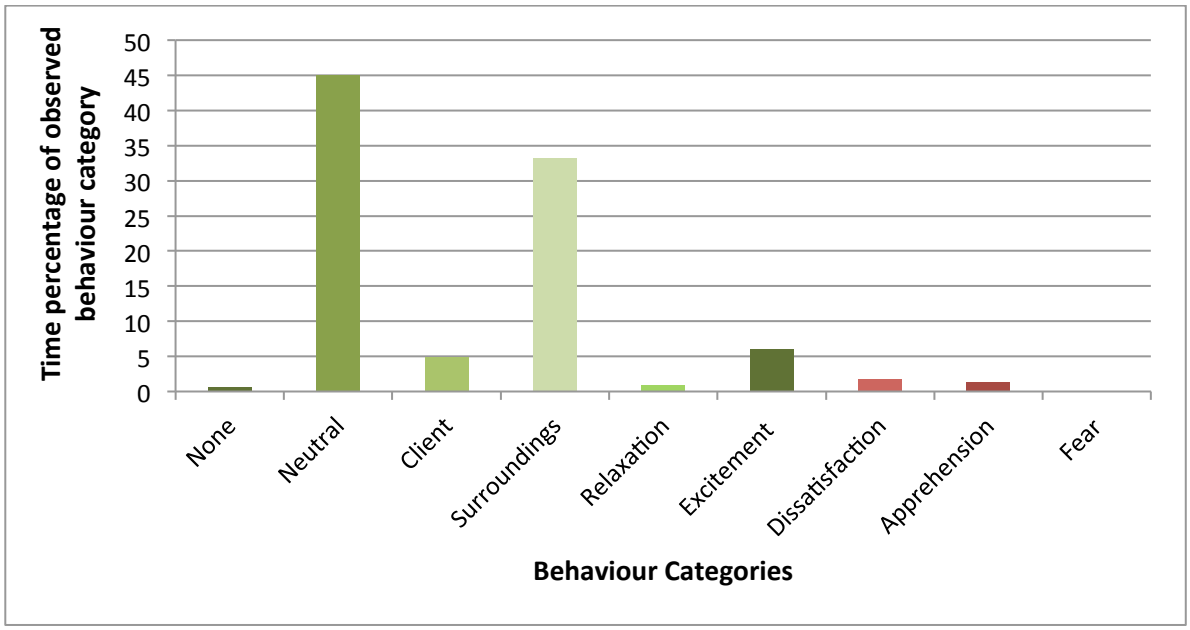
The inter reliability of the two observers shows a minimum Kappa of 0,7 and a max of 0,9 with a mean of 0,8. (Appendix XV)

The intra and inter reliability of the observers is above 0,7, which indicates that it is a good reliability as mentioned by Altman (1991).

2.2 Overall observed behaviours

The observations showed that there were stress behaviours during the observations. The time percentage of each behaviour category can be found in graph 1; there the average of all observations is represented.

During the observations the horses showed 0,61% of the category 'None'. Neutral behaviour was displayed 45,05% of the time of the observations. The category 'Attention to the client' scored with a total of 4,94% and the category 'Attention to the environment' (surroundings, including the trainer) 33,22%. 'Relaxation' was demonstrated by the horses 0,91% of the time whereas 'Excitement' was shown 6,06%. The stress categories 'Dissatisfaction' was represented 1,76% of the time observed and 'Apprehension' was demonstrated 1,34%. The behaviour category 'Fear' was not shown during the observations.

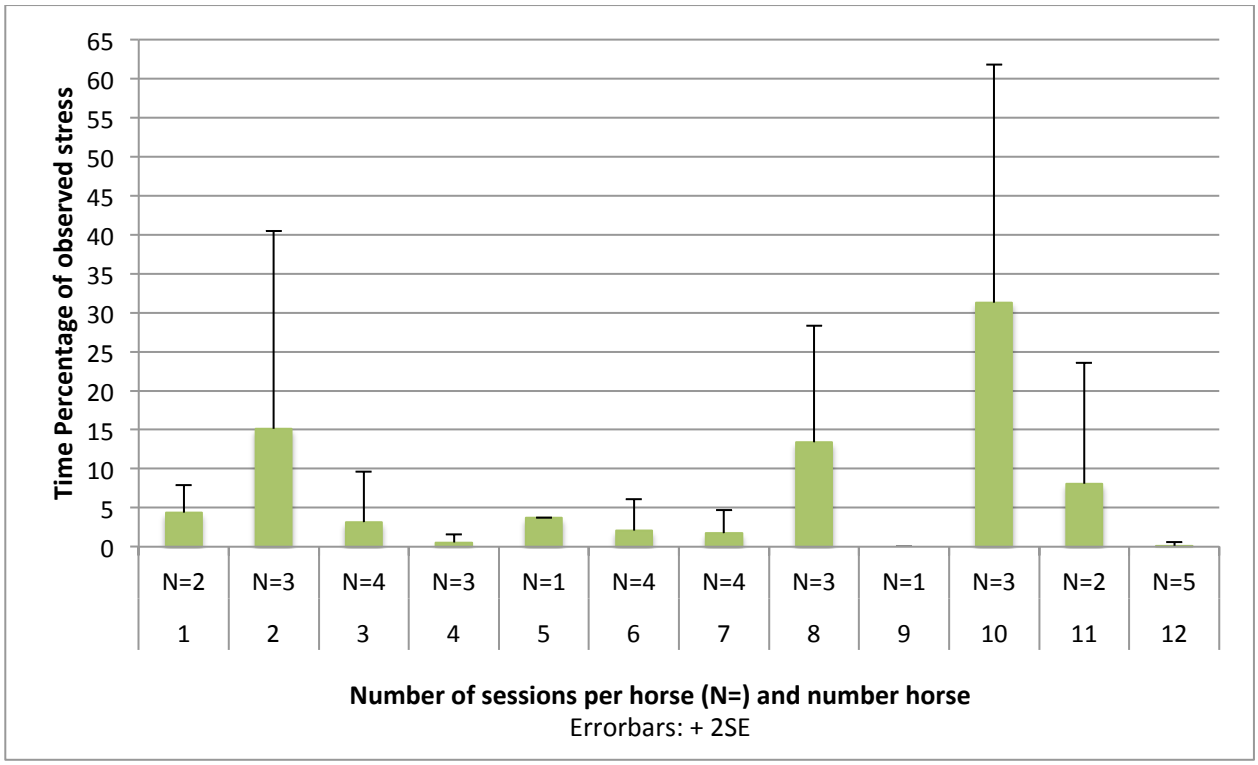


Graph 1 Time percentage of observed behaviour category demonstrated per behaviour category as an average of all observations. $N_{Sessions}$=33

Moreover, there were two behaviours namely yawning and nibbling on the own body that were shown multiple times from different horses during the sessions but were not in the ethogram. Therefore, these two behaviours were scored with 'None'.

The stress behaviours 'Dissatisfaction' and 'Apprehension' were summed up into one variable that was called *Time percentage of stress behaviour*. Because this variable was not normally distributed it was transformed with a $\log_{10}$(variable+1) (Appendix XVI).

The 12 horses that were used in the study were of different breed, age and character (see table 3) and showed different amounts of stress behaviour during the observations. The mean amounts of stress behaviour can be seen in graph 2. The horses displayed from 0% up to 57% of stress during sessions.



Graph 2 The mean time percentage of the observed stress with the standard error per horse over the different sessions (N= number of sessions) a horse participated in.

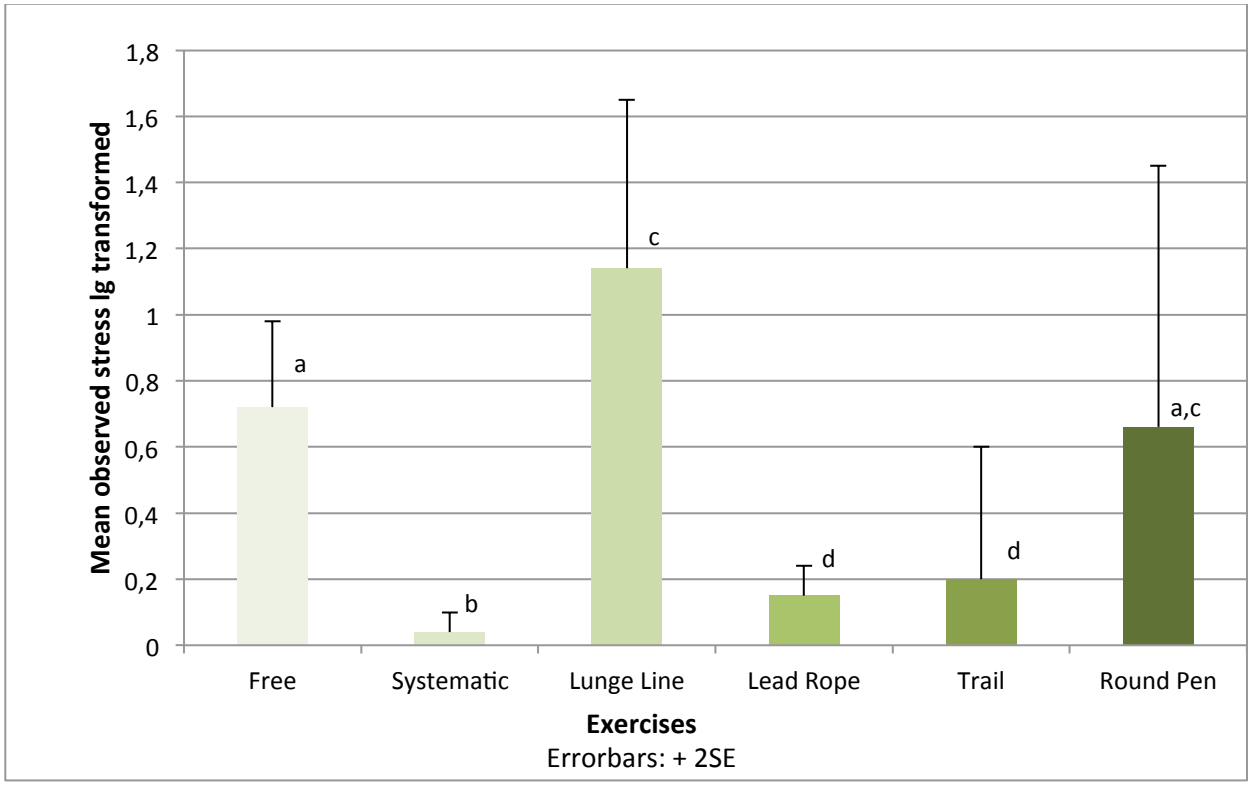
It appeared that 50% of the distribution of the dependent variable is explained through the horses that participated in the study.

2.3 Statistical analysis

The LMM (Appendix XVII) showed that stress is dependent on the exercise (LMM; $F_{4;2,992}$; p=0,032). Whereas it is not dependent on the age of the horse (LMM; $F_{0;2,846}$; p=0,140). All the other factors ('Previous Experience EAC') and covariates ('Experience Horse', 'Experience in handling horses', 'Trainer with the horse', 'Trainer away') were taken out of the model in order to get the most reliable result and thus those factors and covariates were not significant. The model could not run with interactions.

Graph 3 illustrates the observed stress in the log transformation for each exercise that was used during the study with the standard error. The exercises were significantly different from each other

($p < 0,05$) concerning the observed stress behaviour. Analysis showed that the exercise 'Systematic' is significantly different from all other exercises. 'Free' is also significantly different from the other exercises, except for 'Round pen'. The latter also applies to 'Lunge line'. 'Lead rope' and 'Trail' are not significantly different from each other; 'Round pen' on the other hand is significantly different from both.



Graph 3 The observed stress in log transformation for each exercise with standard error. Exercises with the same letter are not significantly different. $N_{sessions}$=33

3 Discussion

This chapter focuses on relevant points of discussion of the study. During the observations there were several restrictions that are considered. There also is a discussion about the results.

3.1 Observations

The willingness of the EAC trainers in participating in the study was very low. Just 4,9 % of the contacted organizations disposed to deliver data. The others either did not react on the request or rejected their participation. Many trainers said that observations would disturb their coaching and invade the privacy of the client. Another reason was the season in which the data collection took place. In the winter there are often no trainings due to the weather conditions.

During the execution of the study some situations occurred which may have an influence on the results. This especially concerns situations during the data collection. During some observations the horse was partial out of sight. Sometimes just the back of the horse was in sight so that the head was not visible. When the horse stood with the front to the observers, the tail was out of sight. Mostly this could be solved by moving to another position, but sometimes not. In this situation important behaviour could have been missed.

The trainer often moved within the arena and around the client and the horse. That is why it was difficult to score the position of the trainer. For further research this should be defined more precisely by determining a distance from trainer to horse.

There were a few situations in which the horses showed behaviour that was not described in the ethogram. Some of the horses were nibbling on their legs intensely. None of the behaviour categories included this behaviour. Nibbling can be a reaction to an itch (McDonnell, 2003; Ransom & Cade, 2009). It could also be interpreted as a displacement activity as known from dogs or monkeys. Such activities are out of context and may be performed in a conflict situation. They give evidence of frustration. (Appleby et al., 2011) However, there is no literature that supports this assumption for horses. That makes it difficult to add it to one of the behaviour categories. In case that an itch was the reason for nibbling, it had no negative effect on the results of the study. But in case it was caused by high motivation for two or more conflicting behaviours, it could have had an influence. Another behaviour that was not part of the ethogram was yawning. Yawning does not mean that the horse experiences stress in that moment but that the horse had muscle tension, anxiety or mental tension beforehand and releases this tension with the yawn. It is a positive sign. (Irwin, 2005; Masterson, 2011; Ransom & Cade, 2009) So there is no influence on the results because yawning itself is no stress.

Another situation, which could have had an influence on the results, was that one horse was constantly swishing its tail. It was not possible to determine whether there were flies in the arena that annoyed the horse. If that was the case the scored behaviour ‘Dissatisfaction’ was not valid. The observation took place in an indoor arena with closed doors and it was a cold winter day. The session was not taken out of analysis because of the fact that flies are quite unlikely on such a day.

The procedure of the trainings differed from trainer to trainer and exercise to exercise. It was not possible to predict how a task will proceed. During some sessions the trainer and participant talked to each other quite a long time, paying no attention to the horse, so that the horse just stood there

and could do whatever it wanted. The kind of exercise had an influence on how much contact the client had with the horse. That made it difficult to compare the trainings of different trainers. For further research it can be recommended that it is important to choose trainings which are as similar as possible concerning the process.

3.2 Questionnaires

The questionnaires were important for getting information about the horses and the clients. Unfortunately the breed of some horses was unknown and could therefore not be taken into account. Also data of the character of the horse was incomplete and could no longer be considered during the data analysis. It is important to consider this factor in further study because according to Mills and McDonnell (2005) the character can influence the stress level. From one of the horses the age was unknown. Nevertheless age was considered during data analysis.

3.3 Data analysis

During the data analysis several things had to be changed in order to run the LMM. Firstly, the two stress categories 'Dissatisfaction' and 'Apprehension' were summed up into one variable because otherwise the data set was too small for running the LMM individually. Secondly, the dependent variable had to be log transformed in order to get a normal distribution. Because the residuals and predicted values were distributed randomly the transformation could be used.

The LMM also gives the variance and residuals. These two numbers can indicate how much of the distribution of the time percentage of stress in log transformation is explained due to the horses. In this study the horses explain almost 50% of the distribution of the stress behaviours. This means that there is still 50% of the distribution that is not explained through the horses alone but through other factors. It cannot be said which factors influence the stress behaviours of the horses as well because this was not tested during this study.

Moreover, interactions between the variables were not possible because of the small data set. However, a graph showed that there is a possibility for an interaction of the age of the horse and the exercise (Appendix XVIII). In general every horse should have participated in every exercise to obtain greater and more reliable data.

In fact most of the factors and covariates and also interactions of such had to be taken out of the model in order to get a valid result. This can also be dependent on the small sample size and few sessions that were observed. In a further research a greater sample size should be considered to get a more reliable result.

3.4 Results

The results are discussed separately in order to get a better overview of them.

There were six sessions with systematic coaching. Two sets of three came after one another and were with the same trainer, client and horse. The only difference was that the amount of people being part of the coaching increased from two up to 14. The sets were analysed as separate sessions due to the fact that more people may lead to more stress with the horse.

3.4.1 Overall observed behaviours

The most prominent behaviour during this study was 'Neutral' followed by 'Surroundings'. The fact that 'Surroundings' had such a high percentage is also dependent on the focus of the horse on things and persons that were situated around them. Despite that all trainings took place in an indoor arena the horses did notice when something loud was happening outside, such as a tractor driving by or another horse walking by. Also the trainer was part of the surroundings and some horses were focused on him or her. This behaviour includes a variety of factors that can influence it and therefore it cannot specifically said which factor has the most influence on this behaviour.

The behaviours 'Relaxation' and 'Attention to the client' were rather low in comparison to 'Neutral' and 'Surroundings'. This means the horse is not so much focused on the client or can totally relax during exercises.

The stress behaviours 'Dissatisfaction' and 'Apprehension' were shown only 3,1% of the whole sessions. 'Fear' was not shown at all during the coaching sessions, which can be interpreted that the horses were not threatened during the coaching and only familiar obstacles were used. Also the character of the horse and experience could have had an influence on that, however this could not be researched in this study due to the lack of data.

Despite the rather low demonstration of stress behaviour it is still important to know where this stress comes from in order to minimize it even further.

3.4.2 Statistical analysis

The LMM showed that the kind of exercise has a significant influence on the stress behaviour of the horses as described in the introduction. Hinchcliff et al. (2008) said that it is important to take into account the exercise stress. This is defined as the concentration of several stressors during an exercise. Those stressors can either be psychological or environmental, social and physiological.

The horses showed the highest stress response during lunging and round penning. The lunge line and/or a whip demonstrated environmental stressors during these exercises. The concentration of several stressors could have been the indicator for stress (Hinchcliff et al., 2008). The tension of the lunge line could have had an influence on the reaction of the horse as well. This assumption can be linked to the study of Chamove et al. (2002) where they came to the conclusion that the tension of the lead rope has an influence on the head position and resistance of the horse. There can also be a link to the predator and prey relationship (Irwin & Weber, 1999; Hollinger, 2008) mentioned in the introduction. Therefore the flight response of the horse is activated and this leads to a stress response as mentioned by McGreevy and McLean (2010).

The flight response in the round pen can decrease with the learning process of the horse over several sessions. Krüger (2007) discovered that during round penning the behaviour can be learned and the time that the horse needs to follow the human decreases over the course of repetition of this exercise. If a horse has never been in the round pen it shows more flight response at first and then reduces it to more submissive behaviour. During Krüger's observations it could be seen that the horse which was in the round pen for the second time, showed better reactions to the human than the first time. This result coheres with the principle of controllability and predictability. "The degree of controllability and predictability of the stressor seems to influence the response to stress."

(Appleby et al., 2011) When the horse is in the round pen for the second time it is able to predict what is going to happen and thus is less stressed.

The free horse showed the second highest stress response. During this exercise the horse can move independently from the client. It is a fact that emotions of the human can be transferred to the horse. A horse can turn into the emotional state of the human and respond to his or her feelings. (Coates, 2009) So when the human is nervous, the horse will be nervous as well and when the human is relaxed, the horse will be too or the other way around. (Blake, 2008) This indicates that when clients have stress during an exercise, the horse will also have stress. A reason for the stress of the human may be connected to not being able to predict what is going to happen when the horse is free.

Trail and lead rope presented the second lowest stress response. Being led with a lead rope is a familiar task for the horse therefore the stress response was low. Moreover most of the horses that participated in the trail exercises were lesson horses for children and adults and were also used to a lot of different stressors. This may be the reason for a low amount of stress during these exercises. (Fraser, 2010) Therefore the controllability and predictability for the horses in this study was rather high (Appleby et al., 2011).

Systematic sessions demonstrated the lowest percentage of stress behaviour, which may cohere with the statement of Hinchcliff et al. (2008). During systematic coaching there were no other stressors observed than people in the exercise. During the other exercises props like plastic tape, whips or blankets were used which are environmental stressors. Moreover, the content of this exercise differs from the others. Whereas during the other exercises the client performs a task with the horse, during systematic coaching the client has no direct communication with the horse. It can move around independently from the people. Its behaviour serves as an indication for personal issues of the client, which is interpreted by the trainer. Therefore it can be assumed that the horse has less stress because it is just in contact with the familiar trainer.

The age of the horse could not be defined as a factor that influences stress like Baragli et al. (2014) suggested. He found out that aging influences the behaviour and physiology of emotional expression to stressful stimuli in horses. They tested 98 horses by inflating a balloon in an environment that was familiar to the horse. Right after that they measured the heart rate variability for the purpose of a stress response. Avoidance and exploring are behaviours that express emotions and therefore these behaviours where related to the stress response as well. Older horses are more experienced and did not show as much of these behaviours as the younger horses. This means that the older horses already have some control over their sympathetic nervous system thus they have a lower heart rate. During ‘huifbedrijden’ (a special construction for therapeutic purposes) stress behaviours are also dependent on the average age of the horses that are used to carry the patient that is lying in the ‘huifbed’ (van Ginkel & Meijers, 2013). The reason that age was not significant in this study can be related to the fact that not every horse participated in all exercises and therefore not all horses underwent the same stressors.

The factor experience handling horses could also not be proven significant. In their literature review Visser et al. (2008) arrived at the conclusion that it is important to have adequate knowledge in order to compensate negative situations when interacting with a horse and thus to reduce the negative consequences for the horse-human relationship. In addition Chamove et al. (2002) found that people

with extensive experience in handling horses have a positive attitude towards them. When those people were in contact with a horse the researchers could observe a calm and comfortable horse. The reason why experience could not be declared as an influencing variable may be that there was a too big of a variety of experience of handling horses within the small sample size.

Just as the experience of the human the factor experience of the horse has no significant influence. Contrary to this Fraser (2010) stated that early experience of horses affects their adult behaviour. Routine procedures in the management of horses help the horse to understand its environment and this proceeds also in the handling of the horse. Good habits will then be much easier to accomplish for the horse when it is exposed to these routines step by step. Most of the horses had no or just one year experience in EAC. Just three out of the 12 had more years of experience. Because of the little variety concerning this factor, it is possible that it was not proven as significant. For further research it is important to have a bigger variety so that the comparison of the stress behaviours between horses with different experience is more reliable.

When comparing EAC with other horse assisted interventions it is difficult to rank those interventions on the basis of the stress level. It can be said that the stress and frustration level in horses used in therapeutic riding programmes is not greater than experienced by horses used for recreational riding (Kaiser, et al., 2006). Denderen (2008) found out that on a treadmill more stress behaviours and less relaxation can be observed than during riding or lunging. Lunging and riding differ not much, but horses are better under control when ridden. That is why it would be interesting to compare the different interventions with each other in further research.

4 Conclusion

After listing the results and discussing possible uncertainties in the previous chapters, the main questions will now be answered to get an insight into the view of the horse. In consideration of the main questions, attention will be paid to the corresponding sub question(s) first.

In how far show horses stress behaviours during an equine assisted coaching session?

When looking at the sub question about w*hich stress behaviours do the horses show during the trainings?*, it becomes clear that the 12 horses showed two of the three categories with stress behaviour: 'Dissatisfaction' and 'Apprehension'. 'Fear' was not observed during the sessions so there is no high stress during the sessions. 'Dissatisfaction' is the stress behaviour that was demonstrated longest. It took 1,76 % of the total time observed. The duration of 'Apprehension' was a bit shorter; it was represented in 1,34 % of the time. So if there is stress, the stress level is low to medium. Altogether, in 3,10 % of the observation time stress behaviours were shown.

Which factors have an influence on the stress behaviours and to which extent do the factors influence the stress behaviours?

Considered factors during this study were age, character, breed and experience of the horse, experience of the client in handling horses and previous experience of the client with EAC as well as the kind of exercise and the trainer's position. The data analysis showed that only one factor is significant for the stress behaviour shown in horses, namely the kind of exercise. The age of the horse had no significant influence. The other factors were not in the model and therefore had no influence on the stress level in this study.

There are not two or more factors that are significant, therefore it cannot be said which one has more influence than the other. Also interactions could not be taken into consideration, because of the small sample size. However, the exercises differ in the shown stress behaviours from each other, which means that some exercises are more stressful for the horse than others. Lunge line was the most stressful exercise for the horses. The exercises free and round pen were also considered as stressful due to the amount of stress demonstrated. Systematic was the least stressful exercise. Lead rope and trail had respectively low stress considering the exercises free, lunge line and round pen.

In summary, the view of the horse of EAC does not contain a high amount of stress. Notwithstanding, depending on the situation specific sessions consist of a higher amount of stress behaviours than the average.

When looking at the points of discussion it becomes apparent that by improving the sample size and variety, more precise and reliable data can be obtained. Nevertheless the results of the study can help trainers be aware of the content of their exercises and thus bear in mind how the horse handles the situation and reflects this in its behaviour.

5 Recommendations

It is important to do further research concerning this topic in order to understand the horses' view even better. The next research should contain a bigger sample size and more sessions for data collection in order to get a more reliable result. In such a study every horse should participate in every exercise. In this context it also is recommended that it is important to choose for trainings that are as similar as possible concerning the process. Interactions of different factors are important to take into account as well.

When considering whether the trainer is present or not it should be defined when the trainer has contact with the horse and thus can influence its behaviour. This can be done by defining a distance between the two, for example when the trainer is next to the horse with a maximum radius of three metres.

It is important that the behaviours that were seen during observation but not defined in the ethogram are added, in this case yawning and nibbling. If in further studies again the situation should occur that behaviour is shown which is not in the ethogram, it should be weighed whether it is reasonable to take that session out of analysis. The same applies to situations in which cannot be said if a specific behaviour is caused by a factor that is not part of the research. For this reason it is also important to have a sample size that is big enough.

Additionally the triangle between horse, client and trainer should be considered to find out who influences whom and which of them is the trigger of stress behaviour. Moreover, it would be useful to study the suitability of the horse and to look for indicators for choosing the right horse. The trainer could use this information to pair client and horse properly because not every horse is suitable for every client. This is supported by the study of Meinzer (2008) where she found that people which tend to behave hectically or unsettled, prolong the time a horse shows dissatisfied behaviour. In order to rank EAC regarding stress behaviours of horses it can be recommended to compare different types of horse assisted interventions in future research.

When these aspects will be considered for further research there is great possibility to get a better insight into the horses' point of view and to make it even easier to realize horse friendly coaching.

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Appendix

THE VIEW OF THE HORSE

Equine Assisted Coaching from the horses' point of view

Helena Hollenhorst & Ronja Wagenknecht

January 2015

Content

Appendix I Behaviour of the horse

Vision

It is crucial to understand the predator and prey behaviour of humans and horses. The human is a predator with his eyes in front of the head, making it easy to focus on prey. The horse is a prey animal and has its eyes at the side of the head with an almost 360° vision (figure 1), enabling it to see almost everything around it. The predator has a tendency to go forward and attack in straight lines whereas the prey moves in circles and curves. Prey animals rarely focus in on things, but rather are aware of everything that goes on around them. (Irwin & Weber, 1999) Figure 1 shows the different kind of vision of the horse. The horse can see with both eyes just in the front of the head and around it can only see with one eye. Behind the horse is the vision even poorer and only a marginal vision or a blind spot are behind the horse. Directly in front of the horse there is a small blind spot as well.

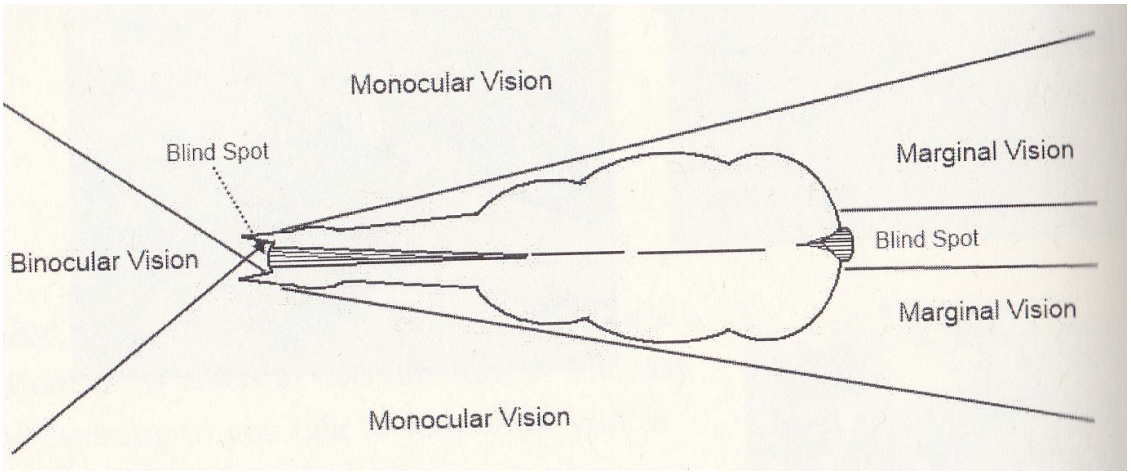


Figure 1 Aerial view of the horse showing the extent of its field of vision (Gage, 2013)

Several studies indicate that the horse cannot see all colors (Leblanc & Bouissou, 1981; Pick et al., 1994; Smith & Goldman, 1999) but it has yet to be defined which colors they can see.

Body language

The body language is complex and has several indicators that show how the horse is feeling, as Irwin and Weber (1999) said ´Frame of body is frame of mind' of the horse. This indicates that the horse cannot deceive another horse by its body language, like humans can do. However for humans it is often not clear what the horse is saying, because of the difference of the body language. The human can understand the message of the horse following the most essential points of equine body language such as the toplines, head, tail, eyes, ears and snout.

Toplines

The topline is the key to how the horse is feeling. An inverted horse (high head and hollow back) lacks impulsion (it has the brakes on) and is rough to ride. Inversion can cause all kinds of behavioural problems. The hollow back compresses the spine and pinches the nerves, which causes the release of adrenaline rushing to the horse's brain. This creates an unfocused and stressed horse. When the spinal column is stretched and the back starts

lifting, with the head low, the spinal column lengthens and endorphins start flowing to the horse's brain.

Underneath the 5 toplines are summarised:

- Level-headed (poll at the height of the horse's withers) → neutral – no endorphins, no adrenaline
- Lower than level (poll lower than then horse's withers → spine opens up, endorphins start flowing to brain
- Round and collected (poll higher than horse's withers, but back is lifted and round)
- Inverted (hollow back, high head) → spine compressed, vertebrae pinched, adrenaline starts flowing to brain
- Inverted with round poll (hollow back, round poll) → man-made, mechanical

(Irwin & Weber, 1999)

Head

There are various features of the equine head, which give information about the horses' feelings as described by McGreevy (2004) and Irwin (2008). The following table 1 shows the different positions of the head and the message that stands behind it.

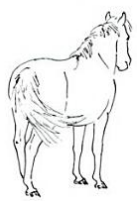
Table 1 Eight positions of the equine head

Pose of head	**Message**
Nose flips up	Indignant challenge to who pushes whom, uppity
Twirling head/neck	Aggression
Neck shakes laterally	Release of muscular stress
Head low with teeth baring	Bite threat, biting, driving others
Head high	Alert
Head low	Investigation, observing surrounding
Head goes down and stays down, with eyes open staring wide, mouth closed tight, ears stiff	Sullenness/poutiness (sullen horse shutting down) – horse has been pushed too hard
Yawn	Release of anxiety

Tail

The position of the tail can show the state of mind of a horse. McGreevy (2004), Mills and Nankervis (1999), Irwin and Weber (1999) and Meinzer (2008) indicate about six different messages as shown in table 2.

Table 2 Six messages of the equine tail (pictures by Timmers (2011) and McDonnell (2003))

Pose of the tail		**Message**
	Curled, hanging losely	Calm and relaxed, while at ease
	Wringing or twirling	Aggression, anger
	Swishing	Annoyed, prior to bucking and balking, swishing at insects
	Sticking straight out	Feeling good, excited, arousal
	Stiff, pointing straight down	Apprehensive, suspicious, alarm
	Tucked tight between hindquarters	Fear, pain

Eyes

Irwin (2008) and Gage (2013) describe several expressions of the equine eye. The indication of the state of mind of the horse is certainly given by the eyes; table 3 shows all the expressions of the eyes.

Table 3 Four expressions of the equine eye, Gage(2013)

Expression		**Description**
	Soft eyes (with blinking)	Horse is relaxed, calm and willing to work/aware
	Half-closed eyes	Resting or angry, dependent on other body signals
	Wide opened	Horse focused on an object, if the white can be seen, it indicates fear and stress
	Rolling eyes	Horse is unsure, apprehensive

Ears

The ears are part of the horses' communication and indicate in what state of mind they are. Table 4 shows different positions of the ears as described by Gage (2013)

Table 4 Five positions of the equine ears, Gage (2013)

Position		**Description**
	Ears in front	The horse is alert and is focused on a sound or movement.
	Ears V-shaped	The horse is relaxed but still aware of the surrounding.
	Ears back	The horse is focused on something behind it.
	One ear in front, one ear back	The horse is focused on something in front of and behind it.
	Ears pinned back	The horse is irritated and aggravated; the farther back the ears, the more aggravated the horse.

Snout

The snout is the last body part that will be described. It is also the most difficult to see and interpret, because of the sudden changes in the snout and the many expression that it can make. Table 5 shows nine expressions according to Irwin and Weber(1999) and Gage (2013).

Table 5 Nine expressions of the equine snout

Expression	**Description**
No tension in nostrils and muzzle	Relaxed
Nostrils flared	Alert, fear, smell, after labour
Pinched nostrils	pain, anger
Wrinkled nostrils or muzzle	Nervousness, worried
Upper lip protruding	Enjoying being groomed or scratched, investigating new things
Tight lips	Anxiety, nervousness
Drooping lower lip	Relaxation
Flapping lower lip	Nervousness
Chewing	Calm, feeling ok

Resources

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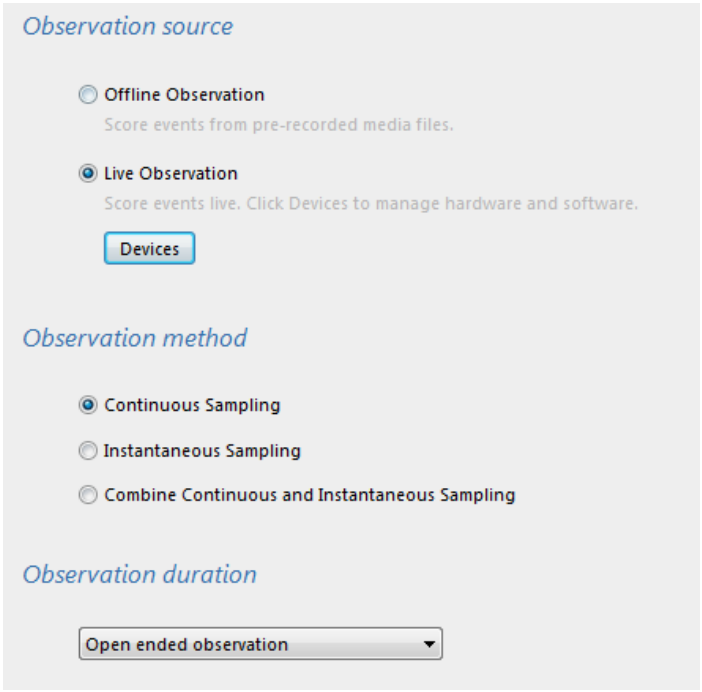
Appendix II Setup observer



Coding Scheme

Check Settings View Settings

Subjects

Add Subject

Subject Name
Continuous Sampling

Behaviors

Add Behavior group... Add Behavior

Behavior Name		Behavior Type	Modifiers
behaviour horse (Mutually exclusive, Exhaustive)			
none	n	Initial State Event	<Click here to add ...
Neutral	N	State Event	<Click here to add ...
Client	C	State Event	<Click here to add ...
Surroundings	S	State Event	<Click here to add ...
Dissatisfaction	D	State Event	<Click here to add ...
Apprehension	A	State Event	<Click here to add ...
Fear	F	State Event	<Click here to add ...
Relaxation	R	State Event	<Click here to add ...
Excitement	E	State Event	<Click here to add ...
Trainer (Mutually exclusive, Exhaustive)			
away	a	Initial State Event	<Click here to add ...
with horse	w	State Event	<Click here to add ...

Independent Variables

Add Variable Add Video Add Audio

	System	System	System	User-defined	User-defined	User-defined	User-defined	User-defined	User-defined
Label	Stop time	Duration	Start time	observer	Client	Exercise	Trainer	Horse	Number Session
Description	The stop time of the observation	The duration of the observation	The start time of the observation						
Type	Timestamp	Duration	Timestamp	Text	Numerical	Text	Numerical	Numerical	Numerical
Format	MM/dd/yyyy H	s,ff	MM/dd/yyyy H		x		x	x	x
Predefined Values				Helena; Ronja	All values	Lead rope; lunge lin	All values	All values	All values
Scope	Observation	Observation	Observation	Observation	Observation	Observation	Observation	Observation	Observation
Value Update	Automatic	Automatic	Automatic	Optional	Optional	Optional	Optional	Optional	Optional

Appendix III Informed consent

Informed Consent:

Stress behaviours of horses used in Equine Assisted Coaching

In the following trainings stress behaviours of the horses will be observed. Therefore two students of the VHL University of Applied Sciences will observe the training sessions and collect data. Only the horses will be observed.

_____ consents that the students are allowed to collect data to analyse these. The data will be handled with full discretion.

The participants were informed beforehand and had enough time to decide to participate in the study.

_____ _____

Date, location Signature

Appendix IV Questionnaires

Hogeschool VHL University of Applied Sciences

Research: Stress in horses used in equine assisted coaching's

Questionnaire Horse

Name: _____

Age: _____

Gender: o mare o stallion o gelding

Breed: _____

Time working in EAC: _____

Short description of the character (several answers possible):

o Sensitive o Calm o Alert o Pushy o Excited o _____

Hogeschool VHL University of Applied Sciences

Research: Stress in horses used in equine assisted coaching's

Questionnaire Client

Experience in handling horses:

Number of years:_____

When?_____

Previous experience in EAC:

- o Yes, how often?: _____
- o No

Comments: _____

_____

Appendix V Screen shot paired observations inter

Pair	Observation A	Observation B
1	H1 / Results	R1 / Results
2	H1.1 / Results	R1.1 / Results
3	H10 / Results	R10 / Results
4	H10.1 / Results	R10.1 / Results
5	H11 / Results	R11 / Results
6	H11.1 / Results	R11.1 / Results
7	H12 / Results	R12 / Results
8	H12.1 / Results	R12.1 / Results
9	H12.2 / Results	R12.2 / Results
10	H12.3 / Results	R12.3 / Results
11	H12.4 / Results	R12.4 / Results
12	H12.5 / Results	R12.5 / Results
13	H13 / Results	R13 / Results
14	H13.1 / Results	R13.1 / Results
15	H13.2 / Results	R13.2 / Results
16	H13.3 / Results	R13.3 / Results
17	H13.4 / Results	R13.4 / Results
18	H14 / Results	R14 / Results
19	H15 / Results	R15 / Results
20	H16 / Results	R16 / Results
21	H17 / Results	R17 / Results
22	H18 / Results	R18 / Results
23	H19 / Results	R19 / Results
24	H2 / Results	R2 / Results
25	H2.2 / Results	R2.2 / Results
26	H20 / Results	R20 / Results
27	H20.1 / Results	R20.1 / Results
28	H21 / Results	R21 / Results
29	H21.1 / Results	R21.1 / Results
30	H22 / Results	R22 / Results
31	H23 / Results	R23 / Results
32	H24 / Results	R24 / Results
33	H25 / Results	R25 / Results
34	H26 / Results	R26 / Results
35	H27 / Results	R27 / Results
36	H28 / Results	R28 / Results
37	H28.1 / Results	R28.1 / Results
38	H28.2 / Results	R28.2 / Results
39	H29 / Results	R29 / Results
40	H29.1 / Results	R29.1 / Results

41	H29.2 / Results	R29.2 / Results
42	H3 / Results	R3 / Results
43	H3.1 / Results	R3.1 / Results
44	H4 / Results	R4 / Results
45	H4.1 / Results	R4.1 / Results
46	H5 / Results	R5 / Results
47	H5.1 / Results	R5.1 / Results
48	H5.2 / Results	R5.2 / Results
49	H6 / Results	R6 / Results
50	H6.1 / Results	R6.1 / Results
51	H6.2 / Results	R6.2 / Results
52	H7 / Results	R7 / Results
53	H7.1 / Results	R7.1 / Results
54	H8 / Results	R8 / Results
55	H8.1 / Results	R8.1 / Results
56	H8.2 / Results	R8.2 / Results
57	H9 / Results	R9 / Results
58	H9.1 / Results	R9.1 / Results

Appendix VI Screenshot paired observations intra

Observer 1

Pair	Observation A	Observation B
1	intra 1R / Results	intra 2R / Results
2	intra 4R / Results	intra3R / Results

Observer2

Pair	Observation A	Observation B
1	Intra 2H / Results	intra 1H / Results
2	Intra 3H / Results	Intra 4H / Results

Appendix VII Screen shot table percentages

	Observatio										
Behavi		none	Neutral	Client	Surroundin	Dissatisfact	Apprehensi	Relaxation	Excitement	away	with horse
Statist		Percentage (analyzed observation duration)									
	H1	1	1	34	54	10	0	0	0	100	0
	H1.1	1	0	0	98	0	0	0	1	100	0
	H10	0	27	0	72	0	0	1	0	100	0
	H10.1	0	7	4	89	0	0	0	0	100	0
	H11	1	6	9	81	1	2	0	0	100	0
	H11.1	0	2	3	91	0	3	0	0	100	0
	H12	1	79	0	13	3	0	3	0	1	99
	H12.1	1	79	0	8	2	0	10	0	7	93
	H12.2	1	65	0	16	10	0	10	0	0	100
	H12.3	1	41	0	50	7	0	2	0	0	100
	H12.4	0	36	6	39	17	2	0	0	30	70
	H12.5	0	64	1	0	7	0	28	0	1	99
	H13	1	59	0	37	2	1	0	0	95	5
	H13.1	0	56	5	33	3	0	2	0	76	24
	H13.2	0	21	0	60	19	0	0	0	17	83
	H13.3	1	39	2	58	1	0	0	0	31	69
	H13.4	1	41	0	53	5	0	0	0	0	100
	H14	1	53	8	17	3	20	0	0	27	73
	H15	1	29	29	34	0	6	0	0	80	20
	H16	1	87	8	4	0	1	0	0	100	0
	H17	1	88	1	10	1	0	0	0	96	4
	H18	0	53	4	43	0	0	0	0	46	54
	H19	0	73	2	10	1	14	0	0	95	5
	H2	0	0	15	84	1	0	0	0	100	0
	H2.2	1	0	15	80	4	0	0	1	100	0
	H20	1	1	5	46	0	45	0	2	100	0
	H20.1	0	32	10	44	1	13	0	0	100	0
	H21	1	36	4	25	0	0	0	34	88	12
	H21.1	0	70	3	24	0	0	0	2	79	21
	H22	0	55	9	25	0	0	0	11	58	42
	H23	0	1	9	32	0	58	0	0	75	25
	H24	0	73	1	14	0	0	0	12	100	0
	H25	3	91	0	7	0	0	0	0	100	0
	H26	0	46	0	53	0	0	0	0	100	0
	H27	0	82	0	4	1	14	0	0	100	0
	H28	1	59	8	32	0	0	0	0	14	86
	H28.1	0	46	0	54	0	0	0	0	0	100
	H28.2	0	60	0	40	0	0	0	0	1	99
	H29	1	89	1	9	0	0	0	0	0	100
	H29.1	0	4	0	95	0	0	0	0	1	99
	H29.2	0	27	0	72	1	0	0	0	0	100
	H3	1	30	7	63	0	0	0	0	100	0
	H3.1	1	38	22	40	0	0	0	0	100	0
	H4	0	52	7	38	1	2	0	0	100	0
	H4.1	0	46	21	32	0	0	0	0	100	0
	H5	0	37	6	53	0	3	0	0	100	0
	H5.1	0	12	0	37	0	50	1	0	100	0
	H5.2	0	4	1	26	0	69	0	0	100	0
	H6	1	24	12	63	0	0	0	0	100	0
	H6.1	1	52	9	11	14	0	14	0	100	0
	H6.2	0	85	0	0	3	0	11	0	100	0
	H7	1	69	1	29	0	0	0	0	100	0

	H7.1	0	27	0	0	0	0	73	0	100	0
	H8	0	27	18	55	0	0	0	0	100	0
	H8.1	0	28	5	66	0	0	0	0	100	0
	H8.2	1	26	5	68	0	0	0	0	100	0
	H9	1	44	9	46	0	1	0	0	100	0
	H9.1	0	23	0	72	0	3	0	1	100	0
	R1	1	6	26	53	11	3	0	0	100	0
	R1.1	2	0	1	97	0	0	0	0	100	0
	R10	0	31	0	69	0	0	0	0	100	0
	R10.1	0	7	5	88	0	0	0	0	100	0
	R11	1	6	17	70	0	6	0	0	100	0
	R11.1	0	1	4	92	0	2	0	0	100	0
	R12	1	79	0	12	4	0	4	0	1	99
	R12.1	1	81	0	6	1	0	10	0	9	91
	R12.2	1	62	0	16	11	0	10	0	1	99
	R12.3	0	42	0	48	8	0	0	0	1	99
	R12.4	0	35	7	39	16	3	0	0	29	71
	R12.5	1	63	1	0	7	0	29	0	1	99
	R13	2	59	0	36	2	2	0	0	100	0
	R13.1	0	53	7	32	5	0	2	0	76	24
	R13.2	0	21	0	60	19	0	0	0	20	80
	R13.3	0	42	2	55	1	0	0	0	32	68
	R13.4	0	47	0	50	3	0	0	0	1	99
	R14	1	49	11	12	2	24	0	0	28	72
	R15	0	41	14	37	0	7	0	0	80	20
	R16	0	91	3	4	1	0	1	0	100	0
	R17	1	80	0	20	0	0	0	0	96	4
	R18	0	55	4	41	0	0	0	0	47	53
	R19	0	75	0	8	1	15	0	0	100	0
	R2	1	0	17	79	3	0	0	0	100	0
	R2.2	1	0	12	81	4	0	1	0	100	0
	R20	0	2	4	45	0	48	0	1	100	0
	R20.1	0	33	4	43	0	19	0	0	100	0
	R21	0	34	5	24	0	0	0	36	87	13
	R21.1	0	68	4	26	0	0	0	3	79	21
	R22	0	44	17	27	0	0	0	11	58	42
	R23	0	0	7	35	0	57	0	0	86	14
	R24	0	72	3	13	0	0	0	12	100	0
	R25	4	96	0	0	0	0	0	0	100	0
	R26	2	49	0	49	0	0	0	0	100	0
	R27	1	82	0	0	1	16	0	0	100	0
	R28	1	57	9	34	0	0	0	0	14	86
	R28.1	0	45	0	54	0	0	0	0	0	100
	R28.2	0	61	0	38	0	0	0	0	1	99
	R29	2	88	1	10	0	0	0	0	0	100
	R29.1	0	4	0	95	0	0	0	0	0	100
	R29.2	1	27	0	71	1	0	0	0	0	100
	R3	1	26	7	67	0	0	0	0	100	0
	R3.1	1	40	25	34	0	0	0	0	100	0
	R4	1	35	6	51	0	7	0	0	100	0
	R4.1	0	42	25	31	1	0	0	0	100	0
	R5	1	22	5	66	1	5	0	0	100	0
	R5.1	1	9	0	30	0	59	0	0	100	0
	R5.2	2	4	1	26	0	68	0	0	100	0
	R6	1	28	17	54	0	0	0	0	100	0
	R6.1	0	44	9	13	17	1	15	0	100	0
	R6.2	0	85	0	0	3	0	12	0	100	0
	R7	1	71	2	27	0	0	0	0	100	0
	R7.1	1	21	0	0	0	0	78	0	100	0
	R8	0	28	15	56	0	0	0	0	100	0
	R8.1	0	30	13	56	0	0	0	0	100	0
	R8.2	1	26	7	67	0	0	0	0	100	0
	R9	1	43	9	48	0	0	0	0	100	0
	R9.1	0	26	0	71	0	3	0	0	100	0

Appendix VIII Table merged percentages

Merged percentages per session								
Session	**None**	**Neutral**	**Client**	**Surroundings**	**Dissatisfaction**	**Apprehension**	**Relaxation**	**Excitement**
1	1,24	1,62	15,35	75,48	5,29	0,76	0,00	0,25
10	0,41	17,87	2,37	79,18	0,00	0,00	0,17	0,00
11	0,57	3,73	8,44	83,53	0,26	3,47	0,00	0,00
12	0,62	60,51	1,26	20,62	7,85	0,39	8,75	0,00
13	0,59	43,72	1,70	47,35	5,88	0,40	0,37	0,00
14	1,02	50,69	9,46	14,45	2,40	21,98	0,00	0,00
15	0,74	35,33	21,72	35,64	0,00	6,57	0,00	0,00
16	0,47	88,85	5,63	3,88	0,30	0,30	0,58	0,00
17	0,68	83,93	0,41	14,70	0,28	0,00	0,00	0,00
18	0,27	53,85	3,85	42,03	0,00	0,00	0,00	0,00
19	0,47	74,22	0,84	8,90	1,34	14,22	0,00	0,00
2	0,81	0,00	14,85	81,13	2,68	0,00	0,34	0,19
20	0,45	17,25	5,55	44,54	0,22	31,12	0,00	0,87
21	0,49	52,11	3,96	24,58	0,00	0,00	0,00	18,87
22	0,26	49,25	13,04	26,16	0,00	0,00	0,00	11,28
23	0,36	0,41	8,04	33,63	0,00	57,56	0,00	0,00
24	0,35	72,45	2,10	13,33	0,00	0,00	0,00	11,77
25	3,30	93,30	0,00	3,40	0,00	0,00	0,00	0,00
26	0,98	47,62	0,23	51,18	0,00	0,00	0,00	0,00
27	0,57	81,84	0,00	1,85	0,67	15,07	0,00	0,00
28	0,61	57,96	8,51	32,92	0,00	0,00	0,00	0,00
29	0,36	45,73	0,00	53,92	0,00	0,00	0,00	0,00
30	0,40	60,48	0,00	39,12	0,00	0,00	0,00	0,00
31	1,20	88,49	0,60	9,71	0,00	0,00	0,00	0,00
32	0,30	4,30	0,00	95,40	0,00	0,00	0,00	0,00

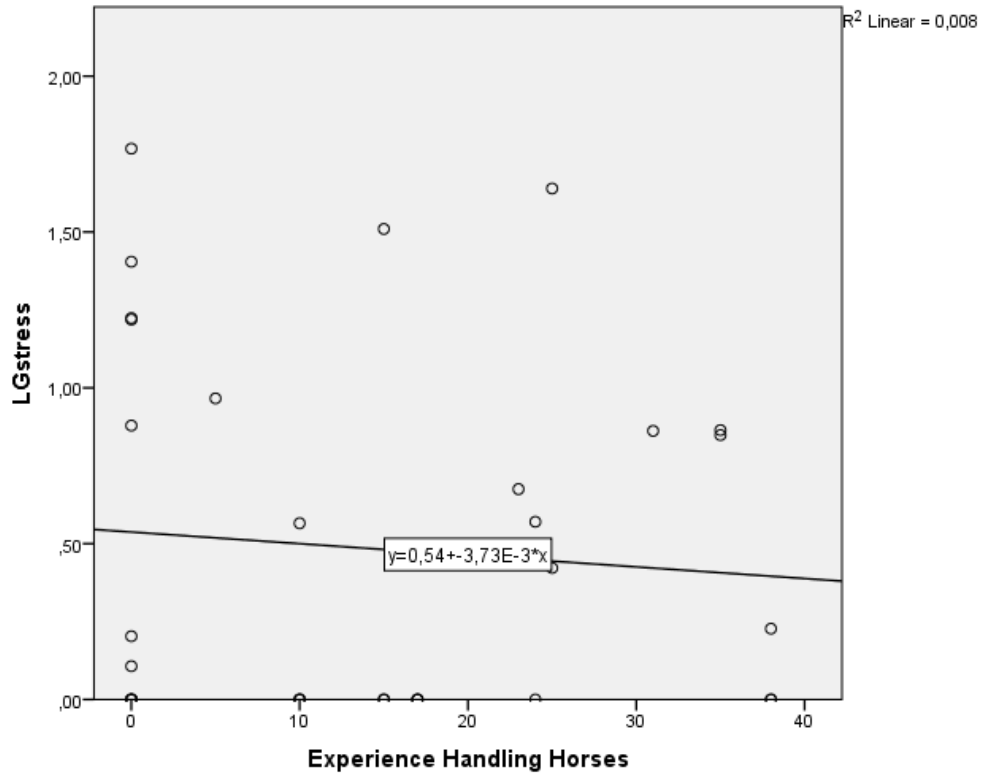
33	0,48	26,86	0,00	71,98	0,69	0,00	0,00	0,00
3	0,75	33,32	15,05	50,88	0,00	0,00	0,00	0,00
4	0,45	43,75	14,95	38,13	0,50	2,21	0,00	0,00
5	0,65	14,68	2,28	39,68	0,26	42,36	0,09	0,00
6	0,58	53,17	7,73	23,57	6,06	0,26	8,64	0,00
7	0,56	46,94	0,68	14,09	0,00	0,00	37,73	0,00
8	0,43	27,72	10,64	61,21	0,00	0,00	0,00	0,00
9	0,54	33,82	4,49	59,28	0,00	1,64	0,00	0,23

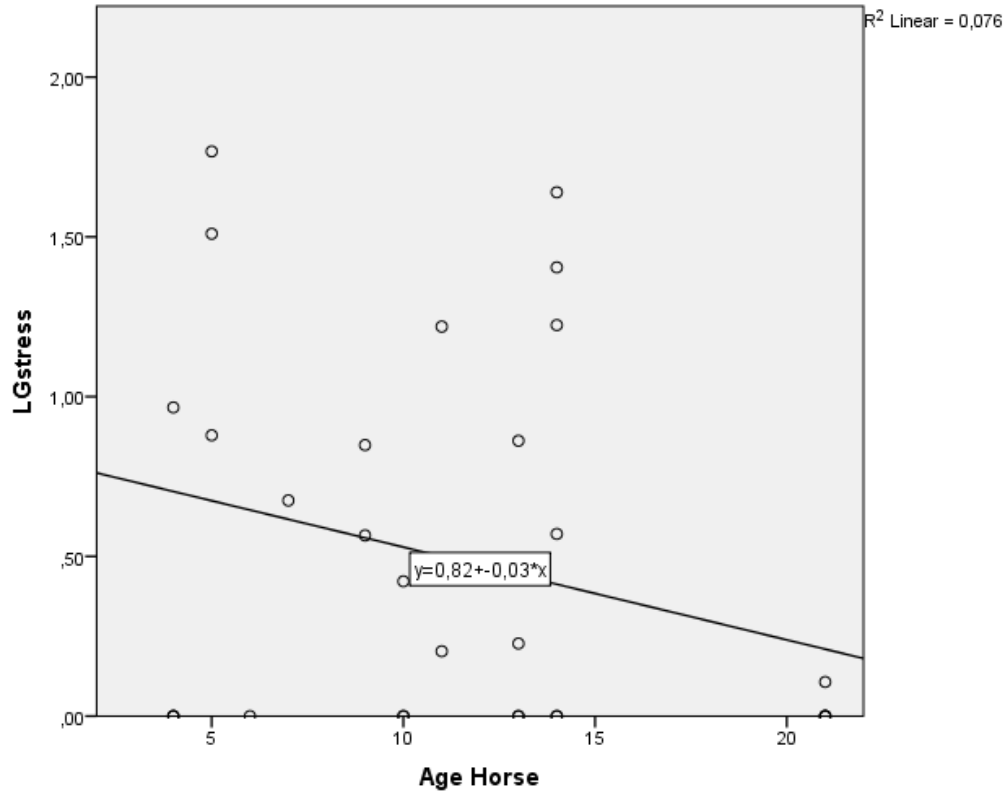
Appendix IX Codebook SPSS

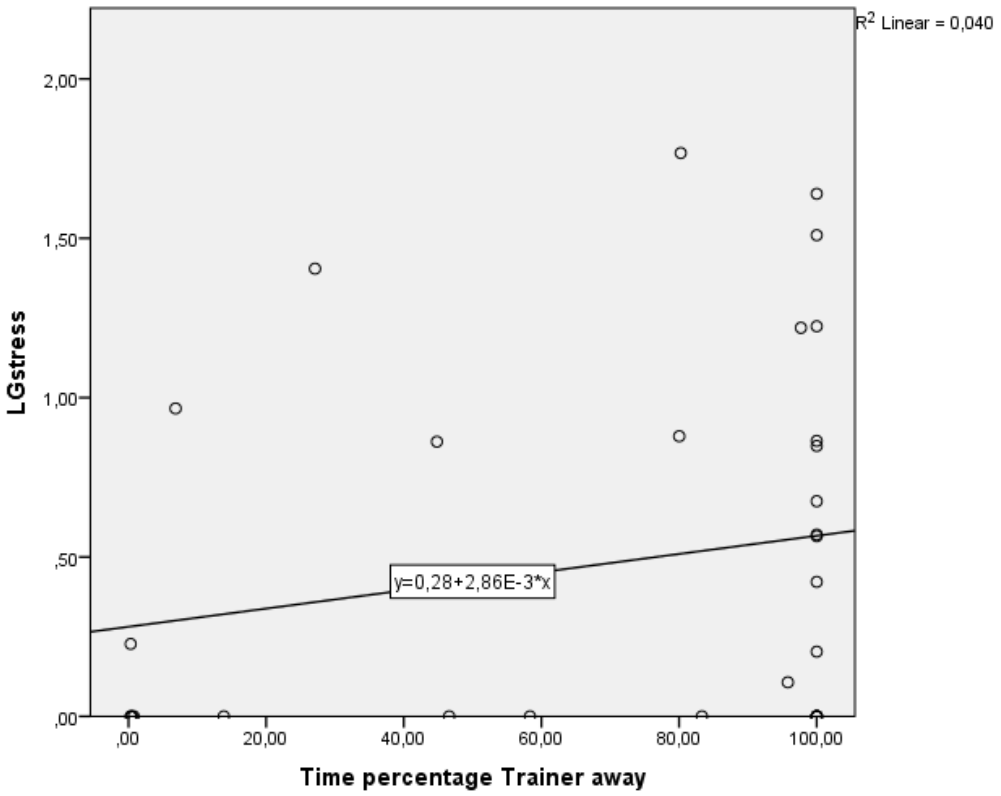
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

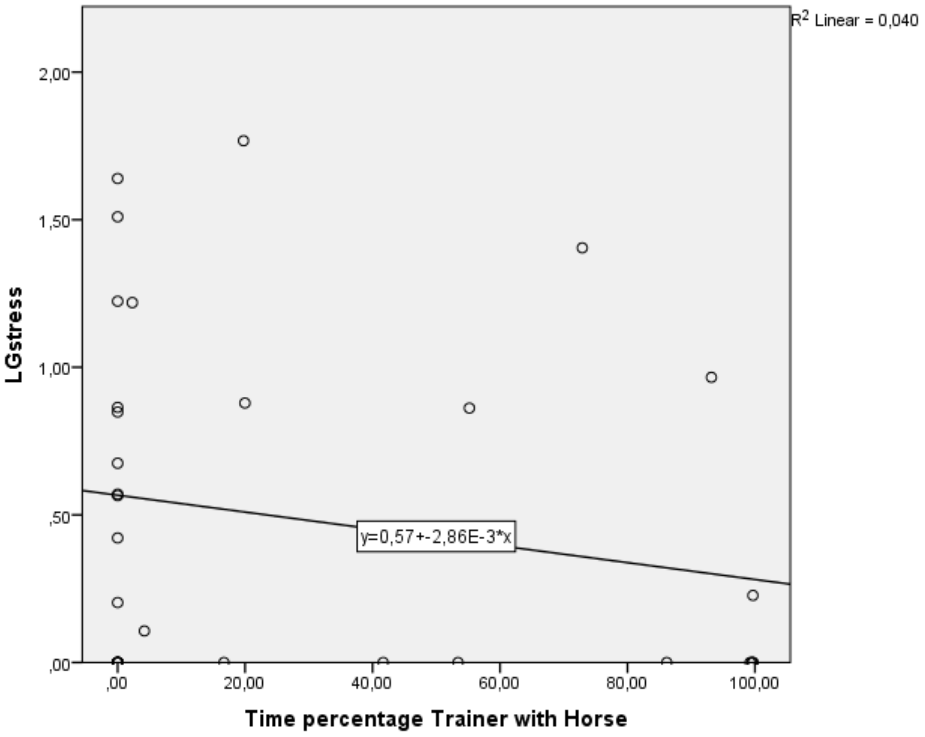
	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	NS	Numeric	8	0	Number Session	None	None	8	Right	Scale	Input
2	E	Numeric	8	0	Exercise	{1, Free}...	None	8	Right	Nominal	Input
3	NH	Numeric	8	0	Number Horse	None	None	8	Right	Nominal	Input
4	AH	Numeric	8	0	Age Horse	None	None	8	Right	Scale	Input
5	EH	Numeric	8	0	Experience Horse	None	None	8	Right	Scale	Input
6	NC	Numeric	8	0	Number Client	None	None	8	Right	Nominal	Input
7	EHH	Numeric	8	0	Experience Ha...	None	None	8	Right	Scale	Input
8	PE	Numeric	8	0	Previous Experi...	{1, yes}...	None	8	Right	Nominal	Input
9	NT	Numeric	8	0	Number Trainer	None	None	8	Right	Nominal	Input
10	percNo	Numeric	8	2	Time percentag...	None	None	8	Right	Scale	Input
11	percN	Numeric	8	2	Time percentag...	None	None	8	Right	Scale	Input
12	percC	Numeric	8	2	Time percentag...	None	None	8	Right	Scale	Input
13	percS	Numeric	8	2	Time percentag...	None	None	8	Right	Scale	Input
14	percD	Numeric	8	2	Time percentag...	None	None	8	Right	Scale	Input
15	percA	Numeric	8	2	Time percentag...	None	None	8	Right	Scale	Input
16	percR	Numeric	8	2	Time percentag...	None	None	8	Right	Scale	Input
17	percE	Numeric	8	2	Time percentag...	None	None	8	Right	Scale	Input
18	percT	Numeric	8	2	Time percentag...	None	None	8	Right	Scale	Input
19	percTH	Numeric	8	2	Time percentag...	None	None	8	Right	Scale	Input
20	percStress	Numeric	8	2		None	None	12	Right	Scale	Input
21	LGstress	Numeric	8	2		None	None	10	Right	Scale	Input

Appendix X Linear dependency covariates

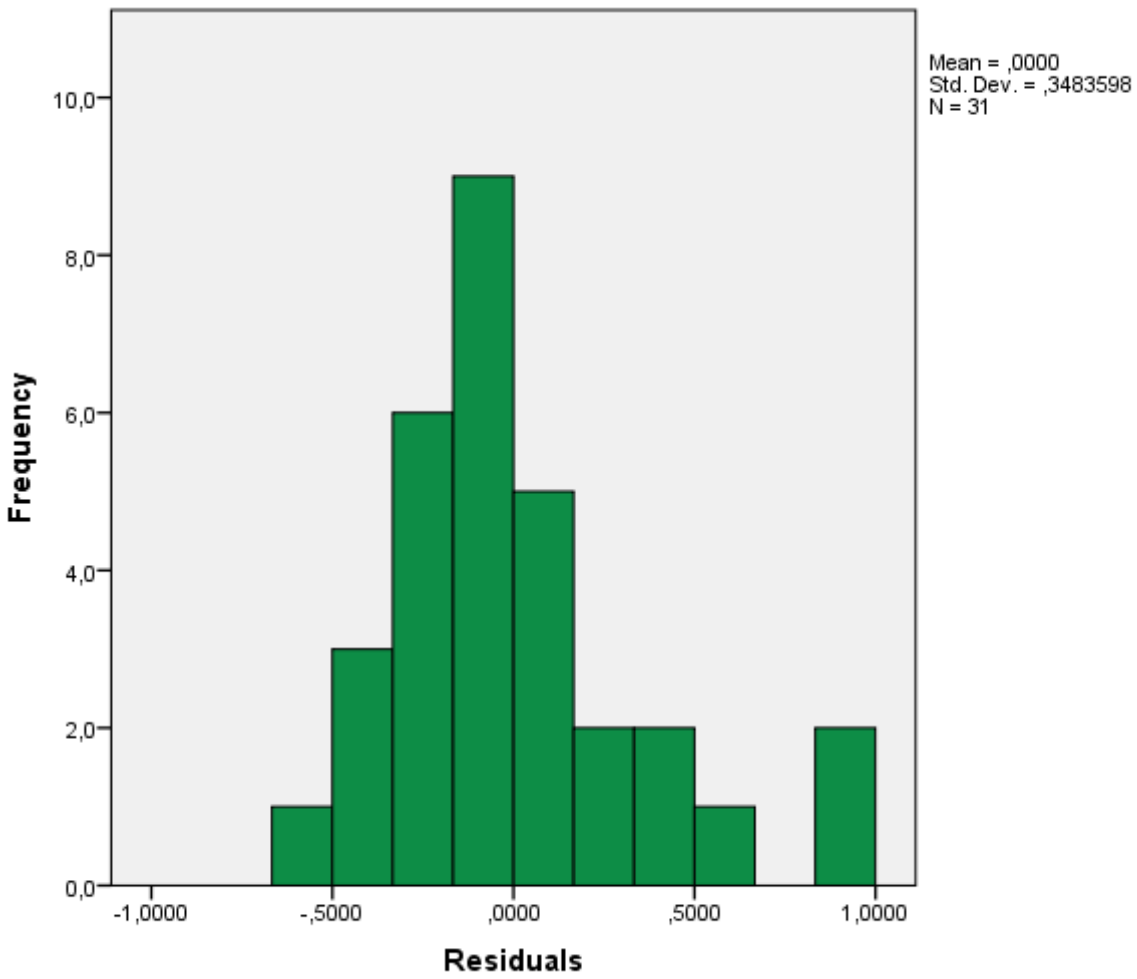




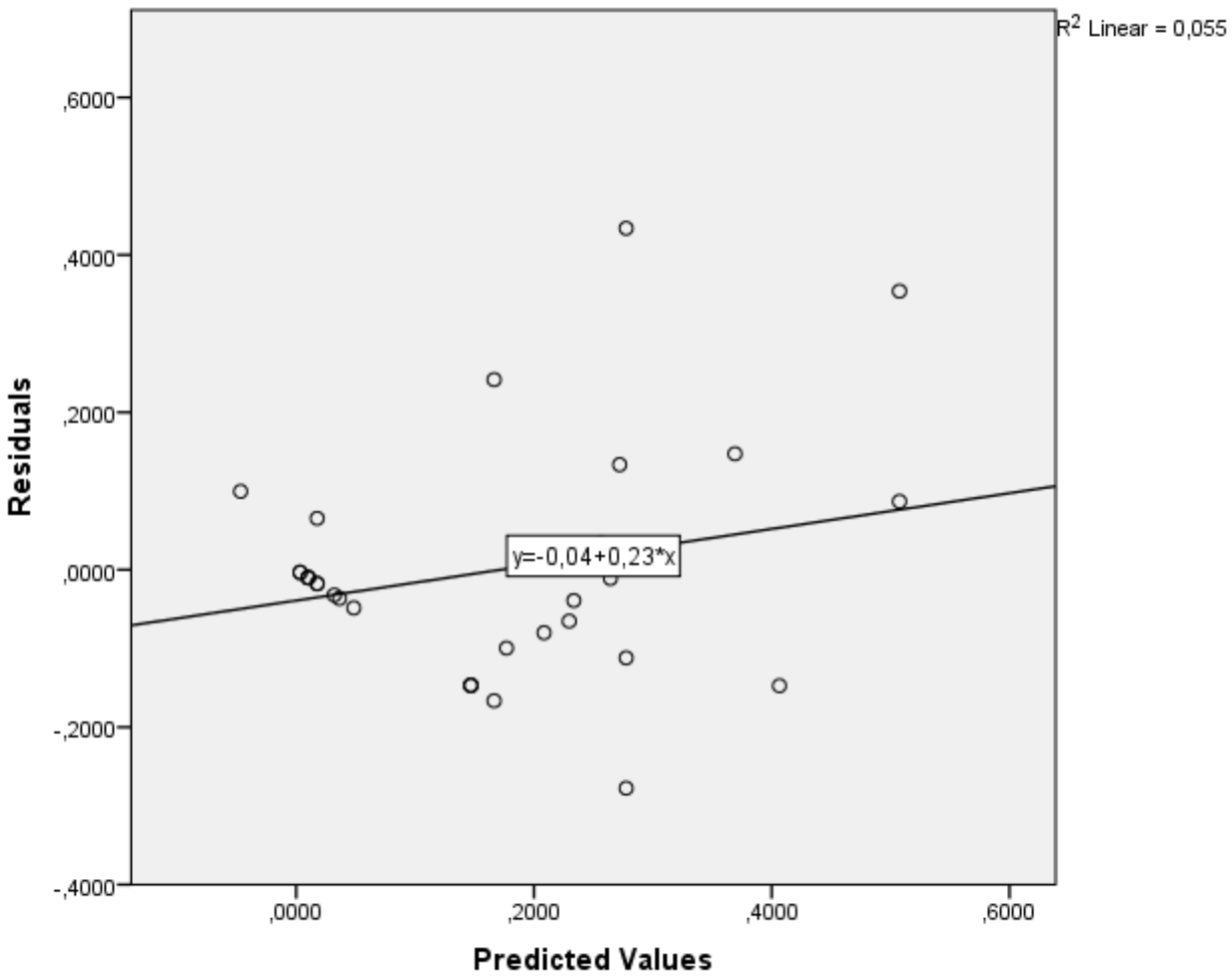

R2 Linear = 0,040
LGstress
2,00
1,50
1,00
,50
,00
y=0,28+2,86E-3*x
,00
20,00
40,00
60,00
80,00
100,00
Time percentage Trainer away


R2 Linear = 0,040
LGstress
2,00
1,50
1,00
,50
,00
y=0,57+-2,86E-3*x
,00
20,00
40,00
60,00
80,00
100,00
Time percentage Trainer with Horse

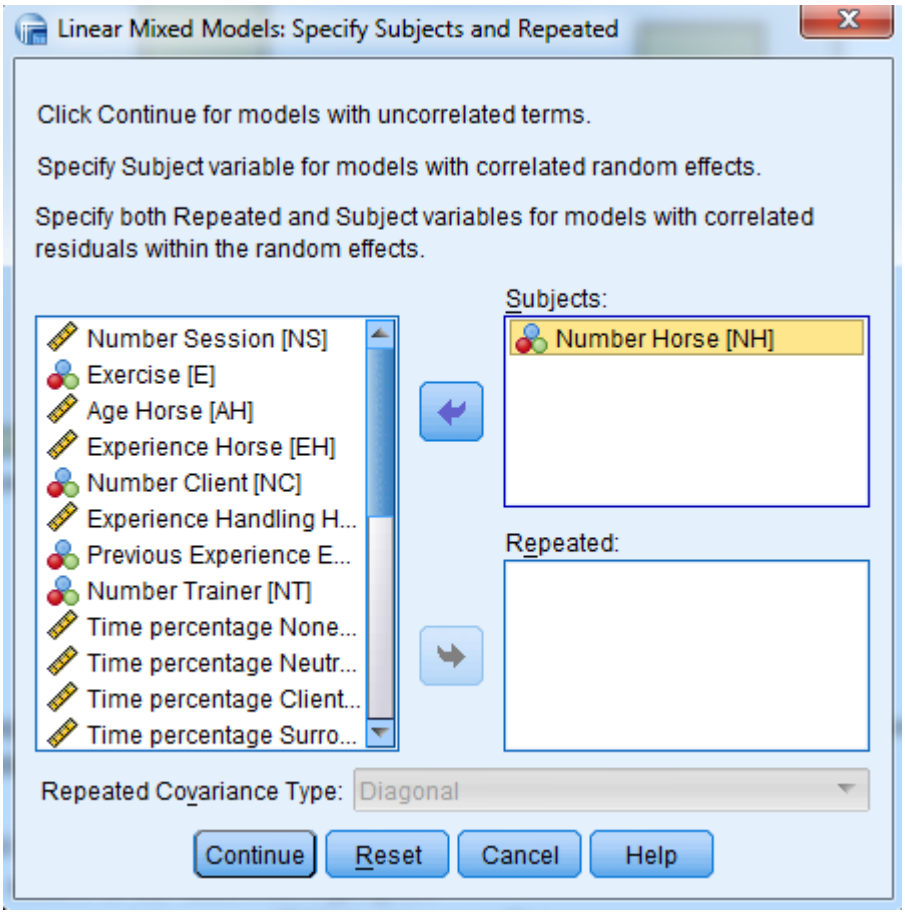
Appendix XI Histogram residuals

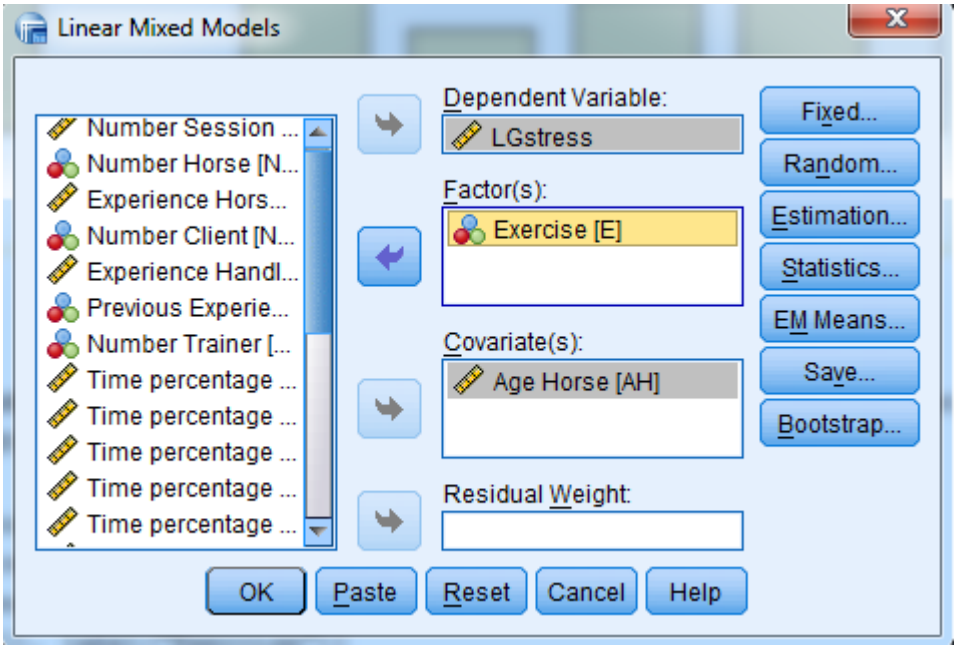


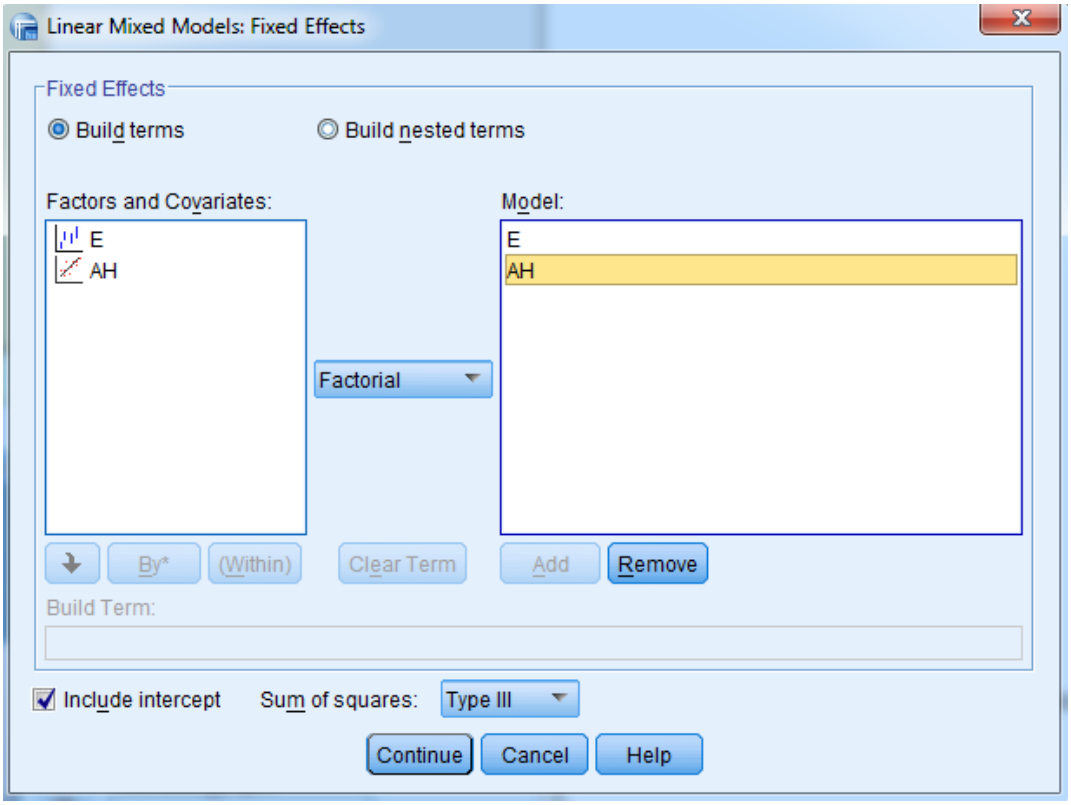
Appendix XII Residual and predicted values

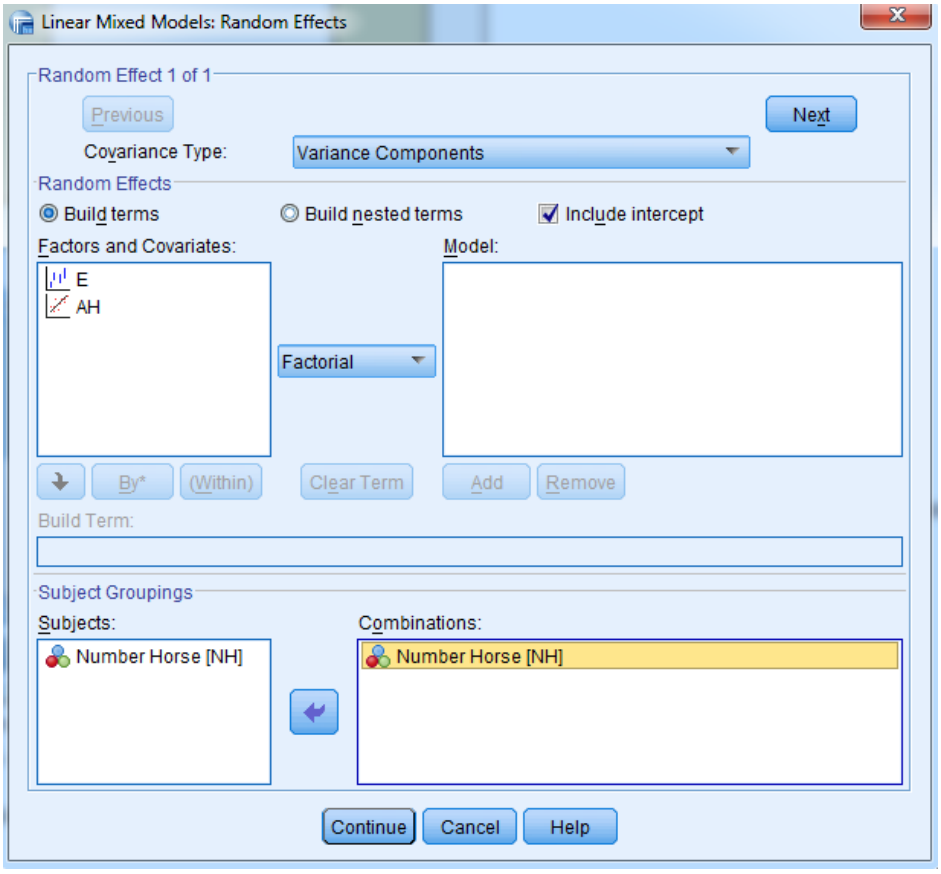


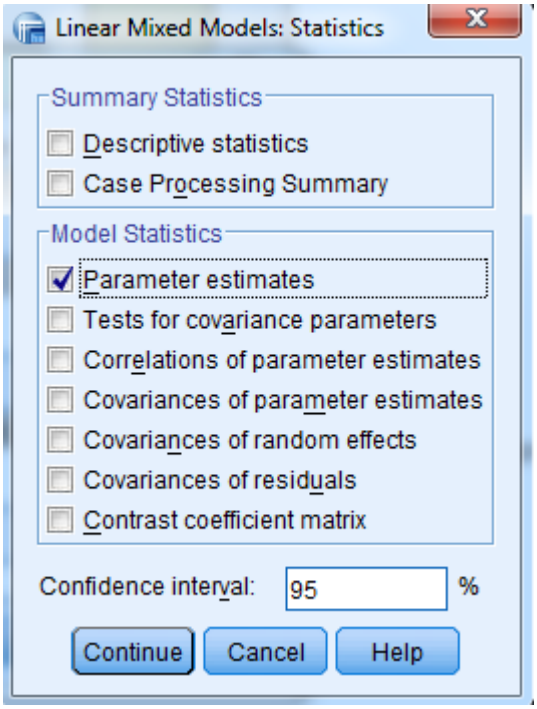
Appendix XIII Screenshot model






Linear Mixed Models: Fixed Effects
Fixed Effects
Build terms
Build nested terms
Factors and Covariates:
E
AH
Model:
E
AH
Factorial
By*
(Within)
Clear Term
Add
Remove
Build Term:
Include intercept
Sum of squares:
Type III
Continue
Cancel
Help


Linear Mixed Models: Random Effects
Random Effect 1 of 1
Previous
Next
Covariance Type:
Variance Components
Random Effects
Build terms
Build nested terms
Include intercept
Factors and Covariates:
E
AH
Model:
Factorial
By*
(Within)
Clear Term
Add
Remove
Build Term:
Subject Groupings
Subjects:
Number Horse [NH]
Combinations:
Number Horse [NH]
Continue
Cancel
Help


Linear Mixed Models: Statistics
Summary Statistics
Descriptive statistics
Case Processing Summary
Model Statistics
Parameter estimates
Tests for covariance parameters
Correlations of parameter estimates
Covariances of parameter estimates
Covariances of random effects
Covariances of residuals
Contrast coefficient matrix
Confidence interval:
95
%
Continue
Cancel
Help

Appendix XIV Kappa intra

Observer 1

Pair	Observation A	Observation B	Agreement	Disagreement	Index of concordance	Percentage of agreement	Kappa	Significance of Kappa	Kappa max.
1	intra 1R / Results	intra 2R / Results	530,665	54,9646	0,906144	90,6144	0,852341	0	0,92491
2	intra3R / Results	intra 4R / Results	299,7	21,3638	0,933459	93,3459	0,893049	0	0,962435

Observer 2

Pair	Observation A	Observation B	Agreement	Disagreement	Index of concordance	Percentage of agreement	Kappa	Significance of Kappa	Kappa max.
1	Intra 2H / Results	intra 1H / Results	520,654	62,5242	0,892787	89,2787	0,834402	0	0,987928
2	Intra 3H / Results	Intra 4H / Results	307,585	15,9015	0,950844	95,0844	0,917525	0	0,987255

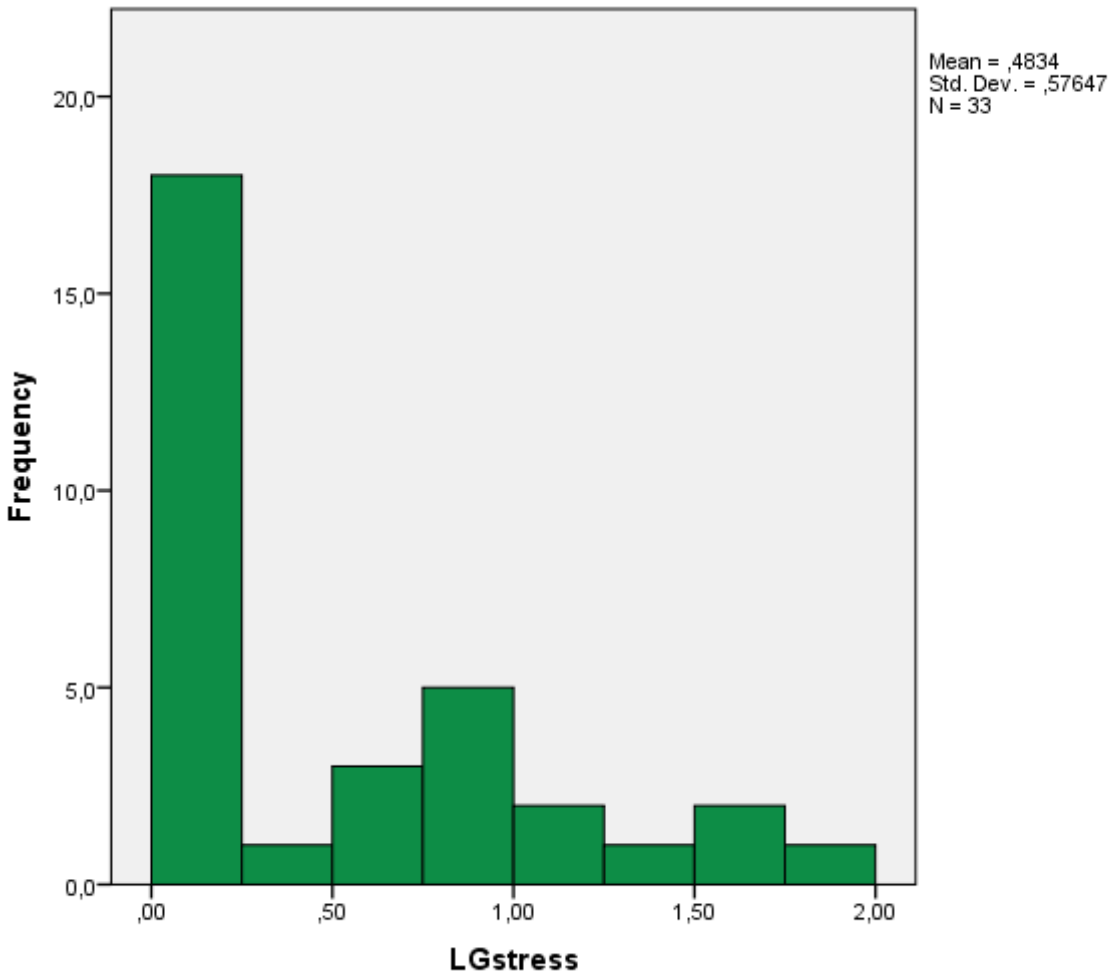
Appendix XV Kappa inter

Pair	Observation A	Observation B	Agreement	Disagreement	Index of concordance	Percentage of agreement	Kappa	Significance of Kappa	Kappa max.
1	H1 / Results	R1 / Results	543,81	67,54	0,89	88,95	0,83	0	0,92
2	H1.1 / Results	R1.1 / Results	261,27	4,67	0,98	98,24	0,97	0	0,98
3	H10 / Results	R10 / Results	583,60	19,95	0,97	96,69	0,95	0	0,97
4	H10.1 / Results	R10.1 / Results	582,88	18,02	0,97	97,00	0,95	0	0,99
5	H11 / Results	R11 / Results	560,72	61,34	0,90	90,14	0,84	0	0,90
6	H11.1 / Results	R11.1 / Results	572,18	28,16	0,95	95,31	0,91	0	0,98
7	H12 / Results	R12 / Results	719,38	44,58	0,94	94,16	0,90	0	0,98
8	H12.1 / Results	R12.1 / Results	617,31	36,56	0,94	94,41	0,91	0	0,96
9	H12.2 / Results	R12.2 / Results	601,69	25,07	0,96	96,00	0,94	0	0,97
10	H12.3 / Results	R12.3 / Results	586,62	17,13	0,97	97,16	0,96	0	0,97
11	H12.4 / Results	R12.4 / Results	574,36	27,46	0,95	95,44	0,94	0	0,98
12	H12.5 / Results	R12.5 / Results	584,04	17,46	0,97	97,10	0,95	0	0,99
13	H13 / Results	R13 / Results	693,39	40,06	0,95	94,54	0,92	0	0,95
14	H13.1 / Results	R13.1 / Results	781,55	57,40	0,93	93,16	0,91	0	0,96
15	H13.2 / Results	R13.2 / Results	585,28	16,12	0,97	97,32	0,96	0	0,97
16	H13.3 / Results	R13.3 / Results	586,70	17,97	0,97	97,03	0,96	0	0,97
17	H13.4 / Results	R13.4 / Results	382,57	28,18	0,93	93,14	0,89	0	0,95
18	H14 / Results	R14 / Results	533,73	69,67	0,88	88,45	0,85	0	0,93
19	H15 / Results	R15 / Results	505,72	98,59	0,84	83,69	0,78	0	0,89
20	H16 / Results	R16 / Results	558,31	42,59	0,93	92,91	0,87	0	0,94
21	H17 / Results	R17 / Results	540,66	65,29	0,89	89,23	0,82	0	0,91
22	H18 / Results	R18 / Results	575,48	25,90	0,96	95,69	0,94	0	0,98
23	H19 / Results	R19 / Results	506,14	58,59	0,90	89,63	0,83	0	0,93
24	H2 / Results	R2 / Results	547,60	58,61	0,90	90,33	0,83	0	0,95
25	H2.2 / Results	R2.2 / Results	453,17	53,42	0,89	89,46	0,82	0	0,97

26	H20 / Results	R20 / Results	576,00	26,06	0,96	95,67	0,93	0	0,97
27	H20.1 / Results	R20.1 / Results	451,75	30,30	0,94	93,72	0,91	0	0,95
28	H21 / Results	R21 / Results	581,74	20,39	0,97	96,61	0,95	0	0,97
29	H21.1 / Results	R21.1 / Results	573,43	27,86	0,95	95,37	0,93	0	0,98
30	H22 / Results	R22 / Results	548,96	52,87	0,91	91,22	0,89	0	0,93
31	H23 / Results	R23 / Results	545,80	59,46	0,90	90,18	0,86	0	0,90
32	H24 / Results	R24 / Results	581,55	26,07	0,96	95,71	0,93	0	0,97
33	H25 / Results	R25 / Results	185,56	13,18	0,93	93,37	0,88	0	0,89
34	H26 / Results	R26 / Results	565,25	37,22	0,94	93,82	0,90	0	0,96
35	H27 / Results	R27 / Results	579,00	22,73	0,96	96,22	0,93	0	0,97
36	H28 / Results	R28 / Results	594,48	23,12	0,96	96,26	0,95	0	0,98
37	H28.1 / Results	R28.1 / Results	595,59	6,39	0,99	98,94	0,98	0	0,99
38	H28.2 / Results	R28.2 / Results	590,16	11,04	0,98	98,16	0,97	0	0,98
39	H29 / Results	R29 / Results	595,69	8,76	0,99	98,55	0,97	0	0,98
40	H29.1 / Results	R29.1 / Results	599,81	6,82	0,99	98,88	0,98	0	0,99
41	H29.2 / Results	R29.2 / Results	587,16	15,63	0,97	97,41	0,96	0	0,99
42	H3 / Results	R3.1 / Results	525,08	90,64	0,85	85,28	0,77	0	0,93
43	H3.1 / Results	R3.2 / Results	536,36	49,58	0,92	91,54	0,87	0	0,95
44	H4 / Results	R4 / Results	501,47	115,64	0,81	81,26	0,71	0	0,85
45	H4.1 / Results	R4.1 / Results	563,83	39,27	0,93	93,49	0,90	0	0,96
46	H5 / Results	R5 / Results	529,05	75,91	0,87	87,45	0,81	0	0,86
47	H5.1 / Results	R5.1 / Results	552,96	52,28	0,91	91,36	0,87	0	0,92
48	H5.2 / Results	R5.2 / Results	559,10	42,58	0,93	92,92	0,89	0	0,99
49	H6 / Results	R6 / Results	541,65	65,12	0,89	89,27	0,83	0	0,92
50	H6.1 / Results	R6.1 / Results	568,80	63,11	0,90	90,01	0,85	0	0,93
51	H6.2 / Results	R6.2 / Results	597,09	6,77	0,99	98,88	0,98	0	0,99
52	H7 / Results	R7 / Results	570,76	30,85	0,95	94,87	0,92	0	0,98
53	H7.1 / Results	R7.1 / Results	581,33	20,59	0,97	96,58	0,94	0	0,94
54	H8 /	R8 /	656,80	55,83	0,92	92,17	0,88	0	0,98

	Results	Results							
55	H8.1 / Results	R8.1 / Results	544,96	57,34	0,90	90,48	0,85	0	0,92
56	H8.2 / Results	R8.2 / Results	465,27	80,25	0,85	85,29	0,76	0	0,97
57	H9 / Results	R9 / Results	566,13	36,46	0,94	93,95	0,91	0	0,98
58	H9.1 / Results	R9.1 / Results	584,60	16,54	0,97	97,25	0,95	0	0,98

Appendix XVI Graph normal distribution



Appendix XVII Tables LMM

Mixed Model Analysis

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters	Subject Variables
Fixed Effects	Intercept	1		1	
	E	6		5	
	AH	1		1	
Random Effects	Intercept[b]	1	Variance Components	1	NH
Residual				1	
Total		9		9	

a. Dependent Variable: LGstress.

b. As of version 11.5, the syntax rules for the RANDOM subcommand have changed. Your command syntax may yield results that differ from those produced by prior versions. If you are using version 11 syntax, please consult the current syntax reference guide for more information.

Information Criteria[a]

-2 Restricted Log Likelihood	46,956
Akaike's Information Criterion (AIC)	50,956
Hurvich and Tsai's Criterion (AICC)	51,528
Bozdogan's Criterion (CAIC)	55,312
Schwarz's Bayesian Criterion (BIC)	53,312

The information criteria are displayed in smaller-is-better form.

a. Dependent Variable: LGstress.

Fixed Effects

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	7,933	10,297	,013
E	5	22,862	2,992	,032
AH	1	6,317	2,846	,140

a. Dependent Variable: LGstress.

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	1,314351	,390821	12,563	3,363	,005	,467036	2,161666
[E=1]	-,123725	,286187	21,367	-,432	,670	-,718262	,470811
[E=2]	-,956419	,354167	17,859	-2,700	,015	-1,700915	-,211922
[E=3]	-,037909	,389703	22,416	-,097	,923	-,845236	,769418
[E=4]	-,430757	,380010	22,503	-1,134	,269	-1,217830	,356315
[E=5]	-,686379	,344836	19,900	-1,990	,060	-1,405926	,033167
[E=6]	0[b]	0	.	.	.	.	.
AH	-,039808	,023597	6,317	-1,687	,140	-,096851	,017236

a. Dependent Variable: LGstress.

b. This parameter is set to zero because it is redundant.

Covariance Parameters

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error
Residual		,177773	,059832
Intercept [subject = NH]	Variance	,074897	,076425

a. Dependent Variable: LGstress.

Estimated Marginal Means

Exercise

Estimates[a]

Exercise	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
Free	,735[b]	,163	14,355	,387	1,083
Systematic	-,098[b]	,247	13,127	-,631	,435
Lunge line	,821[b]	,341	23,726	,116	1,525
Leadrope	,428[b]	,341	23,999	-,277	1,132
Trail	,172[b]	,241	16,231	-,337	,682
Round pen	,858[b]	,253	16,678	,323	1,394

a. Dependent Variable: LGstress.

b. Covariates appearing in the model are evaluated at the following values: Age Horse = 11,45.

Pairwise Comparisons[a]

(I) Exercise	(J) Exercise	Mean Difference (I-J)	Std. Error	df	Sig.[c]	95% Confidence Interval for Difference[c]	
						Lower Bound	Upper Bound
Free	Systematic	,833*	,266	22,625	,005	,282	1,383
	Lunge line	-,086	,372	23,859	,820	-,854	,683
	Leadrope	,307	,361	23,047	,403	-,439	1,053
	Trail	,563	,278	20,251	,056	-,017	1,142
	Round pen	-,124	,286	21,367	,670	-,718	,471
Systematic	Free	-,833*	,266	22,625	,005	-1,383	-,282
	Lunge line	-,919*	,417	21,533	,039	-1,784	-,053
	Leadrope	-,526	,422	23,680	,225	-1,397	,346
	Trail	-,270	,338	16,333	,436	-,986	,446
	Round pen	-,956*	,354	17,859	,015	-1,701	-,212
Lunge line	Free	,086	,372	23,859	,820	-,683	,854
	Systematic	,919*	,417	21,533	,039	,053	1,784
	Leadrope	,393	,476	23,448	,418	-,591	1,377

	Trail	,648	,382	22,910	,103	-,142	1,438
	Round pen	-,038	,390	22,416	,923	-,845	,769
Leadrope	Free	-,307	,361	23,047	,403	-1,053	,439
	Systematic	,526	,422	23,680	,225	-,346	1,397
	Lunge line	-,393	,476	23,448	,418	-1,377	,591
	Trail	,256	,417	23,659	,546	-,606	1,117
	Round pen	-,431	,380	22,503	,269	-1,218	,356
Trail	Free	-,563	,278	20,251	,056	-1,142	,017
	Systematic	,270	,338	16,333	,436	-,446	,986
	Lunge line	-,648	,382	22,910	,103	-1,438	,142
	Leadrope	-,256	,417	23,659	,546	-1,117	,606
	Round pen	-,686	,345	19,900	,060	-1,406	,033
Round pen	Free	,124	,286	21,367	,670	-,471	,718
	Systematic	,956*	,354	17,859	,015	,212	1,701
	Lunge line	,038	,390	22,416	,923	-,769	,845
	Leadrope	,431	,380	22,503	,269	-,356	1,218
	Trail	,686	,345	19,900	,060	-,033	1,406

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

a. Dependent Variable: LGstress.

c. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests[a]

Numerator df	Denominator df	F	Sig.
5	22,760	2,992	,032

The F tests the effect of Exercise. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Dependent Variable: LGstress.

Appendix XVIII Interaction Age and Exercise