

NORWEGIAN UNIVERSITY OF LIFE SCIENCES



## **Abstract**

Dogs are very popular pets and it would be useful to find more tools to better understand their behavior. Reactivity can be seen as emotionality, and indicate a heightened state of arousal. So the aim of this study is to investigate the possible links between numbers and directions of hair whorls according to reactivity in dogs, with focus on the dogs' chest, and upper part of the left and right leg (shoulders).

A quantitative research method was used with a questionnaire (containing Negative scale, Positive scale and Questionnaire1 scale of reactivity trait) distributed in two countries; Norway and Hungary. To validate the questionnaire a direct observation test was conducted to correlate the owners' view of the dogs' behavior to an observers view.

Comparing samples from the two countries there was a similar range of male and female dogs, the same range of age, and similar direction of the chest hair whorls, but hair whorls direction and numbers on the legs were different. There was also a difference between countries in the Negative scale and Questionnaire1 scale score and in breed composition. The several differences between the Hungarian and Norwegian sample can indicate cultural differences, but also that the variation of breeds could have an effect on the results.

There was no effect of sex on behavior scale scores in the Norwegian sample or the Hungarian sample. But there was a weak negative correlation between age and the Positive scale score in the Norwegian sample and a medium negative correlation between age and the scale scores in the Questionnaire1 and Positive scale in the Hungarian sample.

There were few indications that the owner and observer had the same view of the dogs behavior, but that can be due to the fact that dogs might have another behavior in a research situation than in an everyday situation. 20-25 % of owners commented that it was either difficult or very difficult to find the hair whorls. These results can indicate that a questionnaire is not the proper tool for assessing the link between behavior and hair whorl characteristics.

When correlating hair whorls characteristics and the dogs' behavior, the second counterclockwise hair whorl and multiple whorls were related to the Positive scale score in the Norwegian sample. This can indicate that there is a connection between several whorls and a counterclockwise direction of hair whorls to a higher state of energy and excitability.

## Sammendrag

Hunder er populære kjæledyr, og det kan være nyttig å finne flere verktøy for å kunne forstå hundens atferd bedre. Reaktivitet kan bli sett på som emosjonalitet, og indikerer høyere stadier av arousal/opphisselse. Målet med denne oppgaven er å utforske korrelasjoner mellom antall og retning av hundens hårvirvler og reaktiv atferd. Fokus er hårvirvler på hundens bryst samt øverste del av høyre og venstre framfot (skulder).

Det ble brukt kvantitativ metode i form av spørreskjema (med Negativ, Positiv og Spørreskjema1 skalering av reaktiv atferd) som ble distribuert i to land; Norge og Ungarn. For å validere spørreskjemaet ble det gjennomført en direkte observasjonstest for å korrelere eiers syn på hundens atferd kontra en observatørs syn.

I de to landene var det samme utvalg av kjønn, samme rangering av alder, og samme retning på hårvirvlene på hundens bryst. Men det var forskjell i retning og antall hårvirvler på hundenes bein. Det var også forskjeller mellom landene på resultater av Negativ og Spørreskjema1 skalering, og i forhold til rasene som var representert. At det var flere forskjeller mellom det norske og ungarske utvalget kan indikere kulturelle forskjeller, men også at variasjon av rase kan ha en effekt på resultatet.

I forhold til atferd var det ingen utslag på kjønn i verken det norske eller ungarske utvalget. Men det var en svak negativ korrelasjon mellom alder og den Positive skaleringen i det norske utvalget, og en medium negativ korrelasjon mellom alder og Spørreskjema1 og den Positive skalering i det ungarske utvalget.

Det var få indikasjoner på at observatøren og eier hadde samme oppfatning av hundens atferd. Dette kan være på grunn av at hunden viser en annen atferd i testsituasjoner enn i hverdagsituasjoner. 20-25 % av eierne kommenterer at det var vanskelig eller veldig vanskelig å finne hundens hårvirvler. Disse resultatene kan indikere at å bruke spørreskjema for å kalkulere potensiell sammenheng mellom atferd og hårvirvler muligens ikke er den mest nøyaktige.

Ved å sammenligne hårvirvler med atferd fant vi utslag på den andre hårvirvelen på hundens bryst som gikk mot klokken og flere hårvirvler med den Positive skaleringen i det norske datasettet. Dette kan indikere at flere hårvirvler og hårvirvler som går med klokken kan ha en sammenheng med en høyere tilstand av energi og oppstemthet.

## **Acknowledgment**

This master thesis is the final assignment from two years studying Animal Science, Ethology at the University of Life Science in Norway, Ås.

Ethology is an interesting field of science and my interest for relationships between hair whorls and behavior started when a fellow student, Jannicke Larsen, wrote a paper about how to tell if a dog would be a successful guide dog or not. One of the subjects being covered was Dr. Tomkins hair whorls study, which I found really interesting and the idea of doing further research on hair whorls came up over a cup of coffee with Jannicke. I presented my idea to Research Officer, PhD. Judit Bánfiné Vas. She liked the idea and became my Main Supervisor. Judit helped me develop a questionnaire that she translated to Hungarian for me and helped me to make an observation test. She also gave me the opportunity to go to her old working place MTA-ELTE Comparative Ethological, Budapest, Hungary to do the direct observation test. I spent seven busy, but wonderful weeks at the department.

I am really thankful for Judit guiding me through working with the thesis, and for the fantastic opportunity I had traveling to Budapest. I learned a lot from her, and I am really grateful for the cooperation. Also, I am very thankful for my great Supervisor in Budapest, Research Officer, PhD. Enikő Kubinyi for guiding. And my new sweet friend, Master Student in Ethology Flóra Szánthó, who I worked together with on the observation test. Not to forget Professor and head of MTA-ELTE Comparative Ethological Department Adam Miklósi for letting me do my test there. I really learnt a lot from my stay at the department.

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# **1. Introduction**

## **1.1 Hair whorls in horses and cattle**

Hair whorls (also known as crowns or swirls) are phenotypic features (Smith & Gong, 1974) and are considered general in mammals due to the attendance of fur. The presence of hair whorls have been studied in different farm animals for decades (Craft et al., 1933). Several studies of different animals have found significant correlation between hair whorls placement and direction related to different behavior (Grandin et al., 1995; Randle, 1998; Lanier et al., 2001; Broucek et al., 2007; Górecka et al., 2007; Olmos & Turner, 2008; Tomkins et al., 2012).

When studying horses and cattle it is often the facial hair whorls placement, numbers and direction that is related to a specific behavior or motor laterality (Grandin et al., 1995; Randle, 1998; Lanier et al., 2001; Broucek et al., 2007; Górecka et al., 2007; Murphy & Arkins, 2008; Olmos & Turner, 2008). In a study of motor laterality performed on 219 horses, Murphy & Arkins (2008) measured the direction of the facial hair whorls to see if there was a connection between hair whorls and lateralization with the intention to use this as a tool for improving training performance. It was found that 104 horses were left-lateralized and 95 horses were right-lateralized (performed better when traveling from one direction or another) and there was a significant correlation of right laterality and clockwise hair whorl, and left laterality and counterclockwise hair whorls. They concluded that the hair whorls could be used as indication for trainers to early determine the horses laterality, and prepare and perform better training programs for each individual (Murphy & Arkins, 2008).

In order to find correlation between hair whorls and reactivity in horses, Górecka et al. (2007) measured the heart rate of fifty-five Konik horses. The horses were divided into four groups according to their facial hair whorls: high single hair whorl above the top of the eye line, medium single whorl between the top and bottom eye line, low single whorl below the bottom eye line, and elongated or double whorl. Through a handling test and a novel object test different behavior was measured beside the horses' heart rate as a physiological indication of reactivity. The results showed that the majority of the horses that had their facial hair whorl in the medium position, and the horses with a high whorl position were more difficult to handle than horses with a medium position. Parts of the results also revealed that

horses with elongated or double whorls approached the novel object using a significantly longer time than horses with medium and low position. The study did not find any significant difference in heart rate as a measurement of emotional arousal, although there were significant differences in behavioral reactivity (Górecka et al., 2007).

Lanier et al. (2001) studied the behavior of cattle from six different cattle auctions. They classified the hair whorls according to lateral position as left, right or middle and height as high; above the top of the eyes, middle; at eye level, low; below the bottom of the eye. They used a 4-point temperament score to rate each animal inside the auction ring. Score 1 was referred to calm behavior in the ring, like standing still or walking slowly around. Score 4 was an extreme agitated reaction, such as running around, hitting the fence and trying to gore people with the head. 10 % of the cattle had no hair whorls in the face at all, and the conclusion was that cattle with no hair whorl or high facial hair whorl had a higher temperament score. Also those with a hair whorl on the centerline had more a variable temperament score than cattle with hair whorls above or below the bottom of their eyes. The majority of the cattle were in this category (Lanier et al., 2001).

In a study about the relationship between hair whorls, temperament during routine handling and weight gain in frequently handled beef cattle, researchers did not find any correlation of hair whorls position and weight gain. However, they did find a correlation with hair whorls position and restlessness. Behavior was categorized into four categories ranging from calm to violent reactions. The hair whorls were divided into high, middle and low according to the eyes, double hair whorls or no whorls at all. This was based on the same hair whorl approaches used in Lanier et al. (2001), Grandin et al. (1995) and Randle (1998) experiments. One conclusion from this test was that cattle with face whorls located above the eyes were more restless indicating that temperament during routine management can be predicted from their hair whorl location (Olmos & Turner, 2008).

However, in a study of fifty-eight Holstein heifers, they found a significant correlation between the hair whorl and weight gain. This study correlated the hair whorls position in the face according to numbers of crossed squares in an open field test, and the time of traversing a maze. They found no correlation between the hair whorls position and the behavior in the maze. But they found significant correlation between the growing rate and the hair whorls position. A high hair whorl indicated a significantly higher body weight at day 360 than the two other categories; middle facial hair whorl and low facial hair whorl (Broucek et al.,



2007). Randle (1998) assessed fifty-seven *Bos Taurus* cattle in the test that included response to a novel object, response to an unfamiliar human and to a familiar human. To measure the behavior they looked at the cows' problem solving, flight distance and cow- to human interaction for example how close could the human get, would it let the human touch it and for how long would it be touched. The conclusion was that cattle with low hair whorls were more relaxed and showed more interest in unfamiliar humans than cattle with middle whorls (Randle, 1998).

Other results from measuring hair whorls and behavior can be seen in the study of 1500 cattle, where they found that cows with hair whorl patterns above the eye were more agitated during restraint. The behavior was also categorized in four groups based on temperament in a squeeze chute (crush). The ratings were: 1. calm, no movement; 2. restless, shifting weight; 3. head throwing, squirming and occasionally shaking the squeeze chute; 4. violently and continually shaking the squeeze chute. The result of this study showed that cattle with a round hair whorl located above the eyes were significantly more agitated while they were restrained compared to cattle with a hair whorl located either between the eyes or below the eyes. Animals with hair whorls located below the eyes were rated calmer (Grandin et al., 1995).

## **1.2 Hair whorls in dogs**

Tomkins and McGreevy (2010 a) did research on locating hair whorls in dogs, and they found hair whorls in ten different places on the animals. The places they investigated were the head (cephalic), neck (cervical lateral and ventral), chest and thoracic axillary, brachial axillary, shoulders, elbow, abdomen and on the caudal thighs (ischiatric whorls). The aim of their first published article; "Hair whorls in the Dog (*Canis familiaris*) 1. Distribution", was to create a tool for further research for studying the relationship between hair whorls and behavior. It was a study of 120 dogs (covering different breeds) where hair whorls was categorized as either tufted or simple, and the dogs fur was categorized as either short or long. They also categorized the coat thickness as fine, medium or dense. The presence and position of the whorls were often associated with the length and thickness of the fur, and the majority of whorls were classified as simple and not tufted. Differences in the numbers of hair whorls between breeds was also detected (Tomkins & McGreevy, 2010 a).

In their second publication; "Hair whorls in the dog (*Canis familiaris*) Part 2: Asymmetries", they extended the research on the previous located hair whorls. They categorized the

directions as either clockwise or counterclockwise, and measured which was the most typical direction. Half of the 120 dogs covered in the study were shelter dogs where the other half was non-shelter dogs. The results from this study showed that chest hair whorl had a counterclockwise outcome in 91.21 % of the cases. The most common direction of hair whorls located on the right shoulder was counterclockwise, whereas counterclockwise hair whorls on the left shoulder only appeared in 33.33 % of the cases. The same findings were made on the brachial axillary, where the hair whorls on the dogs left side were clockwise, while hair whorls placed on the right side were counterclockwise in all cases. However there was a difference found between the shelter dogs and non-shelter dogs, regarding the hair whorls direction on the right elbow. Non-shelter dogs had a significant higher percent of counterclockwise whorl direction than the dogs from the shelter (95.24 % vs. 76.79 %) (Tomkins & McGreevy, 2010 b).

Furthermore, the same research group investigated whether hair whorls could be used as an indicator of success in guide dog training. The hair whorls were measured together with motor and sensory laterality (if the dog preferred to use the right or left paw in a *Kong* test, or if it was a better jumper when covering the left or the right eye). They measured the distance between hair whorls on the chest and on the thoracic area. All measurements were made independently, and for the hair whorls they found that for every 1 % increase in distance between the thoracic inlet and the hair whorl on the chest it was 15 % more unlikely that the dog would be a successful guide dog. They also found that the direction of the twisted vortex breast whorl was associated with success; counterclockwise whorls gave a success rate of 61 %, but were reduced to 29 % with a clockwise whorl. Counterclockwise hair whorls found on the right elbow had a tendency of relation to success (Tomkins et al., 2012).

### **1.3 Heritability and brain function**

Several studies have been performed regarding hair whorls on humans, often investigating the possible relationship between genes, hair whorls and behavioral traits. Some of the studies try to intend a link between hair whorls and homosexuality without finding any interesting relationship (Rahman et al., 2009; Schwartz et al., 2010). Other studies have been looking at hair whorl patterns in schizophrenic and bipolar patients (Reza & Soroush, 2008) or other mental subnormality, like outcome of hair whorl in people with Down syndrome, with the conclusion that it needs more investigation (David & Osborne, 1976).

It is more interesting that the correlation between hair whorls and left handedness/laterality in horses (Murphy & Arkins, 2008) has also been found in humans. Approximately 50 % of people that were left handed had counterclockwise hair whorls, compared to the remaining population where it was normal to have clockwise whorls (only 8,4 % being counterclockwise). This study also proposed a genetic model that a single gene with two alleles controls both handedness and hair whorl orientation. The dominant allele predisposes right-handedness and a clockwise hair spiral (Klar, 2003).

According to heritability of hair whorls placement and direction, it was found in a study containing 362 Konik horses including parents and grandparents, that there was a significant indication that hair whorls position is highly heritable. The position of the hair whorls were classified in five groups; above the top eye line, on the top of the eye line, between the top and the bottom eye line, on the bottom eye line, and below the bottom eye line. The study concluded that placement of hair whorls are highly heritable (Górecka et al., 2006).

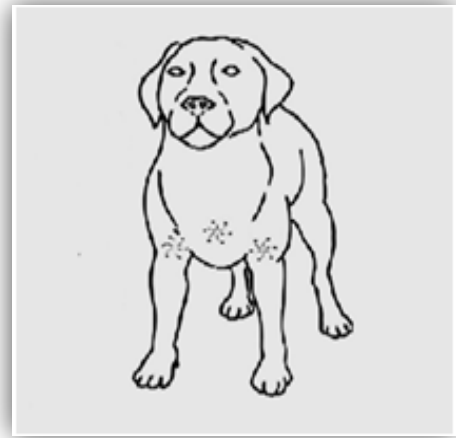
A link between hair whorls and the development of the brain related to the nerve system has also been found. This was discovered through a study in the development of hair whorls in the fetus, where the patterning of follicles starts 10-18 weeks after fertilization/start of the pregnancy (Smith & Gong, 1974).

#### **1.4 Aim of the research**

Since there are documented links between hair whorls and behavior traits in horses and cattle (Grandin et al., 1995; Randle, 1998; Lanier et al., 2001; Górecka et al., 2007; Olmos & Turner, 2008), and there are few studies that have studied the connection between dogs' behavior and hair whorls (Tomkins & McGreevy, 2010 b, Tomkins et al., 2012), it would be interesting to do further investigation on hair whorls and behavior in dogs. Therefore the aim of this thesis is to investigate possible relationships between specific hair whorls in dogs and their behavior.

Firstly the hair whorl direction would be examined, along with numbers of hair whorls with respect to different types of behavior. Tomkins and McGreevy (2010 a) found hair whorls on ten different places on the dogs' body, and they investigated the relationship between the different hair whorls (presence, direction and position) and behavior (successful guide dog training) (Tomkins et al., 2012). The main focus for this study will be the hair whorls on the

dogs' chest (Figure 1). This spot is interesting for further research because of the findings of significant connection between guide dogs success and their chest hair whorl direction (Tomkins et al., 2012). This study will also investigate the upper part of the front legs (shoulders) (Figure 1). No previous research studies have stated a correlation between hair whorls on the front legs according to different types of behavior. This study predicts that the front legs would be an easier place for the owner to search for hair whorls. It would also be easier to describe to the owner what they should do in the questionnaires. Since this way of researching hair whorls is a new proven measurement where the owner itself has to detect and describe the hair whorls, it is important to make it clear and understandable.



**Figure 1:** The three positions on the dogs' body for owners to calculate the hair whorls; on the chest and on the upper part of the front legs (shoulders) (Tomkins and McGreevy, 2010 b).

The behavior we want to investigate further is reactivity behavior. Reactivity can be seen as emotionality, and indicates a heightened state of arousal (McCall et al., 2005). Within species there can be some regulation to an individual variation, but it is confirmed that the individual behavior is the result of an interaction between genes and environment. That is also why dogs can act differently in various situations, and have different reactions in contact with humans (Miklósi, 2007). In the article by Boissy (1995), "Fear and fearfulness in animals", he refers to articles that clarify different personalities in animals as different reactions to positive or negative stimuli and environmental coping. This can differ between breed, sex or individuals, and is correlated with the neuroendocrine system that can give different responses to stress reactions (Boissy, 1995).

So if we correlate hair whorls with reactivity we can see whether there are any possible links between some behavioral traits and the characteristics of hair whorls in dogs. Because the whorls are not influenced by culture but correlated with brain development and function (Smith & Gong, 1974), the results can help to better understand the processes influencing behavior. This can lead to developing a tool for future dog owners in predicting their characteristics based on hair whorls. Dogs are very popular pets, and it could be useful to find more tools for the owners to use when choosing their pets or to better understand their pets' behavior. This is also why I wanted to use personally owned pets of different breeds and base

my questions on everyday situations. Since there are already studies conducting the relationship between reactive behavior and the placement, numbers and direction of hair whorls with the purpose of making a tool for external measurement of behavior (Grandin et al., 1995; Randle, 1998; Lanier et al., 2001; Górecka et al., 2007; Olmos & Turner, 2008), it would be interesting to see if it could be the same findings in dogs.

There are several ways to calculate behavior reactivity in animals, including studying the animals in a specific environment or situation with direct observation (Grandin et al., 1995; Randle, 1998; Lanier et al., 2001; McCall et al., 2006; Broucek et al., 2007; Górecka et al., 2007; Olmos & Turner, 2008), or measuring psychological signs of reactive behavior through a stress response like heart rate or cortisol level (Górecka et al., 2007), or through a questionnaire filled out by the pets' owners (Sheppard & Mills, 2002). Another method that has been used previously, and will be performed for this thesis is a questionnaire to the dog owner covering questions about the animals' behavior. This will be in addition to performing observation tests in order to assess the reliability of the questionnaire. Then the owners view of the dogs' behavior can be compared with an objective observer's opinion through a direct observation test (Momozawa et al., 2003).

Based on the previously mentioned studies of hair whorls and reactive behavior the hypothesis and aim of this study was created, with the target of finding a new tool to calculate dogs' behavior. The main hypothesis is: There is a correlation between hair whorls direction and numbers according to different types of behavior in dogs.

## **2. Materials and methods**

A quantitative research method was used with a questionnaire to collect data to determine the number and direction of hair whorls and reactivity behavior assessed by dog owners. A direct observational study was also conducted, where we recorded observations of behavioral reactivity at different levels in privately held dogs. The direct observation test was conducted in Hungary at MTA-ELTE Comparative Ethological Research group at Eötvös University, Budapest. The aim of the observation study was to monitor the owners' observation and opinion of their dogs' behavior and compare it to an independent observer. This measure was based on experience from a pilot study previously performed in Norway.

### **2.1 Questionnaires**

Because of the interest to use the same study in horses, there have been attempts of finding a method to measure reactivity in a comparable way for both horses and dogs. So the aim was to develop a questionnaire for dogs that later on could be used with little or no modifications on horses. The questionnaire was first made in English as a draft, for then being translated and distributed in two versions; on Norwegian version and one Hungarian version (Attachment 1 and 2). The questionnaires were distributed through Questback to create an online based tool.

The first part of the questionnaire contains questions regarding the owner and the dog, the household and the animals' daily activities habits, for example how often is the dog outside being walked or trained. The second part contains two sub-questionnaires to evaluate the dogs' behavior. During the development of this part we used the dog questionnaire published in Sheppard and Mills (2002); "The Development of a Psychometric Scale for the Evaluation of the Emotional Predispositions" and a horse questionnaire published in Momozawa et al. (2003) "Assessment of equine temperament by a questionnaire survey to caretakers and evaluation of its reliability by simultaneous behavior test.", where the horse questionnaire was transformed in order to fit for dogs.

The third part of the questionnaire covers the characteristics of hair whorls, as the owners locate and register these. Pictures from Tomkins and McGreevy (2010 b) "Hair Whorls In the dog (*Canis familiaris*), part 2: Asymmetries" were used in the questionnaire as guidance for

the owners. The owner had to report the numbers of hair whorls found on the chest, left leg and right leg and if the hair whorls went clockwise, counterclockwise, or if they show other patterns.

### ***2.1.1 Scoring response***

The behavior questionnaire part one was originally made as a 3-point Likert scale (Momozawa et al., 2003) but was changed from a 3- to a 5-point Likert scale to make it fit better with the behavior questionnaire part two which is a 5-point Likert scale. Both of the behavior questionnaires were submitted with the same method used in the study of Sheppard and Mills (2002). The answers in the 5- point Likert scale were used with 5 for “strongly agree” and 1 for “strongly disagree”. In between there were “partly agree, partly disagree” and at the mid-point a “not applicable” option was also provided

The questionnaire part two was developed as either “positive” or “negative” activation that would give the final score of the dogs’ behavior. Positive scale score indicates a persistent, excitability and energetic behavior, and negative scale score indicates a more fearful, less relaxed and anxious behavior. Some of the behavior questions were reversed to ensure the participants did not answer in the same pattern, but had to read the text properly (Sheppard and Mills, 2002). This was developed from the prediction that people will answer in a response set (DeVellis, 1991). The calculated behavior in the behavior questionnaires part one is similar to the negative scale score in part two (Momozawa et al., 2003). They are categorized in the results and named Positive and Negative for behavior question part two, and behavior questionnaire one is named Q1.

There was one question missing in the behavior questionnaire part two in the Hungarian version, therefore all the questions were submitted and divided on how many questions were answered in total for both parts of the behavior questionnaires.

When investigating the hair whorls direction, the main focus was to look at clockwise and counterclockwise direction, so the category “other” and “did not find any” were excluded from the analyses comparing hair whorls to the behavior scale scores.

The age of the dog was rounded to whole years, and the sex was classified as 1 for female and 2 for male. To categorize the dogs breed, the FCI categories (Fédération Cynologique Internationale, 2013) were used (Attachment 5).

### **2.1.2 Participants for the questionnaires**

The questionnaires were first distributed to private dog owners in Norway. For comparison and a better supplement of answers, the same questionnaires were translated and distributed in Hungary. The aim for the questionnaires was to get a good representation of different owners and different dog breeds. Social networking media was used to distribute the questionnaires in Norway and Hungary. This included emails to different breeders, dog schools and kennel clubs and a page on Facebook. In Hungary the department's private database over dog owners was also used.

### **2.2 Behavior observation test, "Pilot study"**

The pilot study for the observation test was mainly aimed to prepare and learn how to do observations on dogs' behavior, and was therefore not coded. The second aim was to develop and test the protocol for the observation test (Attachment 4).

As participants, six dogs of different breeds were used. The dogs were privately owned, by people that were familiar with the test and the observer.

### **2.3 Behavior observation test**

As the aim of the observation test was to control the validity of the questionnaire, it was conducted to validate the score on behavior questions part one and two. It was divided into six different parts, outlined in the protocol (Attachment 4). The *Choice test* was inspired by another experiment that was published by Marshall-Pescini et al. (2011). But the other tests were developed specifically for this master thesis to be in line with the questions in the questionnaires, and are not from published experiments.

The aim of the first test *Exploration in the room* was to see the dogs' behavior in a new environment. Test two *Greeting by a stranger* was made to show the dogs' behavior when a stranger was approaching the room. Part three *Hug by owner* was to see how the dog reacted to being held in a strict hug for ten seconds by its owner. The aim of the fourth part *Paying attention* was to see how much the dog listens to the observers emotion in trying to get the dog interested in an object that is not actually of the dogs interest. The *Novel object* test was number five of the tests, and the aim was to see the dogs' reaction to a toy puppy that was



jumping and barking. The final test was the *Choice test* and was to see if the owner can affect the dogs' choice by pretending that a plate with no treats is better than the plate with one treat. The second part is to see how easy it is to get the dog return to the owner. This test is based on the research by Marshall-Pescini et al. (2011) to see if the dogs are misled more by owners than a strangers in a food choice test (Marshall-Pescini et al., 2011)

### ***2.3.1 Participants for the behavior observation test***

For the observation test we used 24 privately held Rövidszőrű Magyar Vizsla (Hungarian Short-haired Pointing Dogs, Hungarian Vizsla) from the area around Budapest in Hungary, collected through a local Hungarian Vizsla club and from Comparative Ethological Research group, Eötvös University, departments' database for private held dog owners.

## **2.4 Statistical analysis**

There were several different tools used to analyze the data from the questionnaires and the observation test, but all of the statistics were conducted in SPSS for Windows (Statistical Package for the Social Science).

### ***2.4.1 Questionnaires***

The results from the questionnaires were transferred from Questback into Excel and then analyzed in SPSS. The data material was analyzed in four steps. Step one was to detect possible differences between the countries, in order to establish whether the results would needed to be analyzed separately. Step two was to find out if the answers on the behavior part matched each other, so possible correlations between the score on Negative, Positive and Q1 were analyzed. Step three was the main part; to see if there was a correlation between the number of hair whorls, direction of hair whorls growth and reactivity. Step four was to analyze any other possible variables that could have an effect on the Negative, Positive and Q1 score.

#### **Step one: Countries**

To see if there were any differences between male and female dogs between the two countries, a crosstab Pearson Chi-Square test was run. To assess the impact of the dogs' age across the country category a two-independent-samples, Mann-Whitney U test was used. The same test was used for the distribution of Negative, Positive and Q1 compared between the countries, and for the numbers of hair whorls. For the direction of the hair whorls a crosstab

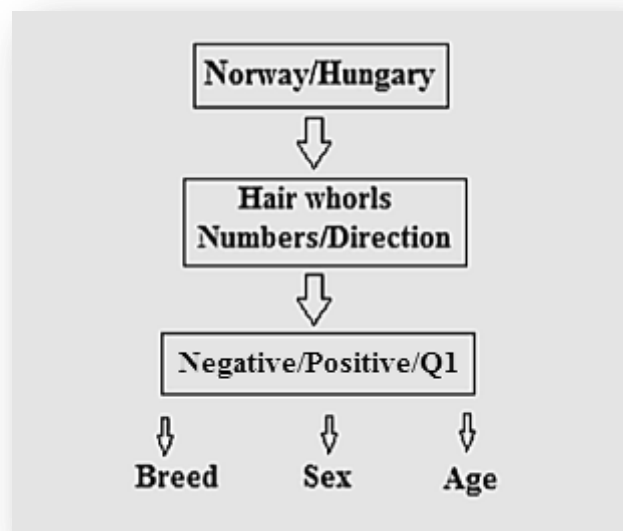
Pearson Chi-Square test was run. To find the percentage of numbers of hair whorls, and how many grow in the different directions, a descriptive statistic frequency analysis was used. The same analysis was used to find the percentage of males and females that were represented, and how many dogs there were from each breed category.

### **Step two: Correlation between the different scales**

The second step was to see if there was a correlation between the answers on the Negative, Positive and Q1 scale scores, and for that a bivariate correlation, Spearman's-rho test was run. The interest was the moderate (0.3-0.4) and high (>0.5) correlation coefficient.

### **Step three: Hair whorls and the behavior questionnaires part one and two**

If a difference between the countries was detected in step one, the third step would be performed separately for both countries. This was done in order to test the relationship between the score on the behavior part and the hair whorls numbers and direction (Figure 2).



**Figure 2:** Step three and four; Step three: Separated analyzes for the countries for numbers and direction of hair whorls compared to the Negative, Positive and Q1scale score. Step four: Age, sex and breed to the Negative, Positive and Q1scale score.

To find any links between the direction of hair whorls and the score on the behavior questions a two-independent-sample, Mann-Whitney U test was used. To find a correlation between the hair whorls numbers and the score on the behavior question a bivariate, Spearman's-rho correlation analysis was used.

#### **Step four: Other causal variables that can affect the score on the behavior questions part one and two**

To see if there were any differences between male and female dogs on the behavior questions a two-independent-sample, Mann-Whitney U test was used. An independent sample, Kruskal- Wallis test was used to test possible differences between dogs from the different categories of breeds and the score on the behavior questions. For age and the score on the behavior questions a bivariate correlation, Spearman's-rho test was run with the interest in the moderate (0.3–0.4) and high (>0.5) correlation coefficient (Figure 2).

#### **2.4.2 Behavior observation test**

The videos from the observation test were analyzed in Solomon Coder after a detailed planned coding system (Attachment 4, Ethogram: Coding Behavior).

There were 41 behavioral variables coded in Solomon Coder, but for further analysis 23 variables was chosen to be correlate to the behavior questions in the questionnaires (the 23 variables represented in the Ethogram). These were selected because they showed variance in the population, and they were not too dependent from each other.

##### *Part 1: Exploration in the room*

Correlated to behavior questions part one (Q1) and behavior questions part two (Q2):

Q1-1; “Curious about new places”, Q1-2; “Adaption time to unfamiliar places”, Q2-5; “Your dog shows little interest in its surroundings”, Q2-11; “Your dog is full of energy”, Q2-13; “Your dog usually appears relaxed”, Q2-14; “Your dog adapts quickly to changes in its environment (e.g. being cared for by different people, moving house or a family member leaving home)”, Q2-16: “Your dog is lazy” and Q2-19; “Your dog appears calm in unfamiliar environments”.

Other variables that were correlated to this test were: Q1-5; “Get into the car” and Q2-12; “Your dog is frightened by noises from the television or radio”.

##### *Part 2: Greeting by a stranger*

Correlated to: Q1-9 (Q1-10 in the Norwegian questionnaires); “Threatening toward unknown persons”, Q1-2; “Adaption time to unfamiliar places”, Q2-5; “Your dog shows little interest in its surroundings” Q2-7; “Your dog is easily excited”, Q2-13; “Your dog usually appears

relaxed”, Q2-16: “Your dog is lazy”, Q2-17; “Your dog requires a great deal of encouragement to take part in energetic activities (e.g. running, vigorous games)”.

*Part 3: Hug by owner*

Correlated to: Q1-4; “When it’s being handled (brushed, washed)”, and Q2-13; “Your dog usually appears relaxed”. Other variables that were tested were Q1-5; “Get into the car”, Q2-9; “Your dog tries to escape from your garden”.

*Part 4: Paying attention*

Correlated to: Q1-1; “Curious about new places”, Q2-4; “Your dog is very persistent in its efforts to get you to play”, Q2-5; “Your dog shows little interest in its surroundings”, Q2-7; “Your dog is easily excited”, Q2-17; “Your dog requires a great deal of encouragement to take part in energetic activities (e.g. running, vigorous games).

*Part 5: Novel object*

Correlated to: Q1-1; “Curious about new places”, Q1-2; “Adaption time to unfamiliar places”, Q2-3;” Your dog is easily startled by noises and/or movements”.

Because of the movement and the loud sound of the toy puppy it can also be correlated to: Q2-12; “Your dog is frightened by noises from the television or radio” and Q2-15; “Your dog appears afraid of the vacuum cleaner or any other familiar household appliance”.

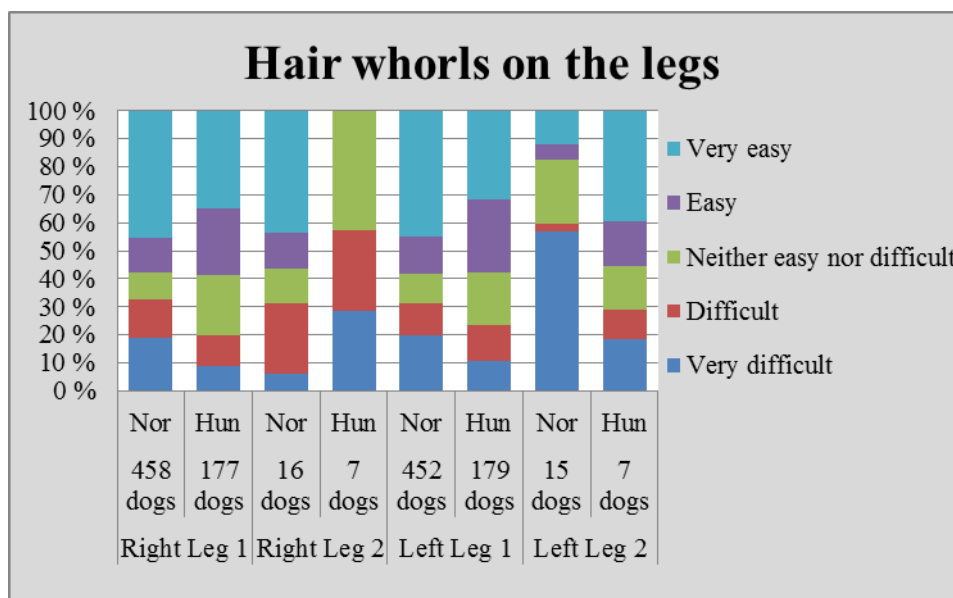
*Part 6: Choice test*

Correlated to: Q1-1; “Curious about new places”, Q1-2; “Adaption time to unfamiliar places”, Q2-3;” Your dog is easily startled by noises and/or movements”, Q2-5; “Your dog shows little interest in its surroundings”, Q2-7; “Your dog is easily exited”, Q2-11; “Your dog is full of energy”, Q2-13;”Your dog usually appears relaxed”, Q2-16: “Your dog is lazy”, Q2-17; Your dog requires a great deal of encouragement to take part in energetic activities (e.g. running, vigorous games)”. Q2-18; “Your dog is persists in being naughty despite being told off for the behavior”, Q2-19 “Your dog appears calm in unfamiliar places”.

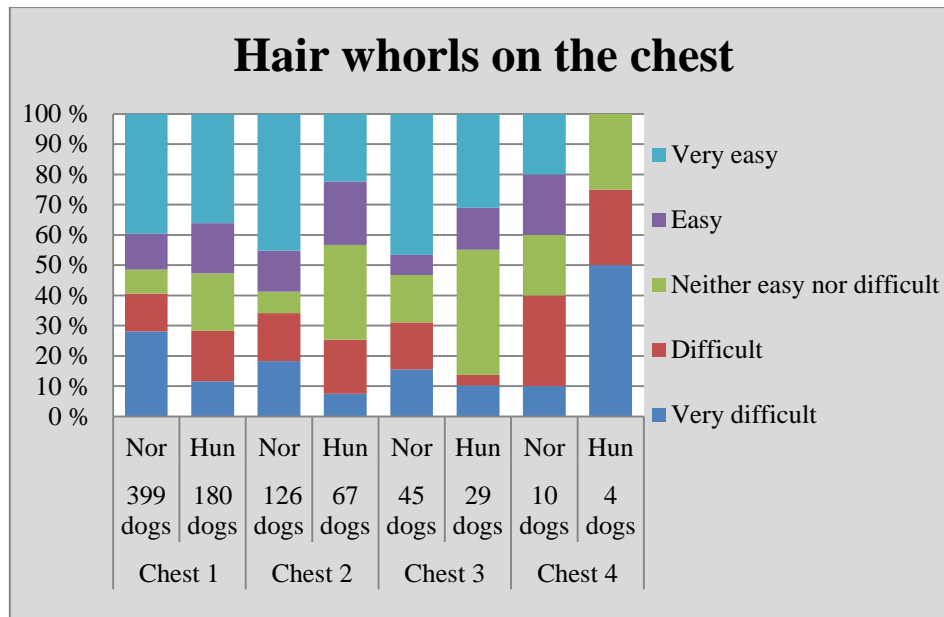
### 3. Results

Overall there were 915 answers in the Norwegian questionnaire and 194 answers in the Hungarian questionnaire. After a thorough selection, 270 Norwegian and 141 Hungarian answers, a total number of 411, remained for analysis.

Two versions of the Norwegian questionnaire were published. The first was completed for 378 dogs. After a general scan of the answers this version was stopped, as some of the questions regarding the numbers and directions of hair whorls were not answered consistently and perhaps not asked in a proper way. Data from this version of the Norwegian questionnaire has not been used in this thesis. After this, we completed the questionnaire with more questions with the aim to make it clearer for owners and published this new version. Questionnaires, where the answer to the question “How many hair whorls can you find” at specific places and the number calculated from the questions about direction of the hair whorls, did not coincide and were also excluded from the analysis. Additionally if the owner reported to the question “How difficult was it to find the hair whorls” as being difficult or very difficult (Figures 3 and 4) the dog was excluded from the analysis as the accuracy of the owners’ observation was in doubt.



**Figure 3:** Percentage of the different categories on how easy or difficult it was to find the first and second hair whorl on the right leg and left leg in the Norwegian sample from the second version of the questionnaire and the Hungarian sample of the questionnaire. The number of dogs is represented under the letters of the country; Norwegian (Nor) and Hungarian (Hun).



**Figure 4:** Percentage of the different categories on how easy or difficult it was to find the first, second, third and fourth hair whorl on the chest in the Norwegian sample from the second version of the questionnaire and the Hungarian sample of the questionnaire. The number of dogs is represented after the letters of the countries Norwegian (Nor) and Hungarian (Hun).

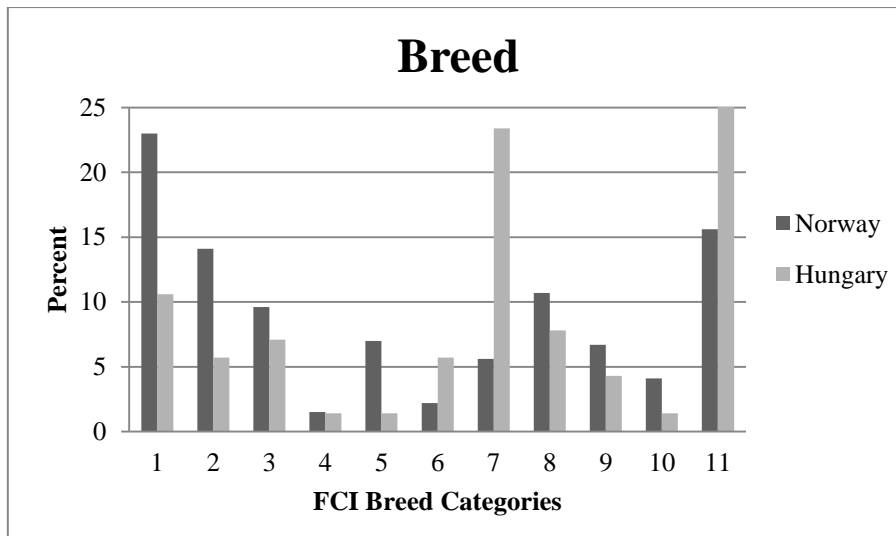
For the behavior test 22 out of 24 dogs were used for further analysis, where two of them were excluded due to recording errors.

### 3.1 Countries

Because of the expected, and found, differences between the countries the statistical comparisons were mainly done with the countries separated. The results from comparing the countries will be presented first. And then the comparisons between the hair whorls and the score on the behavior questionnaire 1 and 2 will be presented separately for the two countries.

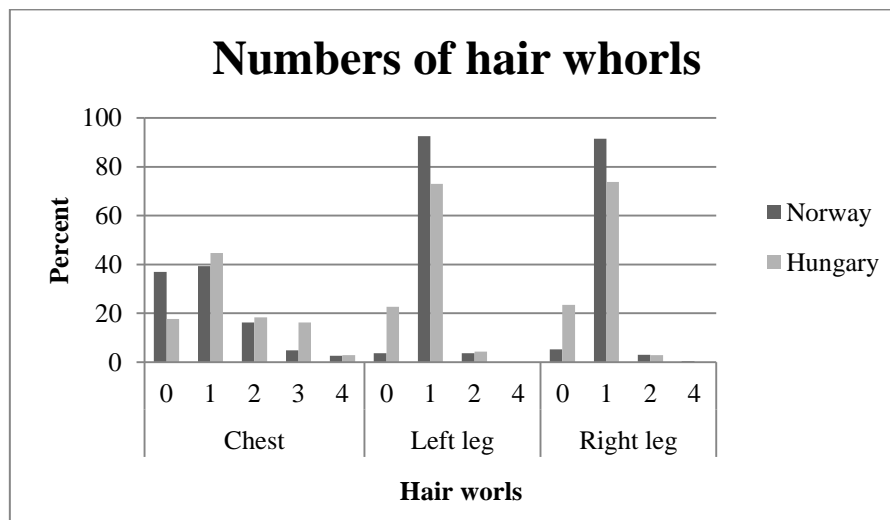
#### 3.1.1 Sex, age and breed compared between the countries

There was a similar ratio of males and females from both countries (Chi 2 = 1.314, df = 1, P = 0.252. N Male 57.8 %, H Male 41.8 %, N Female 52.2 %, H Female 58.2 % ). The same result was found for the dog's age (P = 0.824), but there was a difference in the breed categories between the countries (Figure 5, Chi 2 = 96.915 df = 10, P < 0.001).



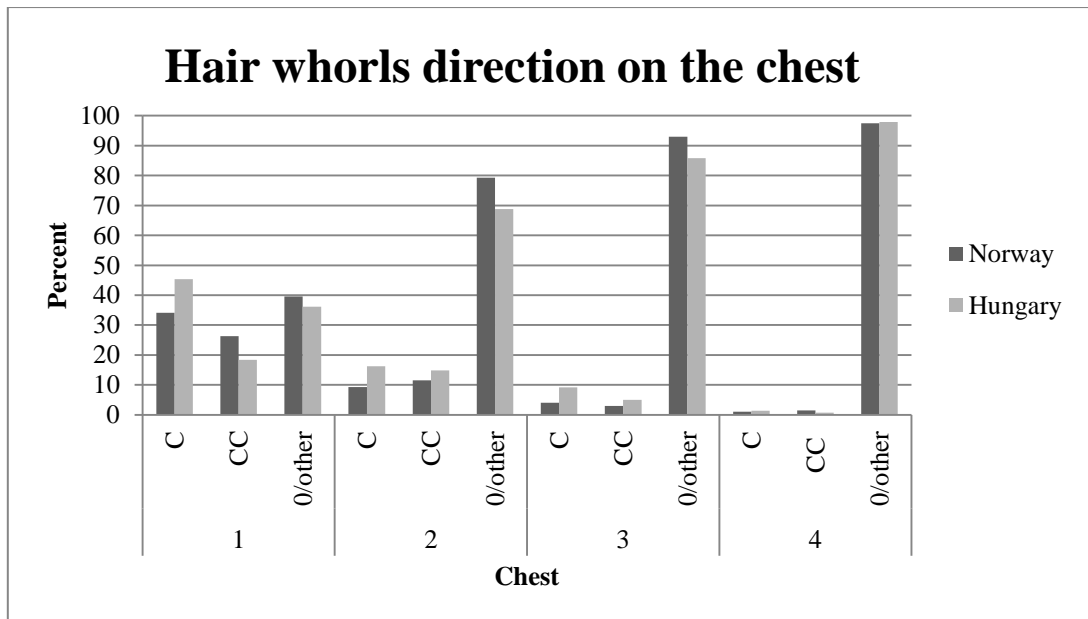
**Figure 5:** Percentage of dogs from the definite FCI breed categories (Attachment 5) in the Norwegian and Hungarian sample.

### 3.1.2 Hair whorls and countries



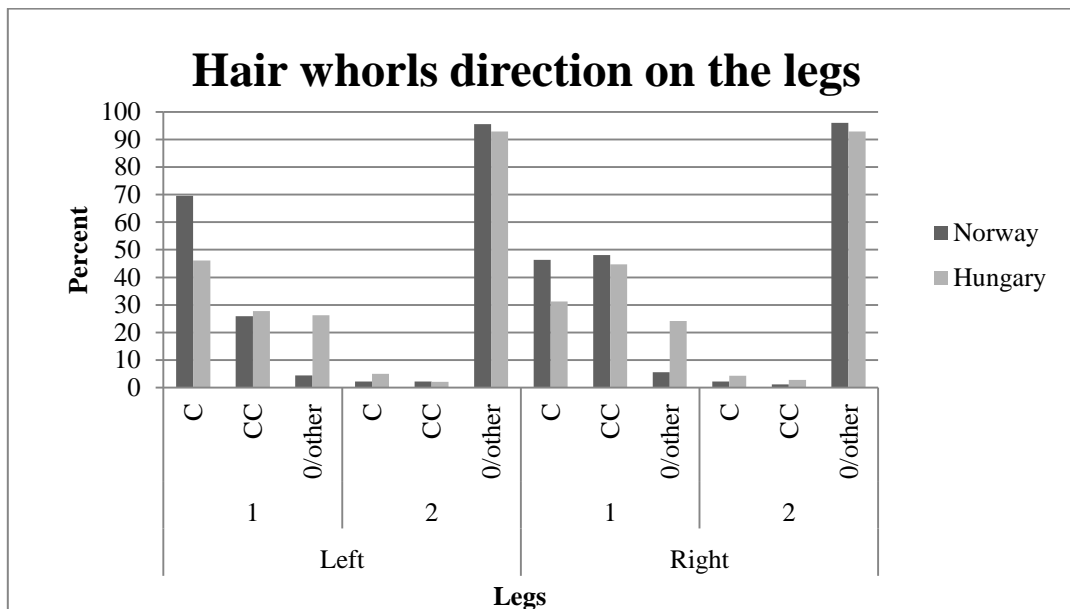
**Figure 6:** Percentage of dogs with definite numbers of hair whorls found by the owners on the chest, left leg and right leg in the Norwegian and Hungarian sample.

Figure 6 shows that the distribution of how many hair whorls the dog has on the chest ( $P < 0.001$ ), on the right leg ( $P < 0.001$ ), and on the left leg ( $P < 0.001$ ) is not the same across the countries. However, owners are more likely to find one hair whorl on the chest for both countries.



**Figure 7:** Percentage of dogs with different direction on the first, second, third and fourth hair whorl on the chest in the Norwegian and Hungarian sample (C = clockwise, CC = counter-clockwise).

Figure 7 shows that there is a similarity between the countries and the hair whorls direction on the chest (Chest 1: Chi<sup>2</sup> = 5.836, df = 2, P = 0.054. Chest 2: Chi<sup>2</sup> = 6.138, df = 2, P = 0.046. Chest 3: Chi<sup>2</sup> = 5.740, df = 2, P = 0.057. Chest 4: Chi<sup>2</sup> = 0.528, df = 2, P = 0.768). Both the Hungarian and the Norwegian answers show that there are more people who find clockwise hair whorls on the dogs' chest than counterclockwise.



**Figure 8:** Percentage of dogs with different direction on the first and second hair whorl on the left and right leg in the Norwegian and Hungarian sample (C=clockwise, CC=counterclockwise).



Figure 8 shows that there is a difference in the hair whorls' direction between the countries (Left 1: Chi 2 = 43.180, df = 2, P < 0.001, Left 2: Chi 2 = 2.275, df = 2, P = 0.321, Right 1: Chi 2 = 28.193, df = 2, P < 0.001, Right 2: Chi 2 = 3.068, df = 2, P = 0.216). Owners in both countries found it more likely that the left leg hair whorl was going clockwise, and the right leg hair whorl was going counterclockwise.

### 3.1.3. Negative, Positive and Q1 compared between countries

The distribution of Negative (P = 0.030) and Q1 (P < 0.001) was different between the countries, but the distribution of Positive (P = 0.662) was equal.

## 3.2 Correlation between Negative, Positive and Q1 scale scores

**Table 3.2.1**

Correlation between Negative, Positive and Q1 scale score in the Norwegian and Hungarian sample

<b>Correlation</b>		<b>Norway</b>			<b>Hungary</b>		
Spearman's rho		<b>Negative</b>	<b>Positive</b>	<b>Q 1</b>	<b>Negative</b>	<b>Positive</b>	<b>Q 1</b>
<b>Negative</b>	rho	1	<b>0.187</b>	<b>0.548</b>	1	<b>0.221</b>	<b>0.340</b>
	P	.	<b>0.003</b>	<b>&lt; 0.001</b>	.	<b>0.022</b>	<b>&lt; 0.001</b>
<b>Positiv</b>	rho	<b>0.187</b>	1	<b>0.346</b>	<b>0.221</b>	1	<b>0.552</b>
	P	<b>0.003</b>	.	<b>&lt; 0.001</b>	<b>0.022</b>	.	<b>&lt; 0.001</b>
<b>Q 1</b>	rho	<b>0.548</b>	<b>0.346</b>	1	<b>0.340</b>	<b>0,552</b>	1
	P	<b>&lt; 0.001</b>	<b>&lt; 0.001</b>	.	<b>&lt; 0.001</b>	<b>&lt; 0.001</b>	.

N=225

Table 3.2.1 shows that there was a correlation between the answer on Q1 with the Positive and Negative scale score both in the Norwegian and Hungarian sample. Also the Positive and Negative scale scores were weakly correlated in both samples.

### 3.3 Breed, sex and age on questionnaire scores

The distribution of Negative, Positive and Q1 is the same across the different breed categories in the Norwegian sample (Negative: P = 0.084, Positive: P = 0.431, Q1: P = 0.394). However, the Hungarian sample shows that Positive and Negative results were the same across the categories of breed, but there was a significant effect of breed category on the Negative scale score (Negative: P = 0.025, Positive: P = 0.453, Q1: P = 0.293).

The results showed that the distribution of Negative, Positive and Q1 was the same for both male and female dogs in both countries (N Negative: P = 0.147, N Positive: P = 0.817, N Q1: P = 0.174, H Negative: P = 0.301, H Positive: P = 0,051, H Q1: P = 0.251).

**Table 3.3.1**

Age and Negative, Positive and Q1 for the Norwegian and Hungarian sample

Correlation			Norway	Hungary
Spearman's rho				
Dogs age in years	Negativ	rho	-0.013	0.023
		P	0.835	0.790
	Positiv	rho	<b>-0.197</b>	<b>-0.315</b>
		P	<b>0.001</b>	<b>&lt; 0.001</b>
	Q 1	rho	-0.044	<b>-0.207</b>
		P	0.467	<b>0.014</b>

Norway N= 270, Hungary N= 141

In table 3.3.1 we can see a weak negative correlation between age and the score on the Positive scale score in the Norwegian sample, but there was no correlation between age and the Negative or Q1 scale scores. There is a medium correlation between age and the score on the Q1 scale score and between age and Positive scale score in the Hungarian sample, but there was no relationship between age of the dog and Negative scale score.

### 3.4 Relationship between the score on the behavior questions part one and two and the behavior observation test

The results for the relationship between the questionnaires and the behavior observation test are represented under the six different test parts (Attachment 3 and 4).

#### *Part 1: Exploration in the room*

The only significant correlation in the *Exploration in the room* test was between the dogs who appeared calm in unfamiliar environments (Q2-19) was looking less frequently at the owner ( $r_s = -0.470$ , P = 0.042, N = 19).

Dogs who were resistant when getting into the car (Q1-5) according to the opinion of their owners were looking more frequently at their owner in the exploration test ( $r_s = 0,482$ , P = 0,037, N = 19) (Attachment 6, Table 3.4.1).

### *Part 2: Greeting by a stranger*

There was no correlation between the behavior variables for the dogs meeting with a stranger, and the score on the questions in the questionnaires (Attachment 6, Table 3.4.2).

### *Part 3: Hug by owner*

There was no correlation between behavior variables for the acceptance of being hugged by the owner, and the score on the questions in the questionnaires (Attachment 6, Table 3.4.3).

### *Part 4: Paying attention*

Dogs who showed little interest in their surroundings (Q2-5) looked more to other places (not the owner, experimenter, or the box) ( $r_s = 0.441$ ,  $P = 0.045$ ,  $N = 21$ ), and dogs that were very persistent in their efforts to get the owner to play (Q2-4) looked more frequently at the experimenter ( $r_s = 0.802$ ,  $P < 0.001$ ,  $N = 21$ ) and changed their focus of attention (direction of looking) more frequently ( $r_s = 0.484$ ,  $P = 0.026$ ,  $N = 21$ ). And the ones that were easily excited (Q2-7) look more frequently at the experimenter ( $r_s = 0.467$ ,  $P = 0.033$ ,  $N = 21$ ) (Attachment 6, Table 3.4.4).

### *Part 5: Novel object*

The one significant correlation on the *Novel Object* test was that dogs who appeared afraid of the vacuum cleaner or any other familiar household appliance (Q2-15) moved more frequently towards the toy puppy ( $r_s = 0.480$ ,  $P = 0.038$ ,  $N = 19$ ) (Attachment 6, Table 3.4.5).

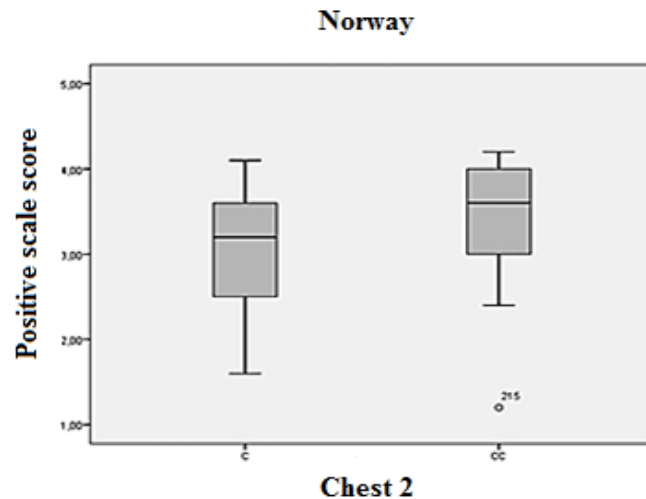
### *Part 6: Choice test*

The dogs that showed little interest in their surroundings (Q2-5) used more time to approach the food when handled by owner ( $r_s = 0.475$ ,  $P = 0.040$ ,  $N = 19$ ) (Attachment 6, Table 3.4.6).

## **3.5. Score on behavior questions part one and two compared with hair whorls numbers and direction**

### ***3.5.1 Negative, Positive and Q 1 compared with hair whorls direction***

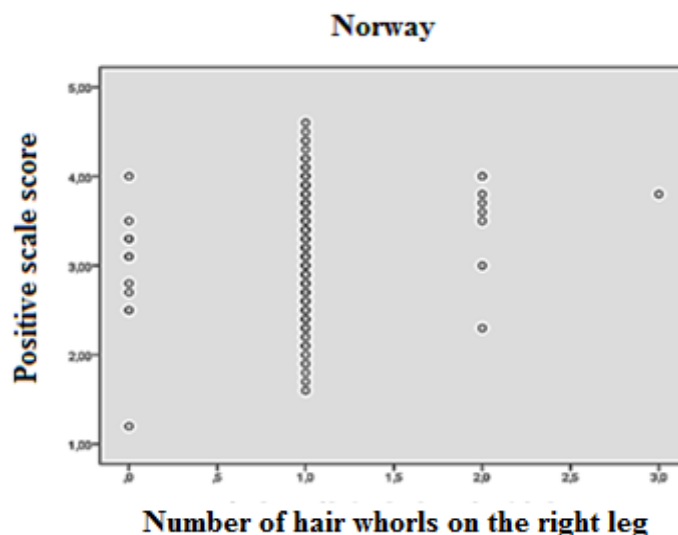
The only significant difference between dogs with clockwise and counterclockwise hair whorls at specific places regarding Negative, Positive and Q1 scale score, was the relationship between the Positive scale score and the second hair whorl on the chest in the Norwegian sample ( $P = 0.019$ ) (Attachment 7, Table 3.5.1.1). Dogs with counterclockwise hair whorl direction on the chest were rated higher on the Positive scale by their owners (Figure 9).



**Figure 9:** Positive scale scores and dogs with clockwise or counterclockwise direction on the second hair whorl on the chest in the Norwegian sample.

### 3.5.2 Negative, Positive and Q 1 compared with numbers of hair whorls

There was not any significant correlation between the numbers of hair whorls on the chest and behavior (Attachment 7, Table 3.5.2.1) nor between the left leg and the behavior in the Norwegian sample, but the numbers of hair whorls on the right leg showed a weak correlation with the Positive scale score ( $r_s = 0,138$ ,  $P = 0.023$   $N = 270$ ) (Figure 10) (Attachment 7, Table 3.5.2.2). There were no significant correlations between the numbers of hair whorl on the chest, left leg and the right leg in the Hungarian sample (Attachment 7, Table 3.5.2.2).



**Figure 10:** Positive scale score and the number of hair whorls on the right leg in the Norwegian sample.

## 4. Discussion

The significant findings in this study regarding the relationship between hair whorls and behavior were connected to numbers of hair whorls on the right leg and the second counterclockwise chest hair whorl in the Norwegian sample. Both of them were related to the Positive scale score of emotional reactivity indicating a positive activation of behavioral reactivity, which manifests in non-fear-related situations (Sheppard & Mills, 2002). With expectation of finding a relationship between hair whorls and behavior, these results can possibly indicate a relationship between persistence, excitability and energy of dogs and a counterclockwise direction of the hair whorl, and a higher number of whorls. Tomkins et al. (2012) found that there was a correlation between the dogs' success in being guide dogs and the hair whorls direction on the chest. Dogs with counterclockwise hair whorls were more likely to be guide dogs at the end of the training procedure (Tomkins et al., 2012). This could be similar to our findings where the dogs with counterclockwise direction on the second hair whorl scored higher on the Positive scale in the Norwegian sample, indicating a higher level of excitement and interest in their surroundings (Sheppard & Mills, 2002). Another resemblance between the two studies was that in this study owners found a higher percentage of hair whorls going clockwise than counterclockwise on the chest. This was the same as Tomkins et al. (2012) research where 77 % had a clockwise whorl and 14 % a counterclockwise whorl (Tomkins et al., 2012).

In our research we did not find any correlation between the hair whorls direction on the legs and behavioral reactivity. There are no earlier studies determining any relationship between hair whorls direction on the legs and behavior, which might indicate that there actually are no strong connections between them. For the hair whorls on the right and left legs Tomkins and McGreevy (2010 a) found that the hair whorls on the right leg were all counterclockwise and on the left leg they were clockwise. This was not the same as the findings in this study where both directions was represented on the right and left leg. But except from the Norwegian sample, where the percentage of the whorls going clockwise or counterclockwise was nearly the same on the right leg, there was a higher percent going clockwise on the left leg in both the Norwegian and Hungarian sample. And it was a higher percent going counterclockwise on the right leg in the Hungarian sample. However, that this is not quite the same as in the

other study can be due to the smaller sample represented, where most of the dogs did not have hair whorls on the legs at all (Tomkins & McGreevy, 2010 a).

It was expected to find a correlation between the numbers of hair whorls and behavioral reactivity. This was due to the findings of the Górecka (2007) study who revealed that horses with elongated or double whorls approached a novel object after significantly longer time than horses with medium and low hair whorl position (Górecka et al., 2007). Multiple hair whorls are also associated with shelter dogs that have been shown to have significant more hair whorls on the chest than non-shelter dogs (Tomkins & McGreevy, 2010 b). This link could be more similar to or expectation if the dogs with several whorls on the legs and chest got a higher scale score on Q1 and the Negative part, because the main reason for dogs being rehomed is problematic behavior (Salman et al., 2000). These scores can indicate a higher state of fear and anxiety that is correlated with behavior problems in dogs (Bowen & Heath, 2005). But this prediction was mainly rejected, as the only relationship between hair whorls numbers and behavior was a weak correlation between numbers of whorls on the right leg and the Positive scale score in the Norwegian sample. However a higher state of reactivity, even though it is connected to excitement and higher states of arousal, could be seen as problematic behavior for some owners. It can be said that reactivity in itself is not a problematic behavior. A very enthusiastic, full of energy dog can be good for agility with a quick owner, but very bad for a maybe older person who cannot give enough physical and mental training to the dog. However, the weak correlation means it is hard to make a statement about this relationship and it would just be seen as speculations.

It has previously been found that with the non-shelter dogs the hair whorls direction on the right elbow had a significantly higher percentage of counterclockwise direction than dogs from the shelter (95.24 % vs. 76.79 %) (Tomkins & McGreevy, 2010 b). This can also be related to the findings of the Positive scale score and the counterclockwise direction on the dogs' chest whorl in this study, even though it is not the same part of the body. This says something in general about the hair whorls direction.

To investigate why there were few findings in the relationship between hair whorls and behavior it was considered that there are many components in a scientific process that can affect the final results (Miklòsi, 2007). So can it be the scale score parts that does not work? To assure that the score of reactivity would be a good measurement, it seemed best to use an

already validated method. We can conclude that the behavior question part one that originally was developed for horses (Momozawa et al., 2003) was adapted to dogs successfully as the score correlated with the behavior question part two (Sheppard & Mills, 2002).

We found a correlation between the Negative and Positive scale score of the behavior questions part two both in the Norwegian and Hungarian sample. This was not the result found in the earlier study of Sheppard & Mills (2002), where the two scale scores were more independent from each other indicating two independent facets of behavioral reactivity. This difference is of huge interest since the amount of answers in this thesis are far higher than the 78 dogs in Sheppard and Mills (2002) research, and in this study the two scores indicate a more general reactivity trait instead of two independent facets. Sheppard and Mills argue that these two aspects, Positive and Negative, are independent from each other, as they are regulated by different physiological mechanisms (Sheppard & Mills, 2002). In contrast to this we found that energetic dogs are often afraid of new stimuli and less active dogs are rather calm in unfamiliar situations. So these results can indicate that the Negative and Positive scale scores work in an opposite way than earlier concluded. This is of high interest for further investigations.

It is possible that these differences in the scale score occurred due to translation of the questionnaires to Norwegian and Hungarian where subtle differences in the meaning of the questions emerged. That can also be the reason for the higher score on the Negative and Q1 scale in the Hungarian sample compared to the Norwegian one. Additionally, in the study of Bradshaw and Goodwin (1998) researchers found that the same breeds of dogs were scored differently on their behavior in the USA than in the UK. They mention that this result can refer to cultural differences in husbandry and socialization (Bradshaw & Goodwin, 1998). This can be the same for our study with two different countries generating different scores of the dogs' behavior.

The link between hair whorls and reactive behavior has not been investigated in dogs earlier, so we wanted to do a reliable study and therefore applied two conducted questionnaires to score the dogs behavior. One was already validated in dogs, the other applied now for the first time. We also distributed it in two countries to get a bigger sample and for comparing the answers. The aim of having the questionnaires in two countries was to get a bigger sample and also for comparing the answers. When comparing the two samples it was not so surprising that there were other differences between the countries than just the behavior score. There

was a similar distribution of age and sex of dogs, but there was a difference in breed composition. This can also have affected the difference in the scale score in the Norwegian and Hungarian samples. Several previous studies have concluded behavioral differences between breeds (Hart & Hart, 1985; Boissy, 1995; Bradshaw & Goodwin, 1998; Miklòsi, 2007), so it should be presumed that breed would make an effect on the behavior scale score, but that was only found for the Hungarian sample and the Negative and Q1 scale score. The Hungarian owners were more likely to have dogs in FCI category 7 “Pointing Dogs” (N 5.6 %, H 23.4 %), and FCI category 11 “Mixed breed” (N 15.6 %, H 31.2 %) than the Norwegian owners. The Norwegian owners were more likely to have dogs in FCI category 1 “Sheepdogs and “Cattle Dogs (except Swiss Cattle Dogs)” (N 23 %, H 10.6 %) and FCI category 2 “Pinscher and Schnauzer - Molossoid Breeds - Swiss Mountain and Cattle Dogs” (N 14.1 %, H 5.7 %). It would be of interest for further investigation to see if there is a connection between the separate breeds and the higher state of negative reactive behavior.

A difference between sexes in the behavioral scale score could also be expected as earlier studies showed behavioral differences between male and female dogs in some breeds. Male dogs were found to be more active and aggressive than female dogs (Hart & Hart, 1985). Sex did not have any effect on the behavior scale score in this study. For age there was, as predicted, a connection to the scale score as different state of age can effect on the dogs behavior, for example younger dogs could have more energy and be more exited then older ones (Bowen & Heath, 2005).

When using a questionnaire to collect data you have to trust the owners’ perspective of their dogs’ behavior (Miklòsi, 2007). But comparing the owners’ answers on their dogs’ behavior to the observers’ results in the direct observation test, showed few correlations. Bowen and Heath (2005) clarified specifically that when working with dogs and cats with behavior problems it is important not just to listen to the owners’ view of the problem. That is because the owner does not always have a proper, objective assessment of the dogs’ behavior, or in some cases do not actually know the dogs’ ethology properly enough to make a valid statement (Bowen & Heath, 2005). This can be one explanation as to why we found few correlations between the owners’ opinions and the observers’ assessment. But at the same time we should keep in mind that our comparisons contained just 22 dogs (less in some cases), and all dogs were of the same breed and only dogs from the Hungarian sample. So to testify that the owner has a wrong opinion about his/her dog more research is needed, and this also should have



included the Norwegian sample. Additionally, the dog does not necessarily show us how it would behave at familiar places every day when it is in an unfamiliar test situation (Miklòsi, 2007), and for further investigation it could be useful to have another observer code the dogs behavior to test the reliability of the first observer.

For this study we focused on getting a huge sample because it was predicted to give more significant results. This was due to all the answers on the questionnaires that would be selected out because of difficulties with finding and scoring the hair whorls. We used amongst others social media and collected a huge set of data. However after selecting out the answers that was proper to use, there were a lot that was not applicable (915 results decreased to 270 in the Norwegian sample and 194 to 141 in the Hungarian sample). It was not predicted that so many commented that it was either difficult or very difficult to find the hair whorls in the Norwegian and Hungarian sample.

Tomkins and McGreevy (2010 a) found that 24.17 % of the dogs in the study had no hair whorls on the chest. This was close to the findings in the Hungarian sample where the number was 25 %. But it did not correlate to the findings in the Norwegian sample where the owners that did not find any hair whorls at all on the chest were 37%.

In this research there were more who found hair whorls on the dogs legs than in Tomkins and McGreevy (2010 a) study where a whorl was not represented in 97.5 % on the left leg, and 98.33 % on the right. In the Hungarian sample it was not represented or measured as “other” (not clockwise or counterclockwise) in 22.7 % of the cases in the left leg and 23.4 % on the right. For the Norwegian sample it was 3.7 % that did not have any whorls on the left leg and 5.2 % on the right. So when Tomkins and McGreevy categorize hair whorls on the chest in the group of places where it is typical to find a hair whorl it corresponds to the Hungarian sample, but there are many in the Norwegian sample who did not find any or scored “other” in the questionnaires. The legs (shoulders) are in a category of atypical regions (Tomkins & McGreevy, 2010 a), but in this case there were a huge amount of owners that found whorls there, so our prediction that this would be an easy place for the owners to find whorls and describe what they should do was right.

However they categorize the dogs coat thickness in the study as fine, medium or dense from how easy it was to measure the hair whorls. In the dense group they had among others German Shepherd and Australian Cattle and these breeds are also represented in the FCI group

(Attachment 5) of the highest percentage of the dogs in the Norwegian sample (23 %). It was a surprisingly high number that claimed it was very difficult to find the hair whorls, and some of the long furred dogs and poodles were in the end totally excluded from the sample. Using another sample with just short furred breeds, it would perhaps be a different hair whorl score where several owners would find hair whorls on their dogs. Tomkins and McGreevy (2010 a) proposes that the way to measure hair whorls is best suitable for dogs with short fur, where they found that dogs with longer fur were not associated with the occurrence of hair whorls (Tomkins & McGreevy, 2010 a). This could be in mind for further research to select out specific short furred breeds. That could give a higher number of dogs with hair whorls since the main interest is the clockwise and counterclockwise direction.

To summarize it seems like a difficult way in general to measure hair whorls through a questionnaire, where it totally depends on the owners' reliability. The use of social network gave a lot of answers, but maybe collecting results through the internet is not the best way to get in contact with dog owners. It could be too easy not to take the time to answer correctly, and in this case they had to read the manual properly to understand how to evaluate the hair whorls. The explanation in the hair whorls part might not have been good enough in general to understand. The link between hair whorls and behavioral reactivity is very weak in the results. Perhaps it can mean that with choosing behavior reactivity as a measurement based on earlier findings of correlation it is not a relevant behavioral trait for dogs. When it comes to cows and horses the research is more about the hair whorls position and not the direction that was connected to behavior (Grandin et al., 1995; Randle, 1998; Lanier et al., 2001; Górecka et al., 2007; Olmos & Turner, 2008). This has not been measured in this research. And it might give us a stronger result to study the traits in working dogs where reactivity is through working function and has reserved its original importance, and look at the placement as well as direction and numbers of the hair whorls. To use hair whorls as a tool for calculating behavior it would be predicted to be better to base it more on direct observation of different personal traits to confirm any relationship.

#### **4.1 Further research**

Due to the number of owners that had difficulties with finding the hair whorls or scored the dogs to have no hair whorls at all, it would be interesting to do some investigation to find out why this was the case. For future research it is recommended to use a sample of dogs' hair

whorls and compare the owners and an observer's view of the hair whorls numbers and direction. Then we can find out if it is the owner that does not know what to do or whether it is the questionnaires that explains it poorly. This could be performed through direct observation or by getting the owner to send pictures of their dogs along with their answers on the questionnaires.

But for further investigation it would also be of interest to have another observer coding the observation test to compare the results with my observations. This would make the results for calculating the dogs' behavior more trustworthy when comparing it to the questionnaires.

To do more research with the other variables in the questionnaires to calculate dogs' behavior would be of high interest. For example correlating specific breeds with the scale score and search for more reasons for the differences between the countries. Not to mention further investigation of the correlation between the Positive and Negative scale score that differs from the conducted study of measured reactivity (Sheppard & Mills, 2002)

## 5. Conclusion

There are small correlations in this research determining the relationship between behavior reactivity and hair whorls. These findings are connected to the second counterclockwise hair whorl and multiply whorls correlated to the Positive scale score in the Norwegian sample. This can indicate a connection to several hair whorls and counterclockwise direction of hair whorls with a higher state of excitability and energy.

Interestingly, contrary to earlier findings, there was a difference in the facets of reactivity behavior as we found correlation between Negative and Positive activation indicating a relationship between the two traits.

There were several differences between the Hungarian and Norwegian sample that can indicate cultural differences, but also the breed differences between the countries could have an effect on the results.

By using social media to collect data we got a huge sample, but there was a huge amount of answers that were removed because of the owners' difficulties with finding and scoring the hair whorls. When correlating the owners views of the dogs' behavior with an observer's opinion there were few similarities. This can indicate that using a questionnaire is not the proper tool for calculating behavior and hair whorls.

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# Attachment 1

## The Norwegian questionnaire

### Spørreundersøkelse om hårvirvler og hundens atferd

Takk på forhånd for at du vil delta i denne undersøkelsen. Dette spørreskjemaet er utviklet for masterarbeidet til Sofie Lillebø ved Universitetet for Miljø og Biovitenskap i 2012. I dette studiet ønsker vi å utforske mulige sammenhenger mellom noen atferdsmessige trekk hos hunden og hundens hårvirvler (se senere). Resultatene kan bidra til bedre forståelsen av prosessene som påvirker hundens atferd, og kan være et viktig verktøy som kan komme alle hundeeiere til gode. Det er greit å ha hunden tilstede, da du fysisk må se på hundens hårvirvler. Har du flere hunder kan du fylle ut skjemaet flere ganger.

Data i dette skjemaet vil bli behandlet konfidensielt og vil bare bli brukt i dette forsøket. Grunnen til at det blir bedt om privat informasjon er for å kunne gi tilbakemeldinger om resultatet, og deltakerne er med i trekning av gevinst fra Champion, Felleskjøpet.

Det tar ca. 20 minutter å fylle ut skjemaet, og ditt bidrag blir høyt verdsatt.

Takk for hjelpen:)

Sofie Lillebø, master student, Universitet for Miljø og Biovitenskap, Ås  
Judith Vas PhD, forsker, veileder, Universitet for Miljø og Biovitenskap, Ås  
Enikő Kubinyi PhD, forsker, veileder, Eötvös University, Budapest  
I samarbeid med MTA-ELTE Comparative Ethological Research Group, Budapest, Hungary

### Eier/ansvarsperson

1) Navn

2) \* Kjønn

Mann

Kvinne

3) E-mail

4) Telefonnummer

5) \* Land

6) Hvis Norge, hvor i landet bor du?



7) \* Din alder

## Hunden

8) \* Navnet på hunden din

9) \* Hundens alder

10) \* Kjønn

Hannhund

Tispe

11) \* Er hunden kastret eller sterilisert?

Ja

Nei

12) \* Hvilken rase er hunden din, eller raser hvis den er blandig?

13) \* Hvor mange måneder var hunden når du fikk den?

14) \* Hvorfor valgte du denne rasen?

15) \* Hvorfor valgte du akkurat denne hunden?

16) \* Hvor fikk du hunden din fra?

Fra profesjonell oppdretter

Fra en amatør/hobby oppdretter

- Omplasseringssenter
- Annet

**17) Hva er grunnen til at hunden er omplassert?**

**18) \* Grunner for at du har denne hunden**

- Kjæledyr/familiehund
- Til bruk i sport/konkurranse
- Arbeidshund (eks. politihund, førerhund)
- Annet

**19) \* Hvis hunden blir brukt i sport/konkurranse, vennligst spesifiser**

**20) \* Hvis hunden blir brukt i arbeid, vennligst spesifiser**

**21) \* Hvor bor hunden?**

- Inne
- Ute
- Begge deler

**22) \* Hvor bor du?**

- By
- Forstad
- Landet

23) \* Lar du hunden sove i sengen din om natten?

- Ja  
 Nei

24) \* Hvor mange hunder er det i husholdningen?

25) \* Hvor mange timer/dag er hunden ute i hagen/luftegård?

26) \* Hvor mange timer/dag er hunden ute på tur?

27) \* Hvor mange timer/dag blir hunden trent?

28) \* Hvor mange personer under 14 år er det i husholdningen?

29) \* Hvor mange personer over 14 år er det i husholdningen?

30) \* Hvor mange personer håndterer hunden? (Går på tur, fører, trener)

31) \* Hvor mange hunder har du hatt før denne?

32) \* Har du deltatt på kurs?

- Nei, ingen kurs  
 Valpekurs  
 Andre kurs

33) Hvis andre kurs, vennligst spesifiser

# Atferdsspørsmål del 1

Vennligst kryss av for det som passer best for hunden din

## 34) \* 1. Nysgjerrig på nye plasser

- Aldri
- Svært sjeldent
- Noen ganger
- Ofte
- Alltid
- Vet ikke

## 35) \* 2. Tilvenningstid til nye plasser

- Kort
- Mindre en normalt
- Normalt
- Lengre enn normalt
- Lang
- Vet ikke

## 36) \* 3. Når den er alene hjemme

- Som vanlig
- Litt urolig
- Urolig
- En god del urolig
- Veldig urolig
- Vet ikke

**37) \* 4. Når den blir håndtert (børstet, vasket)**

- Villig
- Litt villig
- Rastløs
- En god del rastløs
- Veldig rastløs
- Vet ikke

**38) \* 5. Få inn i bilen**

- Lett
- Noe lett
- Motstand
- En del motstand
- Mye motstand
- Vet ikke

**39) \* 6. Stikker av når den blir skremt/redd**

- Aldri
- Svært sjeldent
- Noen ganger
- Ofte
- Alltid
- Vet ikke

**40) \* 7. I aktiviteter med tilstedeværelse av andre hunder**

- Rolig
- Noe rolig
- Noe opphisset/oppstemt
- Opphisset/oppstemt
- Veldig opphisset/oppstemt
- Vet ikke

**41) \* 8. I møte med hund av samme kjønn**

- Rolig
- Noe rolig
- Noe opphisset/oppstemt
- Opphisset/oppstemt
- Veldig opphisset/oppstemt
- Vet ikke

**42) \* 9. I møte med hund av motsatt kjønn**

- Rolig
- Noe rolig
- Noe opphisset/oppstemt
- Opphisset/oppstemt
- Veldig opphisset/oppstemt
- Vet ikke

**43) \* 10. Truende mot ukjente personer**

- Aldri
- Svært sjeldent
- Noen ganger
- Ofte
- Alltid
- Vet ikke

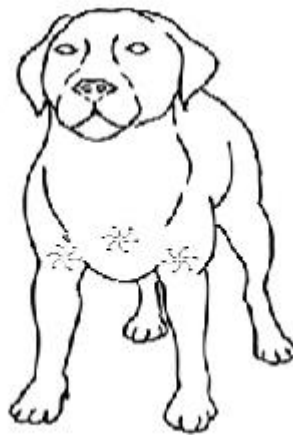
## Atferdsspørsmål del 2

### 44) \* Vennligst kryss av for det som passer best for hunden din

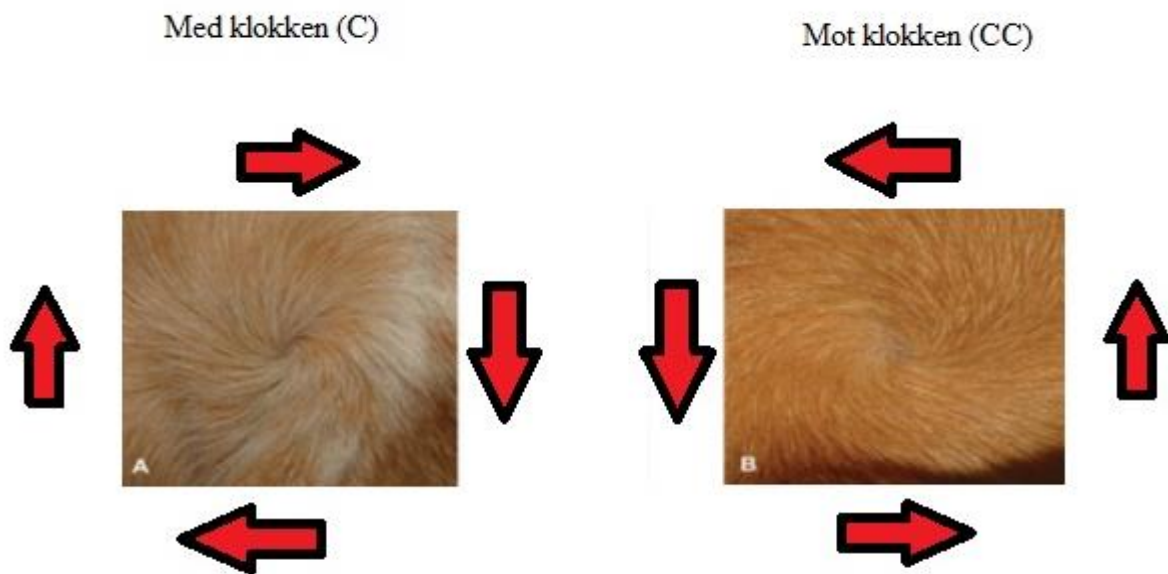
	Helt enig	Litt enig	Enten eller	Litt uenig	Helt uenig	Vet ikke
1. Hunden din blir veldig opphisset når dere skal til å gå på tur (eks. når den ser båndet eller hører «tur».)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Hunden din er sjelden redd	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Hunden din blir lett skremt av lyder og/eller bevegelse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Hunden din er veldig utholdende i sitt forsøk på å få deg til å leke	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Hunden din viser lite interesse for sine omgivelser	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Hunden din er nervøs eller skvetten flere minutter etter den har blitt skremt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Hunden din blir lett opphisset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Hunden din har en spesifikk angst eller fobi	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Hunden din prøver å rømme fra hagen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Hunden din er rolig ved støyende/overfylte plasser	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Hunden din er full av energi	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Hunden din er redd for lyder fra TV eller radio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Hunden din er som regel avslappet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Hunden din klarer fort å vende seg til forandringer i sine omgivelser (eks. passet av forskjellige folk, ved flytting eller familiemedlemmer forlater huset)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Hunden din virker redd for støvsugeren eller andre husholdningsapplikasjoner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Hunden din er lat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Hunden din krever mye oppmuntring for å delta i energiske aktiviteter (eks løping, energisk lek/trening)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Hunden din fortsetter å være rampete selv om den blir korrigert for atferden	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Hunden din virker rolig på nye steder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Hunden din virker urolig ved forandringer i dens rutiner (eks. ikke matet på same tid, hjemme alene lengre enn vanlig)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. Hunden din er veldig høyllytt (eks. bjeffing, klynking)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Vennligst se på hundens hårvirvler på brystet og på øverste del av hvert frambein (bilde 1). Vennligst noter hvor mange du finner på de viste plassene. Kryss så av for om de går med klokken (kryss av for med klokken (C)) eller mot klokken (kryss av for mot klokken (CC)) (bilde 2), eller "Annet" og spesifiser hvis det er verken med eller mot klokken. Hvis du ikke finner noen kryss så av på "Fant ingen". Finner du for eksempel to på brystet krysser du av for "Hårvirvel på bryste 1 og Hårvirvel på brystet 2". Det kan være vanskelig å se eller finne virvlene, spesielt på hundens bryst, og hvis hunden har mye pels. Det kan hjelpe litt å skille håret på bryste.

Bilde 1



Bilde 2





45) \* Hvor mange hårvirvler fant du på hundens bryst?

46) \* Hvor mange hårvirvler fant du på hundens venstre frambein? (som vist på bilde 1)

47) \* Hvor mange hårvirvler fant du på hundens høyre frambein? (som vist på bilde 1)

48) \* Vennligst kryss av for de forskjellige hårvirvlene og hvilken retning de går, eller kryss av på "Fant ingen" hvis du ikke finner noen, eller "Annet" hvis de verken går med eller mot klokken.

	Med klokken (C)	Mot klokken (CC)	Fant ingen	Annet	
Venstre frambein 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Venstre frambein 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Høyre frambein 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Høyre frambein 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Hårvirvel på brystet 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Hårvirvel på brystet 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Hårvirvel på brystet 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Hårvirvel på brystet 4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>

49) Hvor vanskelig var det å finne hårvirvlene?

	Veldig enkelt	Litt enkelt	Verken lett eller vanskelig	Litt vanskelig	Veldig vanskelig	Vet ikke
Høyre frambein 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Høyre frambein 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Venstre frambein 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Venstre frambein 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hårvirvel på brystet 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hårvirvel på brystet 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hårvirvel på brystet 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Hårvirvel på brystet 4



**50) Har du noen kommentar til spørreundersøkelsen?**

Dette forsøket vil bli ferdig i mai 2013, og etter det kan vi sende ut resultatet til de deltakerne som er interessert i dette.

**51) Ønsker du å få tilbakemelding om resultatet på mail?**

Ja  Nei

**52) Ønsker du å få tilbakemelding på mail om din hunds atferd sammenlignet med de andre hundene i forsøket?**

Ja  Nei

En del av studiet er å gjennomføre direkte observasjoner av hundenes atferd. Vi ser derfor etter eiere som er villig til å delta i forsøk der hundens atferd vil bli studert i nærvær av eier gjennom et forsøk. Hvis du kunne vært interessert i dette, og det er greit for deg at vi kan kontakte deg angående detaljer, vennligst kryss av for det.

**53) Jeg vil gjerne delta i forsøk med direkte observasjoner**

Ja  
 Nei

---

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\*Mandatory to answer

## Attachment 2

### The Hungarian questionnaire

#### Kérdőív kutyákról

Köszönjük, hogy részt vesz ebben a kutatásban. Ezt a kérdőívet 2012-ben a Norwegian University of Life Sciences egyetemen Sofie Lillebø egyetemi diplomamunkájához dolgoztuk ki. Célunk annak megvizsgálása, hogy van-e kapcsolat a kutyák bizonyos viselkedési jegyei és szőrforgói között. E kapcsolat feltételezését az indokolja, hogy az idegrendszer és a kültakaró hámborításának embrionális eredete azonos. Az eredmények segíthetnek a viselkedést befolyásoló tényezők megértésében, így a jövőbeni gazdák megjósolhatják a kutyák viselkedési jellegzetességeit a szőrforgók alapján. A kérdőív kitöltése során szüksége lesz a kutyájára, mivel a rajta lévő szőrforgókat meg kell vizsgálnia. Amennyiben több kutyája van, kérjük mindegyikre külön-külön töltsse ki a kérdőívet.

A kérdőív kitöltése során megadott adatokat titkosan kezeljük, és kizárólag ebben a kutatásban használjuk fel. Személyes információkra azért van szükségünk, hogy az alanyokat azonosítani tudjuk, és visszajelzést adhasunk a résztvevők számára, amennyiben erre igényt tartanak.

A kérdőív kitöltése mintegy 20 percet vesz igénybe, és az erre szánt idejét nagyra értékeljük.

#### 1) Gazda neve

#### 2) \* Neme

- Férfi
- Nő

#### 3) E-mail címe

#### 4) Telefonszáma

#### 5) \* Ország

#### 6) Megye

7) \* Kora évben

## Kutya

8) \* Kutya neve

9) \* Kutya kora

10) \* Kutya ivara

Kan

Szuka

11) \* Ivartalanítva van?

Igen

Nem

12) \* Fajta vagy fajták, ha keverék

13) \* Milyen korú volt a kutya, amikor Önhöz került (hónap)?

14) \* Miért választotta ezt a fajtát?

15) \* Miért választotta ezt a kutyát?

16) \* Honnan szerezte a kutyát:

Hivatásos tenyésztőtől

Hobby tenyésztőtől

Menhelyről

Egyéb helyről

**17) Ha tudja, miért került a kutya menhelyre, kérjük, írja le:**

**18) \* A kutyatartás célja**

- Kedvenc / családi kutya
- Sport / versenyzés
- Munkakutya (pl. rendőr, határőr, őrző stb)
- Egyéb

**19) \* Sport / versenyzés, Kérjük írja le részletesen**

**20) \* Munkakutya, Kérjük írja le részletesen**

**21) \* Hol tartja a kutyát az idő nagy részében?**

- Bent  Kint  Bent és kint is

**22) \* Hol lakik Ön?**

- Városban
- Külvárosban
- Vidéken

**23) \* Megengedi a kutyájának, hogy az Ön ágában aludjon?**

- igen
- nem

**24) \* Hány kutya van összesen a háztartásban?**

**25) \* A kutya napi hány órát van a kertben?**

26) \* A kutya napi hány órát van kint sétálni?

27) \* Naponta hány órán át foglalkozik atívan kutyájával (például labdázik vagy gyakorol vele)?

28) \* Hány, legfeljebb 14 éves gyerek van a háztartásban?

29) \* Hány, 14 éven felüli ember van a háztartásban?

30) \* Hány ember foglalkozik a kutyával? (pl. sétáltatás, etetés, tanítás)

31) \* Hány kutyája volt ez előtt?

0

1

2

3

4

5

Több mint 5

32) \* Milyen képzésen vett részt ezzel a kutyájával?

Semmilyen tanfolyamon

Kölyökcsoportos képzésen

Más képzésen

33) Ha más tanfolyamon, kérjük részletezze

# Viselkedés értékelése 1. rész

Kérjük jelölje be a kutyájára jellemző viselkedést

**34) \* 1. Új helyeken érdeklődő**

- Soha
- Ritkán
- Időnként
- Gyakran
- Mindig
- Nem tudom

**35) \* 2. Új helyekhez való hozzászokáshoz szükséges idő**

- Rövid
- Átlagosnál kevesebb
- Átlagos
- Átlagosnál hosszabb
- Hosszú
- Nem tudom

**36) \* 3. Amikor egyedül marad**

- Olyan mint egyébként
- Kissé feszült
- Valamennyire nyugtalan
- Nyugtalan
- Nagyon nyugtalan
- Nem tudom

**37) \* 4. Amikor gondozza (fésülés, fürdetés)**

- Készséges
- Elfogadó
- Kissé nyugtalan
- Nyugtalan
- Nagyon nyugtalan
- Nem tudom

**38) \* 5. Ha be akarja tenni az autóba**

- Készséges
- Beletörődő
- Kissé vonakodó
- Vonakodó
- Nagyon ellenálló
- Nem tudom

**39) \* 6. Ha megjedsz, elfut**

- Soha
- Ritkán
- Időnként
- Gyakran
- Mindig
- Nem tudom

**40) \* 7. Más kutyák jelenlétében**

- Nyugodt
- Többnyire nyugodt
- Kissé izgatott
- Izgatott
- Nagyon izgatott
- Nem tudom



**41) \* 8. Ha azonos nemű kutyával találkozik**

- Nyugodt
- Többnyire nyugodt
- Kissé izgatott
- Izgatott
- Nagyon izgatott
- Nem tudom

**42) \* 9. Ha ellenkező nemű kutyával találkozik**

- Nyugodt
- Többnyire nyugodt
- Kissé izgatott
- Izgatott
- Nagyon izgatott
- Nem tudom

**43) \* 10. Idegen emberekkel szemben fenyegetően viselkedik**

- Soha
- Ritkán
- Időnként
- Gyakran
- Mindig
- Nem tudom

## Viselkedés értékelése 2. rész

44) \* Kérjük jelölje be, hogy az állítások mennyire jellemzőek kutyájára!

	Egyáltalán nem igaz	Többnyire nem igaz	Részb ben igaz, részb ben nem	Többnyire igaz	Teljesen igaz	Nem tudom
1. Az Ön kutyája nagyon izgatott lesz, mikor sétálni indul (pl. amikor meglátja a pórázát, vagy meghallja, hogy "séta")	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Az Ön kutyája ritkán ijed meg valamitől	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Az Ön kutyája könnyen megijed hangoktól és/vagy mozdulatoktól	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. A kutyája nagyon kitartó, mikor játszani hívja Önt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Az Ön kutyája csak kis érdeklődést mutat a környezete iránt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Mikor megijeszítik, kutyája percekig idegesnek és/vagy zaklatottnak tűnik	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Az Ön kutyája könnyen izgatottá válik	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Az Ön kutyájának van valamilyen különleges félelme vagy fóbiája	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Az Ön kutyája megpróbál a kertből kiszökni	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Az Ön kutyája nyugodtnak tűnik hangos, zsúfolt helyeken	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Az Ön kutyáját megijeszítik a tv vagy a rádió hangjai	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Az Ön kutyája általában nyugodtnak tűnik	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Az Ön kutyája hamar hozzászokik a környezet változásaihoz (pl. ha mások gondoskodnak róla, költözéskor, egy családtag távozásakor)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Az Ön kutyája fél a porszívótól vagy más ismert háztartási eszköztől	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Az Ön kutyája lusta	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Az Ön kutyájának sok bátorításra van szüksége, hogy aktív tevékenységekben részt vegyen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Az Ön kutyája folytatja a rosszkodást akkor is, ha viselkedése miatt szidást kap	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Az Ön kutyája ismeretlen környezetben nyugodt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. Az Ön kutyája elbizonytalanodik, ha a szokásos napi ritmusát megzavarja valami (pl. ha nem a szokásos időpontban kap ételt, ha a megszokottnál hosszabb ideig marad egyedül)

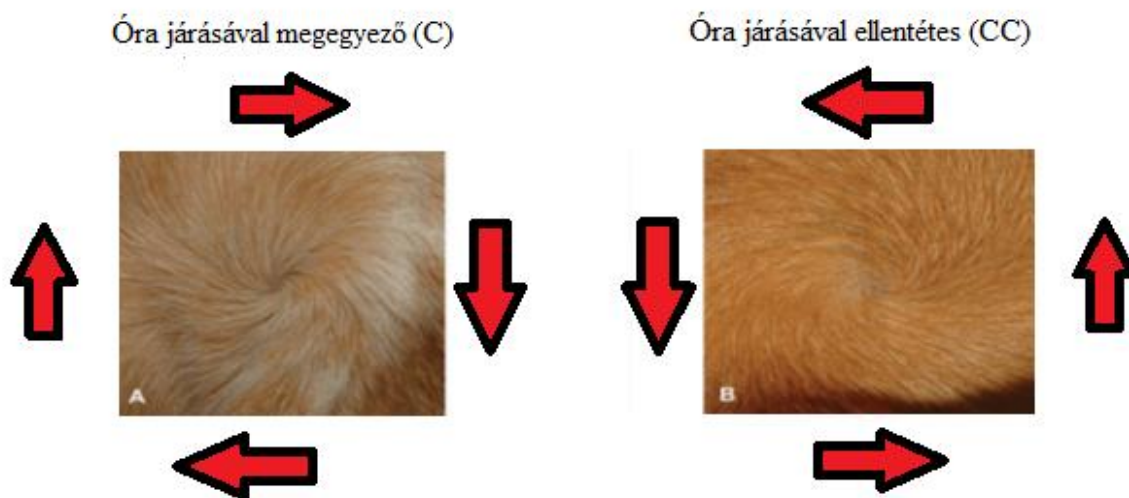
21. Az Ön kutyája nagyon féktelen

Kérjük, vizsgálja meg a szőrforgókat kutyája mellkasán és mellső lábain (1. kép) és állapítsa meg, hogy azok az óra járásával megegyezők (C) vagy azzal ellentétesek (CC) (2. kép), valamint jelezze, hogy hány forgót talált az egyes helyeken. A forgók megtalálása nehézséget okozhat, főleg ha a kutyájának hosszú a szőre, de segíthet, ha a mellkason lévő szőrt egy kissé félrehajtja.

1. kép



2. kép



45) \* Hány szőrforgót talált a kutya mellkasán?

46) \* Hány szőrforgót talált a kutya bal lábán?

47) \* Hány szőrforgót talált a kutya jobb lábán?

48) \* Kérjük jelölje be, ha az egyes helyeken talál az óra járásával megegyező (C) vagy azzal ellentétes (CC) szőrforgót, nem talál szőrforgót (Nincs), illetve ha más típusú szőrzellegzetességet észlel (Egyéb)

	Óra já- rásával megegyező (C)	Óra járásával ellentétes (CC)	Nincs	Egyéb	
Jobb láb 1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Jobb láb 2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Bal láb 1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Bal láb 2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Mellkason szőrforgó 1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Mellkason szőrforgó 2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Mellkason szőrforgó 3.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
Mellkason szőrforgó 4.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>

49) Milyen nehéz volt a szőrforgók megtalálása és irányuk megállapítása?

	Nagyon könnyű	Könnyű	Se nem könnyű se nem nehéz	Nehéz	Nagyon nehéz
Jobb láb 1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jobb láb 2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bal láb 1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bal láb 2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mellkason szőrforgó 1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mellkason szőrforgó 2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mellkason szőrforgó 3.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Mellkason szőrforgó 4.



**50) Van valami hozzáfűznivalója vagy megjegyzése a kérdőívvel kapcsolatban?**

A kutatás 2013 májusában zárul le, ezután ha a résztvevők igénylik, el tudjuk küldeni az eredményt.

**51) Szeretne értesítést kapni e-mail formájában a kutatás eredményéről?**

- Igen
- Nem

A kutatás részeként szeretnénk egyes kutyák viselkedését közvetlenül is megfigyelni. Ezért olyan gazdákat keresünk, akik szívesen részt vennének egy találkozón, ahol a kutya viselkedését videóra vennénk a gazda jelenlétében mindennapi helyzetekben. Amennyiben Önt ez érdekli, és felvehetjük később Önnel a kapcsolatot a részletek egyeztetése végett, akkor kérjük adja meg hozzájárulását itt:

**52) Igen, szeretnék kutyámmal a kutatás többi részében is részt venni**

- Igen
- Nem

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\* Mandatory to answer

## Attachment 3

### PROTOCOL FOR TESTING THE RELATIONSHIP BETWEEN HAIR WHORLS NUMBERS AND DIRECTION ACCORDING TO DIFFERENT TYPES OF BEHAVIOR

Budapest February-March 2013

#### Testing day

A testing room at Eötvös University, Department of Ethology will be used, where approximately 24 private held Hungarian Vizslas will be tested. To document the dogs' behavior we will record it with help of four video cameras. The room will be empty except for a chair in the first part of the test.

#### **QUESTIONNAIRE** (appr. 15 minutes)

Owner answers the questionnaire

#### **PERSONALITY TEST** (6 parts, appr. 20 minutes)

This part will contain an experimenter and the owner of the dog.

**E=experimenter**

**O=owner**

#### **1. EXPLORATION IN THE ROOM**

E is outside the testing room. O sits on a chair, and releases the dog from the leash. O reads a magazine without paying attention to the dog, and the dog is free to explore the room. The dog is filmed for one minute.

#### **2. GREETING BY A STRANGER**

O takes the dog on leash and stops at a defined point with the leash having 1.5 meter reach (not releasing longer later either). E enters the room and approaches the dog from 5 meter (behaves in a usual manner), greets the owner and speaks continuously to the dog by orienting toward it. E stops for 5 seconds at 1 meter in front of the leashed dog, and says „Hello”.

**If the dog approaches** and shows “friendly” behavior (moving towards E, tail wagging), **or** it shows neutral behavior (does not move away, no tail wagging)

**then**

1. E steps towards the dog, and pets it a few times on the head, on the back and on the shoulders (in this order).

2. E steps 1 meter sideways within reach of the leash. If the dog does not follow, E calls the dog.

If the dog does not approach, E crouches and calls it again.

If there is still no response, E goes to the dog and pets it.

In any case E pets the dog again by touching a few times the head, the back and the shoulder (in this order).

**If the dog avoids E** (but without vocalization) or shows little aggressive tendencies (barking, soft growling)

**then**

1. E approaches the dog outside the reach of the leash, and tries to call the dog and pet it (but E does not approach the dog any further). This is done first in a standing position and if there is no response E crouches. If the dog does not respond the trial is terminated after 30 s.

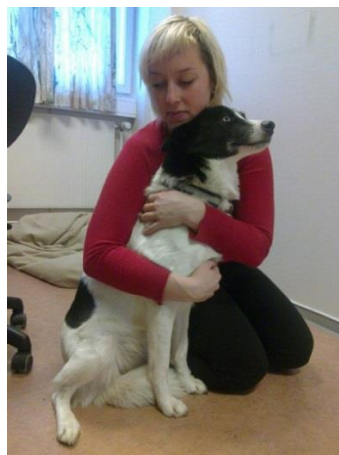
**If the dog is aggressive** (growling on stretched leash)

**then**

E stops any greeting after the 5 seconds

**3. HUG BY OWNER**

O will hug the dog like showed in the photo for 10 seconds. The picture will be shown to O to demonstrate what to do.



#### **4. PAYING ATTENTION**

The dog is loose from the leash.

E will sit down on the floor paying attention to an empty paper box with vocalization and calm movements, pretending that the box is really interesting. This will last for one minute.



#### **5. NOVEL OBJECT**

The dog is on loose leash. E crouches 2 meters from the dog, puts the toy puppy on the ground, turns it on and steps back 2 meters. If the dog approaches or avoids the object the owner should follow but not lead the dog. After 1 minute E crouches at the toy puppy and turns it off. If the dog was afraid of the toy puppy and avoided it, E pets the toy puppy for 10 seconds without looking at the dog speaking to the toy. After this E calls the dog. If the dog doesn't approach in 10 seconds, E calls to get the dogs attention and puts a piece a food on the toy puppy. O encourages the dog to eat it.





## 6. CHOICE TEST

O stands still and holds the dog on the leash.

### *Phase 1*

E has two white plates and puts a piece of food on one of them. E shows the plates to the dog and steps back 2 meters. E holds the hands as far as possible and puts down the plates. Then E stands up a little bit behind the plates and tells O to allow the dog to make a choice. When the dog has made his choice, E quickly removes the plates.

Phase 1 will be repeated 4 times, 2 times with the plate with the food to the right and 2 times with the plate with the food to the left.

### *Phase 2*

Same as above, but O is performing the test while E is holding the dog on leash. After putting the plates down, O steps to the plate without food, crouches down, “grabs” the “food”, imitates eating with making “mmm”, “delicious” sounds. Puts the “food” back on the plate, stands up and steps back, then tells E to allow the dog to make a choice



Phase 2 will be repeated 4 times. 2 times with the plate with the food to the right and 2 times with the plate with the food to the left.

The position of the plate is remaining, if the 1-item plate was first on the right in the first phase, it is first on the right in the second phase too.

## Attachment 4

### ETHOGRAM: CODING BEHAVIOR

**E= Experimenter**

**O = Owner**

Test parts	Behavior Variables	Code of variables	Explanation	Measurements
<b>1. Exploration in the room</b>	Head orientation	Looking at O	The dog is looking at O	Frequency
	Body contact	Body contact with O	Pawing, head on the leg together, touching O	Duration
<b>2 Greeting by a stranger Phase1</b> (entering the room 5m, and 1 m)	Head orientation	Looking at E	Dog looks back at E, and seeks contact with E	Frequency
		Looking at O	Dog looks back at O, and seeks contact with O	Frequency
	Approaching	Move towards E	The dog tries to reduce the distance between itself and E	Latency
<b>3 Hug by owner</b>	Reaction score	0: The dog is relaxed	The dog seems calm and let O easely hug him	Score 0-4
		1: Tense	The dog is tense but stays in the hug	
		2: A little struggle	Struggles a little bit	
		3: Struggling	The dog is struggling hard and O holds it back	
		4: Escape	The dog escapes from the hug	
<b>4 Paying attention</b>	Approaching	Experimenter	How long time from E calls the dog until the dog comes to E	Latency
	Box touching	Touching	Touching the box with the nose, head, foot or sniffing the box	Duration
	Head orientation	Looking at O	Looking at the owner	Frequency
		Looking at E	Looking at the experimenter	Frequency
		Looking at Box	Looking at the box	Duration
		Looking at Misc	Looking at any other object or direction (except owner, box,experimenter)	Duration
	Changing head orientation	Looking total times	Sum of frequencies looking at different directions	Frequency
<b>5 Novel Object Phase 1</b> (Toy puppy (TP) are on)	Approaching	Walking to TP	The dog moves towards the TP, orienting at TP	Frequency Latency
	Head orientation	Looking at O	Looking at the owner	Frequency
		Looking at E	Looking at the experimenter	Frequency
		Looking at TP	Looking at TP	Duration
		Looking at	Looking at any other object or direction	Duration

		Misc	(except owner, box, experimenter)	
	Touching	Touching TP	Touching the TP with the nose, head, foot or sniffing the box	Frequency
	Vocalization	Vocalization	Barking, whining	Frequency
	Changing head orientation	Looking total times	Sum of frequencies looking at different directions	Frequency
<b>6 Choice test</b> Phase 1 (With E) (4x)	Approaching plate	Plate	Time from O says „go” until the dog touches, looks closely, sniffs plate	Latency

## Attachment 5

Overview of dog breeds in the questionnaires categorized by FCI (Fédération Cynologique Internationale, 2013) plus an extra category for the Mixed Breeds.

FCI Groups	Breed		
<b>1. Sheepdogs and Cattle Dogs (except Swiss Cattle Dogs)</b>	Australian Cattle Dog Australian Shepherd Border Collie Belgian Shepherd Collie	Dutch Shepherd German Shepherd Icelandic Sheepdog Mudi Miniature America Shepherd	Pyrenees Puli Shetland Sheep Dog Welsh Corgi Pembroke White Shepherd Dog
<b>2. Pinscher and Schnauzer - Molossoid Breeds - Swiss Mountain and Cattle Dogs</b>	American Bulldog Bernese Mountain Dog Boxer Broholmer Bull mastiff Dogo Canario	Doberman English Bulldog Giant Schnauzer Great Dane Hovawart Miniature Schnauzer	Miniature Pinscher Neapolitan Mastiff Pyrenean Mountain Dog Rottweiler Saint Bernard Dog
<b>3. Terriers</b>	American Staffordshire Terrier American Pitbull Terrier Australian Terrier Bull Terrier Fox Terrier	Fox Terrier Smooth Irish Soft coated Wheaten Terrier Jack Russell Terrier Parson Jack Russell Terrier	Silky Terrier Staffordshire Bull Terrier Yorkshire Terrier West Highland White Terrier
<b>4. Dachshunds</b>	Dachshund*	Wirehaired Dachshund	
<b>5. Spitz and Primitive types</b>	Alaskan Malamute Danish Swedish Farm Dog Finnish Lappdog Jamthund	Lapponian Herder Norrbotenspets Norwegian Buhund	Norwegian Lundehund Siberian Husky Shiba
<b>6. Scenthounds and Related Breeds</b>	Beagle Dalmatian	Norwegian Hound Rhodesian Ridgeback	Lucerne Hound
<b>7. Pointing Dogs</b>	Italian Pointing Dog Brittany Spaniel English Setter French Spaniel	Gordon Setter Drötörü Magyar Vizsla Rövidszörü Magyar Vizsla Irish Setter	Kleiner Münsterländer English Pointer Vorste Hund*
<b>8. Retrievers - Flushing Dogs - Water Dogs</b>	American Cocker Spaniel English Cocker Spaniel English Springer Spaniel Flat Coated Retriever	Golden Retriever Kooiker Hound Nova Scotia Duck Tolling Retriever	Labrador Retriever Portuguese Water Dog Welsh Springer Spaniel
<b>9. Companion and Toy Dogs</b>	Boston terrier Chinese Crested* French Bulldog	Petit Barbancon Griffon * Kromfohländer	Pug Tibetan Spaniel
<b>10. Sighthounds</b>	Borzoi Italian Greyhound	Whippet Saluki	
<b>11. Mixed breeds</b>	Mixed breeds		

\* The owner has not specified fur length or size of the breed

## Attachment 6

**Table 3.4.1**

Part 1: Behavior variables for *Exploration in the room* (Attachment 4) correlated to the relevant questions from the behavior questions part one (Q 1), and part two (Q2) in the questionnaires

Correlation Spearman's rho		Q1 1	Q1 2	Q1 5	Q2 5	Q2 11	Q2 12	Q2 13	Q2 14	Q2 16	Q2 19
Looking at O, Frequency	<b>rho</b>	-0.171	-0.131	<b>0.482</b>	-0.199	-0.137	0.265	-0.391	-0.115	0.066	<b>-0.470</b>
	<b>P</b>	0.484	0.593	<b>0.037</b>	0.414	0.577	0.273	0.098	0.649	0.787	<b>0.042</b>
Body contact with O, Duration, Percentage	<b>rho</b>	0.341	0.152	0.076	0.030	-0.098	-0.156	-0.184	0.237	-0.094	-0.432
	<b>P</b>	0.153	0.535	0.757	0.903	0.689	0.522	0.451	0.343	0.702	0.065

N=19

**Table 3.4.2**

Part 2: Behavior variables for *Greeting by a stranger* (Attachment 4) correlated to the relevant questions from the behavior questions part one (Q 1), and part two (Q2) in the questionnaires

Correlation Spearman's rho		Q1 2	Q1 9	Q2 5	Q2 7	Q2 13	Q2 16	Q2 17
Move towards E, Latency	<b>rho</b>	-0.058	0.161	-0.143	0.154	-0.082	-0.373	-0.272
	<b>P</b>	0.809	0.498	0.548	0.516	0.731	0.105	0.246
Looking at O, Frequency	<b>rho</b>	0.159	0.026	0.010	0.093	-0.257	-0.335	-0.069
	<b>P</b>	0.503	0.914	0.965	0.698	0.274	0.149	0.774
Looking at E, Frequency	<b>rho</b>	-0.186	-0.185	-0.012	0.358	-0.419	-0.294	0.167
	<b>P</b>	0.433	0.434	0.958	0.121	0.066	0.208	0.481

N=20

**Table 3.4.3**

Part 3: Behavior variables for *Hug by owner* (Attachment 4) correlated to the relevant questions from the Behavior questions part one (Q 1), and part two (Q2) in the questionnaires

Correlation Spearman`s rho		Q1 4	Q1 5	Q2 9	Q2 13
Reaction Score	<b>rho</b>	-0.076	0.028	-0.193	-0.157
	<b>P</b>	1.000	0.904	0.402	0.495

N=21

**Table 3.4.4**

Part 4: Behavior variables for *Paying attention* (Attachment 4) correlated to the relevant questions from the Behavior questions part one (Q 1), and part two (Q2) in the questionnaires

Correlation Spearman`s rho		Q1 1	Q2 4	Q2 5	Q2 7	Q2 17
Approching E, Latency	<b>rho</b>	0.073	-0.341	0.282	0.225	0.390
	<b>P</b>	0.752	0.130	0.215	0.327	0.080
Touching the Box, Duration, Percentage	<b>rho</b>	0.152	0.178	0.001	0.333	0.283
	<b>P</b>	0.510	0.441	0.997	0.140	0.213
Looking at Box, Duration, Percentage	<b>rho</b>	0.089	0.039	-0.156	0.146	0.011
	<b>P</b>	0.700	0.866	0.499	0.526	0.961
Looking at O, Frequency	<b>rho</b>	-0.251	0.175	0.029	-0.023	0.155
	<b>P</b>	0.273	0.448	0.900	0.920	0.503
Looking at E, Frequency	<b>rho</b>	-0.188	<b>0.802</b>	-0.399	<b>0.467</b>	-0.006
	<b>P</b>	0.415	<b>&lt;0.001</b>	0.074	<b>0.033</b>	0.980
Looking at Misc, Duration, Percentage	<b>rho</b>	-0.040	-0.229	<b>0.441</b>	-0.147	0.183
	<b>P</b>	0.863	0.318	<b>0.045</b>	0.525	0.427
Looking total times, Frequency	<b>rho</b>	-0.284	<b>0.484</b>	-0.206	0.104	0.078
	<b>P</b>	0.213	<b>0.026</b>	0.370	0.655	0.737

N=21

**Table 3.4.5**

Part 5: Behavior variables for *Novel object* (Attachment 4) correlated to the relevant questions from the Behavior questions part one (Q 1), and part two (Q2) in the questionnaires

Correlation Spearman`s rho		Q1 1	Q1 2	Q2 3	Q2 12	Q2 15
Walking to TP, Frequency	<b>rho</b>	0.053	-0.075	-0.026	-0.393	<b>0.480</b>
	<b>P</b>	0.831	0.760	0.915	0.096	<b>0.038</b>
Area near TP, Latency	<b>rho</b>	0.071	-0.091	0.202	0.192	-0.151
	<b>P</b>	0.771	0.711	0.406	0.432	0.536
Look at TP, Duration, Percentage	<b>rho</b>	0.153	0.140	-0.193	0.129	0.209
	<b>P</b>	0.532	0.569	0.429	0.598	0.390
Look at O, Frequency	<b>rho</b>	-0.351	-0.280	-0.005	-0.285	-0.026
	<b>P</b>	0.141	0.246	0.983	0.237	0.915
Looking at E, Frequency	<b>rho</b>	-0.078	-0.005	0.165	0.110	-0.120
	<b>P</b>	0.751	0.985	0.499	0.654	0.626
Looking at Misc, Duration, Percentage	<b>rho</b>	0.087	-0.044	0.120	-0.246	-0.155
	<b>P</b>	0.723	0.858	0.626	0.310	0.526
Touch the TP, Frequency	<b>rho</b>	0.093	0.274	-0.159	0.065	0.071
	<b>P</b>	0.704	0.257	0.515	0.791	0.773
Vocalisation, Frequency	<b>rho</b>	0.207	-0.095	-0.211	-0.210	0.333
	<b>P</b>	0.395	0.700	0.387	0.389	0.164
Looking total times, Frequency	<b>rho</b>	-0.312	-0.325	0.123	-0.173	-0.172
	<b>P</b>	0.194	0.174	0.616	0.480	0.481

N=19

**Table 3.4.6**

Part 6: Behavior variables for *Choice test* (Attachment 4) correlated to the relevant questions from the Behavior questions part one (Q 1), and part two (Q2) in the questionnaires

Correlation Spearman`s rho		Q1 1	Q1 2	Q2 3	Q2 5	Q2 7	Q2 11	Q2 13	Q2 16	Q2 17	Q2 18	Q2 19
Choice total average time, Latency	<b>Rho</b>	-0.315	-0.247	-0.426	<b>0.475</b>	-0.112	-0.138	-0.038	0.269	0.391	-0.026	-0.338
	<b>P</b>	0.190	0.309	0.069	<b>0.040</b>	0.648	0.574	0.878	0.265	0.098	0.915	0.157

N=18

## Attachment 7

**Table 3.5.2.1**

Negative, Positive and Q1 scale scores compared to clockwise or counterclockwise direction on the first, second, third and fourth hair whorl on the chest, and the first and second hair whorl on the left and right leg in the Norwegian and Hungarian sample

Mann-Whitney U		Norway	Hungary			Norway	Hungary
		P	P			P	P
<b>Chest 1</b>	Negative	0.717	0.340	<b>Left leg 1</b>	Negative	0.986	0.545
	Positive	0.732	0.103		Positive	0.332	0.923
	Q1	0.224	0.623		Q1	0.285	0.757
<b>Chest 2</b>	Negative	0.082	0.525	<b>Left leg 2</b>	Negative	0.310	0.833
	Positive	<b>0.019</b>	0.832		Positive	1.000	0.677
	Q1	0.096	0.229		Q1	0.485	0.517
<b>Chest 3</b>	Negative	0.600	0.485	<b>Right leg 1</b>	Negative	0.174	0.059
	Positive	0.904	0.438		Positive	0.526	0.640
	Q1	0.840	0.699		Q1	0.976	0.950
<b>Chest 4</b>	Negative	1.000	1.000	<b>Right leg 2</b>	Negative	0.167	0.476
	Positive	0.857	0.667		Positive	0.717	0.762
	Q1	1.000	0.667		Q1	0.048	1.000

**Table 3.5.2.2**

Numbers of hair whorls on the chest, left leg and right leg compared to the Negative, Positive and Q1 scale score for the Norwegian and Hungarian sample

Correlations Spearman's-rho		Norway			Hungary		
		Negative	Positive	Q 1	Negative	Positive	Q1
<b>How many chest</b>	rho	0.029	-0.028	0.082	0.125	0.091	0.154
	P	0.637	0.649	0.179	0.138	0.284	0.068
<b>How many left</b>	rho	-0.003	0.071	0.041	-0.108	-0.015	-0.015
	P	0.962	0.243	0.501	0.203	0.863	0.864
<b>How many right</b>	rho	0.022	<b>0.138</b>	0.104	-0.014	0.035	0.028
	P	0.714	<b>0.023</b>	0.089	0.873	0.679	0.744

Norway N= 270, Hungary N= 141



