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Relaxing Dog?

Creating and testing non-vocal music in dog environments

Master's thesis in the Master programme Sound and vibration

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MASTER'S THESIS ACEX30

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Chalmers University of Technology
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Resting dog? Creating and testing non-vocal music in dog environments

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Abstract

Sounds of different kinds have an impact on humans as well as on animals. Regarding animals, it is known that for example dogs can be negatively affected by fireworks on new years eve. Hence, the owners try to facilitate for their dog through putting cotton wool in their ears, providing them de-stressing pheromones or even taking them to an airport hotel to get rid of the frightening noises of that night. However, the stress is not always caused by sudden noises. A trip to the veterinary can cause stress to the animal due to sound-, sight- and scent impressions. Is it possible to add sound to ease the experience in this type of situation?

This thesis work is a continuation of sound tests performed in dog environments. It overlaps the existing literature by testing classical music and expands the knowledge by also testing nature and ambient sounds with the aim to enhance dogs' welfare. The purpose of this study is to investigate whether it is possible to use sound design as a tool for improving dog environments.

The study is performed exploratively so that the assessors had a chance to provide feedback on the design of the forms. Direct observations were carried out in a dogs' daycare and at a veterinary station. The data processing was a combination of quantitative and a small part qualitative analysis.

The results are of varying character. However, two test sounds: ambient and classical, may have deactivating effects on some groups and individuals. Nature sound showed more activated behaviour in a majority of groups and individuals. Brayley & Montrose, (2016) and Bowman et al., (2017) supports the difficulties with certainty pointing out a universal genre or type of sound that would work deactivating on dogs in general. However, it is clear that individual preferences play an important role and that the variation itself can be a key to enhancing the welfare of dogs.

Keywords: Dog; stress, sound test, music test, welfare, heart rate, respiratory rate, veterinary station.

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CONTENT PAGES

1. Background

1.1 The dog - man's best friend

The well known expression "the dog is man's best friend" may extend more than 100 000 years back in time. At least that's when the co-operations in hunting with wolves are believed to have begun (Naturhistoriska riksmuseet, 2000). Then some individuals were tamed and hence eventually genetically modified into the domestic dog as it is known today (Harrison, 2019). However, according to NRM (2000) the domestication process is still ongoing.

Sounds have an impact on humans as well as on animals. Regarding animals, it is known that for instance dogs can be scared and stressed by fireworks on new years eve. Hence the owners try to facilitate for the dog through putting cotton wool in their ears, providing them de-stressing pheromones or even taking them to an airport hotel to get rid of the frightening noises of that night (Söderström, 2017). However, the stress is not always caused by sudden noises. According to Sveriges Lantbruksuniversitet (2021) a trip to the veterinary can cause stress to the animal due to sound-, sight- and scent impressions.

The welfare of animals, particularly in dogs, is prioritised in today's society where pet animals are highly valued and a natural part of many families. Studies are done to investigate the possibility of increased welfare in dogs (Beerda et al., 1998; 2000; Csoltova et al., 2017; Bergamasco et al., 2010; Boone et al., 2003; Bowman et al., 2015; 2017; Kogan et al., 2012; Köster et al., 2019; Palestrini et al., 2005 and Perego et al., 2015) and more.

1.2 History of music

Music is believed to be as old as humanity itself. In ancient times, music took shape from imitation of nature sounds such as the birds chirping. It had varying functions in daily life, for instance used to achieve hunting luck, for expression of feelings, for work purposes and to please the gods (Alm, 2015). In modern times, music is used as a mood setter on a great variety of occasions all the way from ceremonial festivities, such as weddings, to background music for everyday activities like work and exercise. Non-vocal sounds are commonly used for the purpose of relaxation, for example when performing meditation and yoga. It is already used for the purpose of calming dogs in for example shelter environments (Bergamasco, 2010; Brayley & Montrose, 2016).

1.2 Theory about psychoacoustics

According to Zwicker & Fastl (1999), psychoacoustics describe the relationships between physical stimuli and the sensations caused by them. In psychoacoustics there are several psychological parameters that can be used to describe the audio (auditory?) content, for instance loudness, which is used to describe the magnitude of an auditory sensation (Fletcher & Munson, 1933). Other parameters used to describe an intrinsic property of a sound are sharpness, roughness, fluctuation and tonality, claims R. Sottek (personal communication, 26 january 2021).

According to the International Organization of Standardization [ISO] (2020), the first step of detecting and representing the acoustic environment is the auditory sensations. The interpretation of it is connected to both conscious and unconscious processing of the auditory signal, thus creating information fit for use, advantageously leading to understanding of the acoustic environment (ISO, 2020). It also states that there is a function of neurological stimuli beginning when the auditory stimuli reaches the ears, more specifically the receptors. Further, R. Sottek (personal communication, 26 january 2021), suggests that the sound perception represents cognitively processed sounds conducing to feelings, states of emotion and recognition. The response includes, not only short-term reaction and emotion, but also behaviour (ISO, 2020).

1.3 Humans' and dogs' hearing

The human ear, with normal hearing, can detect sound from 20-70 Hz to 20 kHz while the hearing range of dogs is reaching from about 20 Hz to 70-100 kHz (Holistic Vet Practice, 2021; Kuttruff, 2007). According to Arriaga & Jarvis (2013) dogs hear up to 60 kHz and American Kennel Club (2018) claims that the they hear up to between 47-65 kHz. Hence there are frequencies that the dogs can hear that are not perceivable by their owners. For example, dogs are believed to hear mice performing ultrasonic vocalisation of 40 000 Hz (Arriaga & Jarvis, 2013). There is also a difference where dogs can hear softer sounds at high frequencies. In the range of 3 kHz to 12 kHz dogs can detect sounds in average between -5 to -15 dB(A) (American Kennel Club, 2018). They also claim that a comparison to humans above 12 kHz would be pointless since the sensitivity of dogs is much higher.

Furthermore dogs have the capability of hearing sounds that are four times the distance that the human ear can hear as well as finding the exact location of the sound much faster than humans (Holistic Vet Practice, 2021). On the other hand, humans are more sensitive in finding the difference in location between two sounds and can manage to do so by just a one degree angle, while dogs require eight degrees of separation (AKC, 2018). It is known that the hearing organs in humans

and dogs are mainly similarly shaped, with sound waves reaching the outer parts of the ear, then getting amplified in the middle ear before reaching the inner ear where they are transduced into electrical signals (Barber et al., 2020). However, the pinna of humans have small variation in size (Brucker et al., 2003 & Ito et al., 2001) while there is great variation in dogs due to body and head size. Nevertheless, the form of the pinna is depending on breed and amongst dogs there are three main forms: a) erect, which is seen in huskies, b) semi erect, on pugs and greyhounds and c) dropped, seen in poodles and beagles (Barber et al., 2020).

1.4 Stress in dogs

This chapter treats different aspects of stress. What is good and bad stress, how stress is visible in dogs and how it can be measured.

1.4.1 Good versus bad stress

There are two kinds of stress in dogs, one that is good and one that is bad (Virbac, 2019). The “good” stress is the one caused by physical activity that releases adrenaline during play or exercise. This has a positive impact on the dog if it is obtained in a moderate amount. The “bad” stress, however, has a negative impact on the animal and causes high levels of the hormone cortisol, which weakens the production of the adrenaline and breaks down the immune system. Apart from weakened immune systems, high levels of cortisol may lead to: early ageing, allergies, infections, eating disorders, decalcification, skin problems and poor healing of wounds (Virbac, 2019).

1.4.2 Physical and behavioural signs on stress

Stress-related behaviours that are seen in dogs are barking, whining, hypersalivation, low posture, yawning, licking around the mouth, trembling or turning away (Beerda et al., 1997; 1998). Other physical indicators might be panting and shaking claims (Beerda et al., 1997 & Bodnariu 2008). Furthermore, acute stress can be detected when dogs perform excessive vocalisations, other than barking: growling and whimpering (Beerda et al., 1998), as well as increased activity (Beerda et al., 2000). According to Bodnariu (2008) stress is also seen on a lowered tail and a curled up body. Pursuant to Virbac (2019) more signs of stress in dogs are showing teeth, excessive drooling, tail between legs and the body weight on the hind legs, blinking and having dilated pupils, ears in a flat position, vomiting or diarrhoea and decreased appetite.

In a summary article, about the welfare in dogs in a kennel environment, Rooney et al. (2009) claims that behavioural changes due to stress are appearing of great

variation depending on individuals. For instance, dogs that seem calm, rest a lot and are quiet can have a high inner stress anyway.

1.4.3 How to measure stress

One way to estimate the stress level in dogs is to measure heart rate, which is a physiological parameter used in a handful of studies (Beerda et al., 1998; Bergamasco et al., 2010; Csoltova et al., 2017; Palestrini et al., 2005; Perego et al., 2014). Heart rate has the units of beats per minute (bpm) and has a close relation to another measure, namely heart rate variability or HRV (Bilchick, 2006). HRV has units in time in milliseconds (ms) (Bilchick, 2006) and is a measure of variety in the autonomic tone between consecutive heart beats (Köster et al., 2019). Further, Köster et al., (2019) claims that the HRV is affected by psychophysiological factors, neurohormonal mechanisms and cardiac disease. There are several other ways of reading stress levels in dogs. For instance, measuring respiratory rate, blood pressure, checking levels of secreted hormones and measuring body fluids as urine and saliva (Beerda et al, 1997 & Bodnariu, 2008). According to Beerda et al, the level of cortisol is an indicator of chronic stress and can be measured in both urine and in the fur.

1.4.4 From earlier research: stress measurements

Heart rate and cortisol level in the blood was measured on two groups of dogs in a veterinary environment (Perego et al., 2014). Group A were waiting indoors in the veterinary waiting room and group B waited in a garden outside. The results showed that both cortisol level and heart rate were higher in the dogs of group A, and hence they were considered more stressed than the dogs of group B.

The stress level in dogs may also be evaluated by behavioural parameters such as posture, walking, sitting and standing, inactivity (resting and sleeping) and vocalisation (barking and howling) according to Brayley & Montrose (2016). In Beerda et al. (1998) noninvasive sampling methods including saliva cortisol and heart rate are used to affect the results minimally and to make the test flexible in terms of not being bound to an experimental setting. The two methods were used to support the visual assessment and both measures were shown to have a strong connection to the dogs' behaviours. For instance Beerda et al. (1998) claims that dogs with high levels of saliva cortisol also showed low posture which according to the same study is a sign of high stress levels. However, according to Bergamasco et al., (2010) the correlation between cortisol levels and heart rate variability or behavioural signs on stress is poor. It is believed to be due to high inter subject variability.

For identifying varying behavioural types in dogs when exposed to a stressful situation, a study performed on police dogs analysed the behaviour of 60 German Shepherds meeting a person acting threateningly (Hórvath et al., 2007). Cortisol levels were measured during a state of baseline but also after the encounter with the figurant. The results led to three different groups divided from cortisol levels and behaviour. Group 1, who was seen using a *passive management strategy* had a low, yet significant increase of cortisol level. Their behaviour was mainly ruled by fear and they showed the lowest activity level of all participants and it took some time before they decided to attack the threatful person.

Group 2 included the dogs who used an *active management strategy* and behaved obviously aggressively. This group had no significant increase of cortisol, nevertheless, they attacked the person straight away. Group 3 was said to be *ambivalent* where they showed mixed behaviour between *passive* and *active management strategy.* This group first showed an active reaction, but then changed and became passive when the figurant approached them. This group also held the greatest variation in cortisol levels. According to Hórvath et al., (2007) both strategies are natural ways for the dogs to handle stressful situations. In the case of group 3, a solution does not come naturally, leading to high levels of stress. Further it claims that the individuals of group 3 might have been abandoning their strategies due to ageing or gaining new experiences, which presented a transition phase (Hórvath et al., 2007).

In a study by Mariti et al. (2015), dogs and owners were filmed for 3 minutes while at the waiting room in a veterinary hospital. The frequency and duration of stress related behaviour was later evaluated from the recording. Each dog owner assessed the dogs behaviour and concluded if it indicated low, medium or high stress levels and a veterinarian did the same for each animal. The answers of the owners and the veterinarians were low in conformity. The owners assessments did not correlate with either frequency or duration of the stress related behaviours. However, the veterinarians showed strong- and medium correlation in the duration respectively the frequency of showed stress behaviours (Mariti et al., 2015). The main difference was that the dog owners noticed clear physical signs such as when the dogs tried to flee or hide, while the veterinarians also included more subtle signals such as the direction of the ears and tails for example (Mariti et al., 2015).

1.5 Music testing for enhancing the welfare of dogs

1.5.1 Tests in kennel environments

A study performed on shelter dogs in Oxford, England showed that dogs exposed to such stimulating and possibly stressful environments could be calmed by sounds

playing in their room (Brayley & Montrose, 2016). In the study, several sounds, including Beethoven's classical music, mixed pop music, special "dog calming music", consisting mainly of classical music and audiobook, were tested in a random order to investigate if they might have a calming effect on the dogs. The classical music was expected to have the most soothing impact, however the audiobook led to calm and resting kennel dogs, better than any other played sound (Brayley & Montrose, 2016). The pop music and the playlist of dog calming music, however, did not show any changes in behaviour.

Kenneled dogs were exposed to different kinds of music including classical, heavy metal and specifically designed classical music for calming dogs (Kogan et al., 2012). It was seen that the heavy metal music led to body shaking and low postures indicating a negative impact. Another study, based on classical music exclusively, Bowman et al., (2015), determined that the kenneled dogs showed more relaxed behaviours than the control group that were exposed to silence for the same amount of time. Both studies ascertained increased sleeping when classical music was played (Bowman et al., 2015; Kogan et al., 2012). Further, another study on kenneled dogs by Bowman et al., (2017) tested more genres including soft rock, motown, reggae, pop and classical music. It was determined that reggae and soft rock provided increased heart rate variability and contributed to more relaxed behaviours than motown, pop and classical music showing less effect on the dogs. Regardless of the varying effect due to genre, the study suggests that the variation itself is favourable since it provides for reducing the effect of habituation that was seen the day after introducing music to kennelled dogs (Bowman et al, 2015).

1.5.2 Tests in hospital environments

A study of harp therapy and the music's effect on dogs was done in a veterinary hospital setting. Dogs of three different test groups (determined by how long their hospitalisation time was) and a control group were included (Boone & Quelch, 2003). The harp music was performed live for 60 minutes. The effect of the harp was evaluated by visual measures of discomfort such as: restlessness, anxiety and respiration. All three parameters were seen to decrease in comparison to the test group that was not exposed to the harp therapy.

1.5.3 The owners influence on the dog's behaviour

A study suggests that dogs develop a bond to their owner that is comparable to the one between a human baby and their parents (Horn et al., 2013). The study was based around testing if the dogs would respond differently to the following categories: 1. Absent owner, 2. Silent owner and 3. Encouraging owner. A follow-up experiment was also done with 4. Replaced owner. What was inspected was the dogs' degree of priority in manipulating interactive dog toys, where they would get

food as reward if doing so. The outcome was that the dogs were much more keen on working for food when the owner was present. If the owner was encouraging or silent had little importance of the results. When the owner was replaced by an unknown person the dogs showed little interest in working for the food when this person was present, compared to when it was not. Horn et al. (2013) draw the conclusion that this relationship is comparable to the “secure base effect” that can be found in relationships between young children and their parents. What distinguishes the result is that also adult dogs behaved in this way towards their owner. This substantiates the fact that most dogs remain in the puppy stage their whole lives, not chasing, nor reproducing but getting cared for and fed by one or a few human “parents” (Warner, 2007). In medical terms this is called “neoteny” and means that the youth characteristics of the wild ancestors remains when the domestic dogs are getting older and hence the dogs never evolved the behaviour or traits of character of the grown wolves (NRM, 2020).

Dogs are affected by the emotional state- and react to stress in humans (Zubedat et al, 2014). For instance, it was demonstrated that dogs at the veterinary station got decreased heart rate from interactions with their owner (Csoltova et al., 2017). In this study, two groups were examined at the veterinary station. In one group, the owner remained present but did not interact with the dog and in the second they also remained but were also petting the dog meanwhile it was investigated. The dogs of the second group were seen to have much lower ocular outer temperature and heart rate, and were hence assessed to have a lower level of stress. However the participants of both groups were showing similar stress related behaviours while being investigated. Studies also indicate that the level of oxytocin and cortisol increases when interacting with humans (Handlin, 2010).

1.6 Aim and questions of issue

The purpose of this thesis is to investigate whether non-vocal music can have an influence in dog environments such as dogs daycare and veterinary stations.

Following are the questions of issue:

1. Is it possible to increase the dogs’ welfare in different environments by non-vocal sounds?

2. Which sound seems to have the greatest impact on the dogs?

3. Is heart rate correlated to stress level in dogs?

4. Can non-vocal music make dogs rest more in their everyday environment?

2. Method and equipment

This chapter provides information about the preparations to the study and will describe how the sound tests were carried out, treating both equipment and procedure implementation.

2.1 Contacting partners and performing site visits

The first step of the study was to localise relevant partners for carrying out the experiments. Professionals and people of great experience were contacted per telephone. Two veterinary stations were asked and one of them was positive to try the test sounds in their waiting room and in their personnel dogs area. Regarding the dogs daycares, the question was asked to two different businesses where one was interested in participating in the study.

A site visit was performed at each test location to collect information about the building's and room's design and hence decide for the most optimal placing of the equipment such as loudspeakers and cables. During the site visits the executive of each place was interviewed regarding schedules, most busy times of the day and the week to get further information to the decision for when the sound test is optimal to be carried out considering minimising biases.

2.2 The test environments

Following chapter treats the environments where the sound tests were carried out. It explains what kind of space it is and provides some information about the businesses that were received during the site visits.

2.2.1 Dogs' daycare Hund i Centrum

At the dogs daycare Hund i centrum on Hildebrandsgatan in Gothenburg, the dogs were divided into herds of approximately five to eight dogs with a composition based on age, gender and simply behaviour. According to M. Bodén (personal communication, 1 october, 2021) the older dogs teach the younger how to behave. The caregivers use only "soft methods" to communicate with the dogs, for instance, they never use punishment, only set boundaries in combination with diversion of focus and motivation.

The herds were separated in two connected large rooms. In the center of the outer room, with aisles around them, there were nine herd rooms and the inner room holds in total 8 herd rooms. However, the herd rooms of the inner room are placed on the long sides of the room and the aisle extends between them, with four on

each side. They all consist of three semi walls and one higher wall in the back, and small windows in between rooms. According to M. Bodén (personal communication, 1 october, 2021) this is so that the dogs can see each other and the caregivers, leading to less wondering and visualisation due to clear facts about what is going on.

The design at the dogs daycare was not left to chance since the colouration was carefully done to match the degree of activation that the caregivers had intended. The walls on the side of the aisles, leading to the dogs' rooms are coloured in a calm grey shade, to not be triggering but neutral, see *Figure 1*.

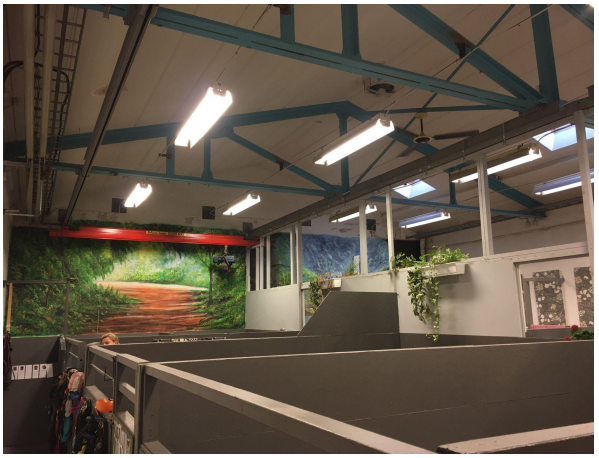


Figure 1. The grey walls in the outer room.

The walls inside the dogs' rooms were painted in the same shade of grey, however they had paintings in different bright colours hung on them, because the dogs are allowed to get activated within the herd/flock, said M. Bodén (personal communication, 1 october, 2021), see *Figure 2*.

Figure 2. Coloured paintings in a herd room.

2.2.2 Veterinary station

The veterinary station is centrally situated on the first floor of a smaller apartment building. The waiting room consists of two smaller areas with a few seatings in each, divided by a semi-wall with two see-through windows in usual window height, see *Figure 3 and Figure 4*.

Figure 3. The waiting room at the veterinary.

Figure 4. The waiting room at the veterinary.

The two areas are connected to the reception disk that is always manned during opening hours. Inside this space there is an additional room intended as a cat waiting room.

2.2.3 Personnel dogs rooms

The personnel dogs are located in the veterinary station's branch clinic situated in the countryside. It's located in newly built premises that are larger than the small veterinary practice. The personnel dogs reside in three different rooms connected to a corridor. Each dog has its own box room, each of approximately three square feet. In between the box rooms there are semi walls to provide for the dogs to hear and weather each other, see *Figure 5*.

Figure 5. The semi walls between the boxes.

The premises are bright and the walls are painted white. Some of the box rooms have windows that provide for a big amount of daylight, see *Figure 6*.

Figure 6. Boxes with windows in the back.

2.3 Description of the test sounds

Following chapter describes the test sounds in terms of content and production procedure. Earlier studies, such as Kogan et al., (2012) & Bowman et al., (2017) have used several sounds including different genres with vocal parts and classical music. This study is however based on non-vocal test sounds/music. The three pieces of test music were created and produced by the sound architect Margareta Andersson and the producer Alexander Kassberg at Efterklang - Part of AFRY. The

different styles are nature sound, ambient sound and classical music. The sound files are included in the following link to be listened to: https://we.tl/t-dJC82WADVt

2.3.1 Test sound 1, Nature sound

This sound consists of different sounds of the woods. Varying sound sources, including birds chirping, hissing leaves and wind, are manually mixed together to get a static sound image. Nonetheless it should be experienced as varied. The birds heard are common in Sweden, such as chaffinch, willow warbler and blackbird. They are produced to sound evenly loud, sharp, bright and to be perceived as equally far away. Due to the hissing leaves and the wind, the sound image has a roughness to it. Following, *Figure 7*, shows the spectrogram of the nature sound. The production is half an hour long and will therefore be looped when tested.

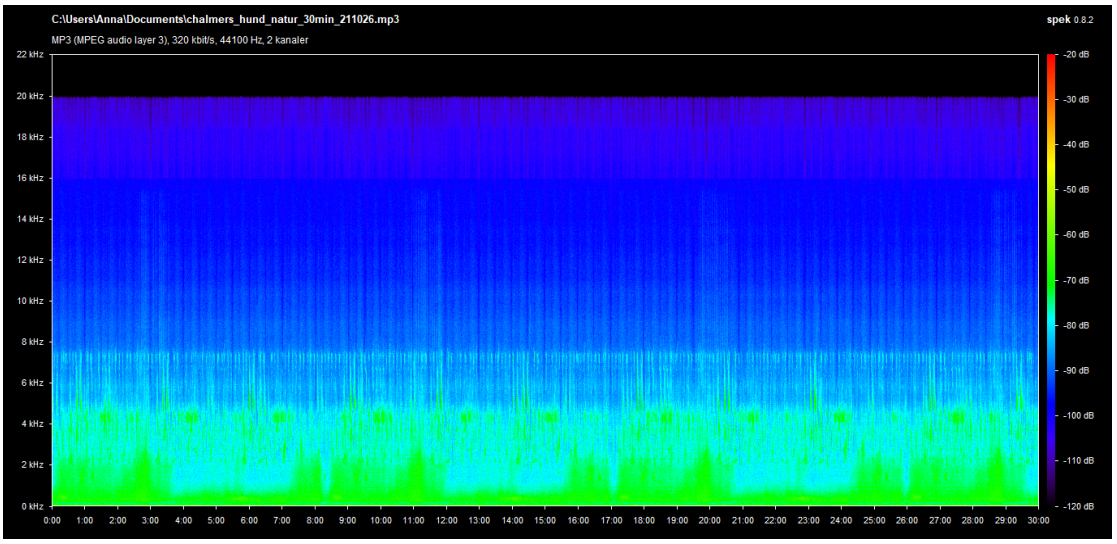


Figure 7. Spectrogram of the nature sound.

It shows frequency and sound pressure level on the vertical axis from 0 to 20 kHz (on the left) respectively from 20 to 120 dB (on the right) and time from 0 to 30 minutes (which is the length of the sound file). The intensity, in decibels, is defined by the blue/blackening rate. In this case, the bright green parts reach from 55 to approximately 75 dB and are turning into light blue and dark blue, the higher the level gets, all the way up to 120 dB. *Figure 8* shows the frequency content of the nature sound production on the horizontal axis and the sound pressure level extends from 0 to 140 dB. The frequency content is seen to be statically distributed where all octave bands up to about 4 kHz are equally strong. When going higher, the treble decreases steeply with time except for a peak at approximately 7,5 kHz. The peak is due to a certain bird song that makes it distinct.

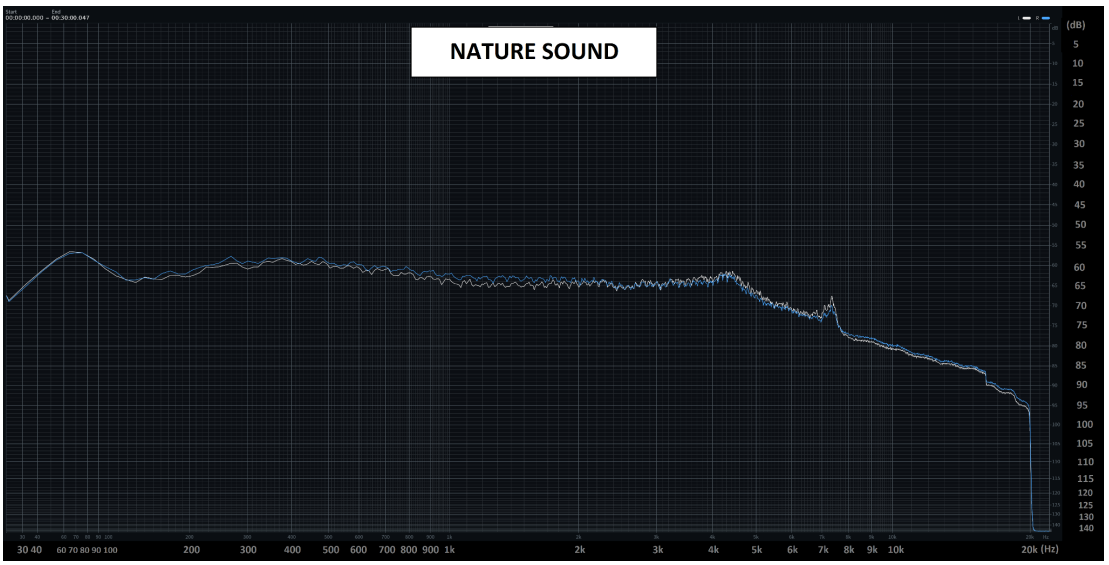


Figure 8. Frequency content of the nature sound.

2.3.2 Test sound 2, Ambient “spa” music

This sound is toned down musical ambience. It’s produced to give a tasteful, smooth and soft impression. It is based on different ambient songs that mainly lack beat, rhythm and melody and are primarily built around tonal drones. *Figure 9.* presents the spectrogram of the ambient “spa” music. The production is one hour long and will therefore be looped when tested.

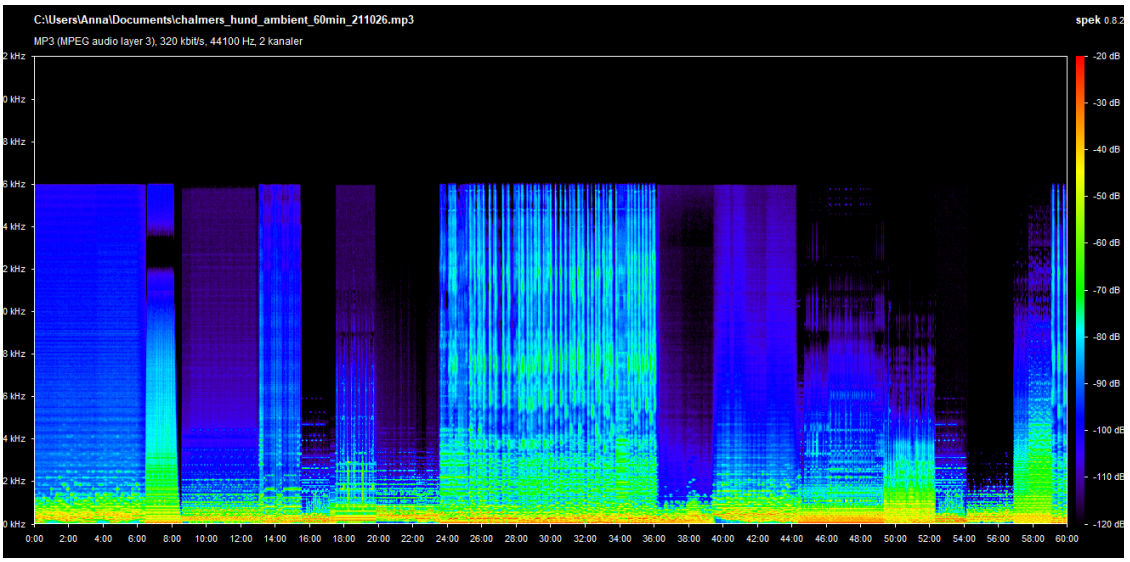


Figure 9. Spectrogram of the ambient “spa” sound.

The ambient sound is distinctly broad banded. The red, yellow, blue and green parts present a sound pressure level between 20-80 dB(A), while the dark blue/purple and black parts go from 80-120 dB(A). The frequency content reaches from 20 Hz

to approximately 16 kHz. There is great variation in the spectrogram due to large spectral variation since the test sound is composed by songs that have varying spectral content. *Figure 10.* shows the frequency content of the ambient test sound.

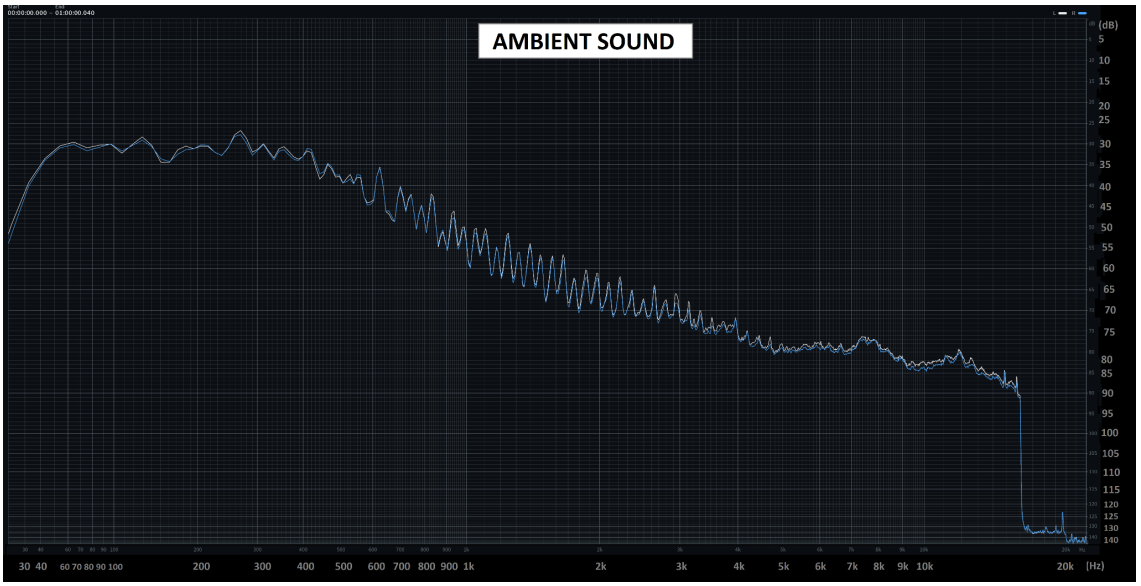


Figure 10. Frequency content of the ambient "spa" sound.

The frequency curve in *Figure 10.* is steadily decreasing with about 10 dB per octave band. This is explained by the music being generally muffled and being low in treble.

2.3.3 Test sound 3, Beethoven

This sound is classical music based on Beethoven's piano compositions. The pieces included are carefully chosen to be dynamically uniform. Hence the recordings are processed with a compressor so that the dynamic range is reduced. Further, the recordings have a slow tempo and they are mainly in major keys. The production is one hour long and will therefore be looped when tested. *Figure 11.* shows the spectrogram of the Beethoven classical music.

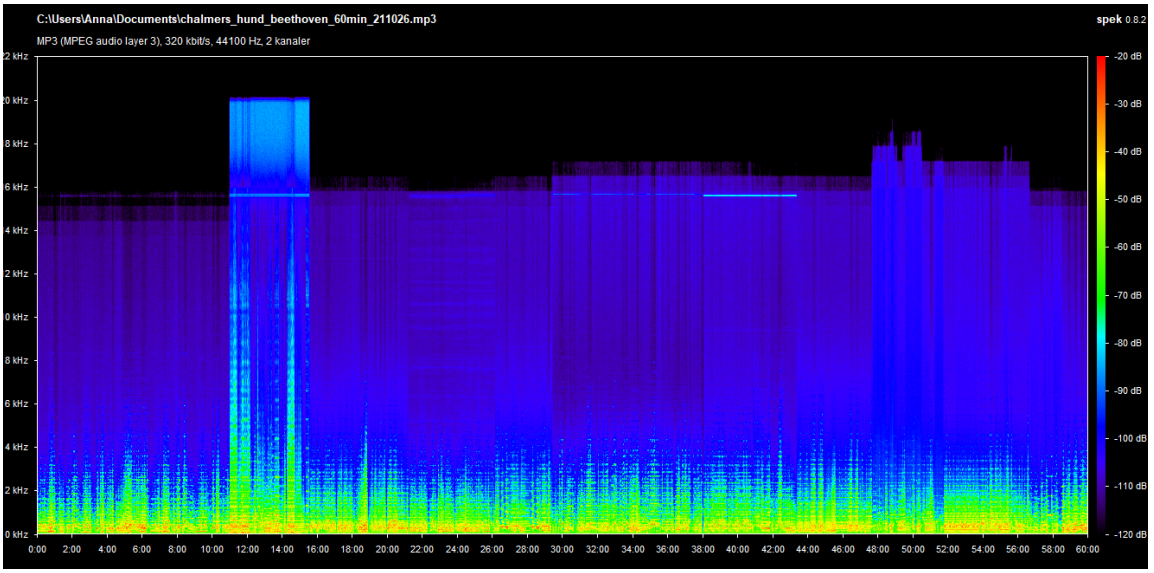


Figure 11. Spectrogram of the Beethoven sound.

It is broad banded and low in base content since it consists of mainly the middle register and a little below and above which is included between 27,5 Hz at the A0 key to 4186 Hz at the C8 key (Hyper physics, n.d). *Figure 12.* shows the frequency curve of the Beethoven sound.

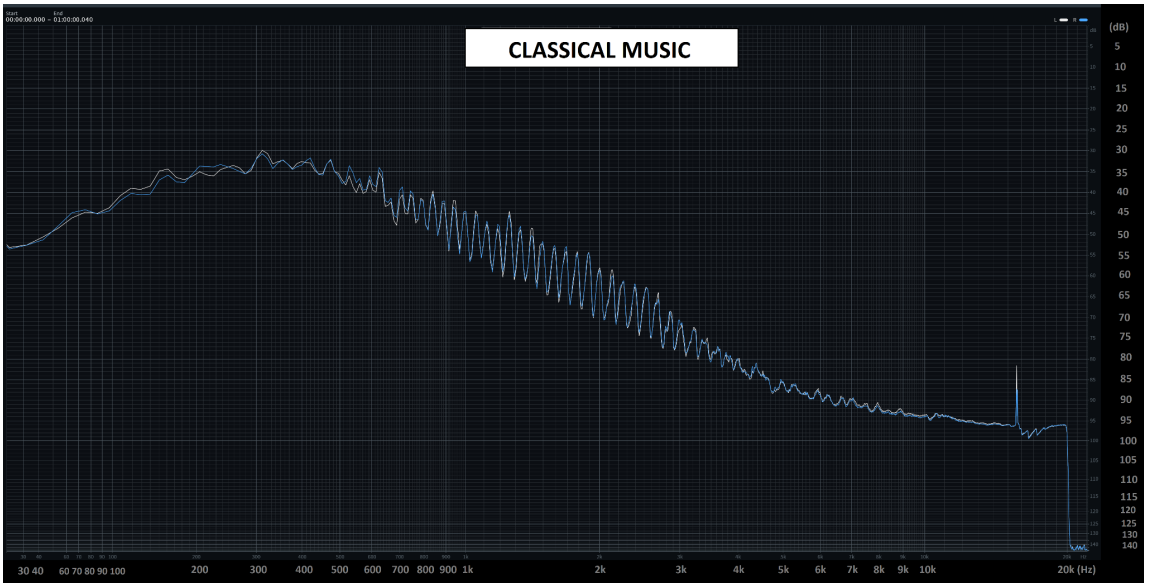


Figure 12. Frequency content of the Beethoven sound.

It is decreasing by approximately 6 dB per octave band and the base content is strongest in about 400 Hz.

2.4 Equipment, installation and sound test design

Following chapters describe what musical equipment was used, how it was installed and then how the sound tests were to be carried out at each test location. The placing of the loudspeakers was done with taking into consideration that one solid wall may increase the sound pressure level in low frequencies by 6 dB respectively by 12 dB when placed in a corner (Genelec, 2021). *Table 1.* below shows the equipment and its quantity used in the sound tests. The computer was used to play back the sound productions with its media player, the splitter is the connection between the computer and the loudspeakers. It was connected to the computer by an XLR/AUX-cable as input and gives output to XLR-cables that are connected to the loudspeakers.

Table 1. Equipment and quantity.

Type of equipment	**Model**
Computer	SAMSUNG NF 210
Splitter with AUX	behringer DS2800
Loudspeaker x6	Genelec 8020DPM-6
Stands x6	
XLR-cables	
Power extension cables	

2.4.1 Dogs' daycare

In the Dogs' daycare the mounting was done in the afternoon of November the second. Three loudspeakers were mounted on stands in each of the two large rooms including six to eight smaller dog rooms, or boxes, that are open with semi walls and no ceiling. See *Figure 13* and *Figure 17* for the positions of the dogs rooms: A,B,C,D,E and F. The loudspeakers were mounted to 164 cm above the floor, where the upper tweeter has its center at 160 cm and the lower at 150 cm. They are placed in the three corners; the fourth corner in both large rooms is actually inside a dog room, and is therefore not used for this test. The placing of loudspeakers was discussed with Alexander Kassberg, the producer, since it is known that the corner position may amplify the bass content. However it was decided to be appropriate to put them close to the walls and/or in corners since the productions have none or little bass content and hence the enrichening effect would be an advantage. The loudspeakers, especially the three in the room in the back (the inner room), see *Figure 13*,

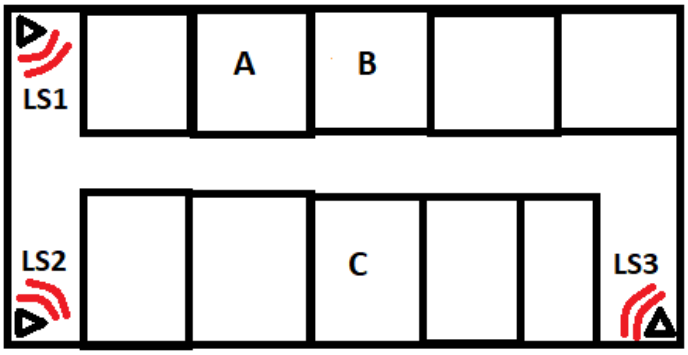


Figure 13. *Schematic sketch on the placing of the dog rooms A, B & C and loudspeakers in the inner room.*

were extended by several XLR-cables and taped along the floor in the corridor leading to the front room, to reach the splitter in the front room as seen in *Figure 17*. The position of loudspeaker 1 is shown in *Figure 14.*

Figure 14. Position of loudspeaker 1.

This loudspeaker is placed between the washing machine and the shelf of dog blankets. Loudspeaker 2 and 3 are placed as in *Figure 15* and *Figure 16*.

Figure 15. Position of loudspeaker 2

Figure 16. Position of loudspeaker 3.

The splitter and the computer used to play back the test music was placed on a shelf in the front room, see “split” in *Figure 17* for their position relative to the dog rooms D, E and F.

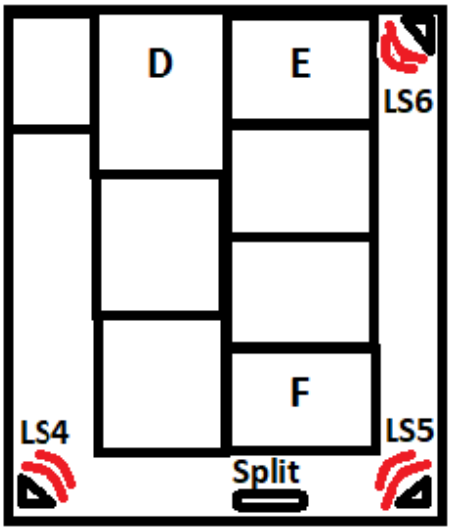


Figure 17. Schematic sketch on the placing of the dog rooms D, E & F, loudspeakers 4, 5 & 6 and the splitter.

The placing of loudspeakers 4,5 and 6 in the front room are *Figure 18, 19 and 20.*

Figure 18. Placing of loudspeaker 4.

Figure 19. Placing of loudspeaker 5.

Figure 20. Placing of loudspeaker 6.

The sound test was carried out during four weeks. The first week was used to collect information about the baseline, hence no sound was played that week. Since the habituation is seen already on the second day of sound exposure (Bowman et al, 2015) the music was chosen to be played on mondays, wednesdays and fridays. These days were also considered most interesting to investigate due to the usual energy level at the dogs daycare. According to M. Bodén (october, 2021) mondays

are generally the day with the most noisy environment, while tuesday, wednesday and thursday usually are a little calmer, and friday is usually the calmest day since there are fewer dogs coming that day.

2.4.2 Veterinary waiting room

In the waiting room at the veterinary station, the loudspeakers were not mounted since the number of participants was non-existent during the baseline week of “no sound” and hence the sound test could not be carried out as planned.

2.4.3 Veterinary personnel dogs rooms

The musical equipment was mounted in the three different facilities of the dog's rooms on December third. Hence two loudspeakers were placed in each part to give an evenly spread sound and sound pressure level to the dogs’ rooms along the hallway and in the room in the back of the veterinary station, where the personnel dogs reside during the weekdays, see *Figure 21*. Thereafter, the loudspeakers were connected to the splitter and computer by cables placed and taped along the floors.

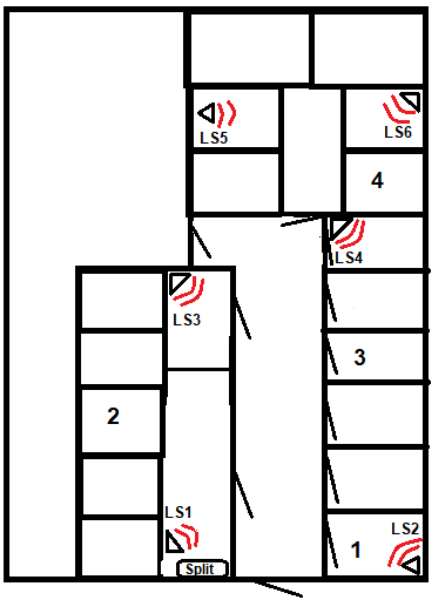


Figure 21. Schematic sketch on the placing of the dog rooms, loudspeakers 1-6 and the splitter.

In the outer room, there were five boxes behind the wall and doors to the left from the corridor where Loudspeaker 1 and 3 are placed, see *Figure 22* and *23* for position. This room is where Dog 2 resides and is marked with the number 2.

Figure 22. Placing of loudspeaker 1, splitter and computer.

Figure 23. Placing loudspeaker 3.

Further, six rooms, each with a door straight to the corridor is seen on the right side in *Figure 21*. In this area, the dogs can not see each other, but since the rooms, both to the left and to the right from the corridor, consist of semi walls between them, the dogs can hear and weather each other. Here Dog 1 is placed together with loudspeaker 2, see *Figure 24,* in the first room and Dog 3 stays in the fourth room, see *Figure 21*. Loudspeaker 4 is placed in the sixth room, see *Figure 25*.

Figure 24. Placing of loudspeaker 2.

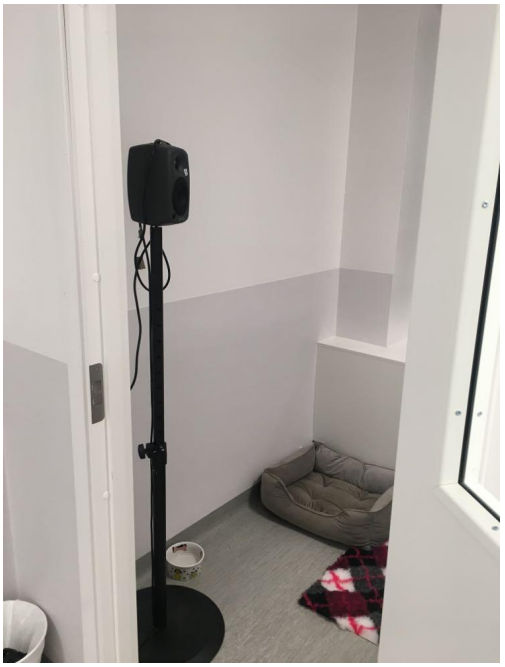


Figure 25. Placing of loudspeaker 4.

In the inner room, at the end of the corridor, there were six boxes in a room with a door connecting the area to the corridor and Dog 4 was placed there, see *Figure 21*. Here, the boxes had doors made from plexi glass and no ceiling so that the dogs could see, hear and weather each other. This is made possible from the design where the boxes are placed along the walls of a quadratic room with the doors facing the open area in the middle. Loudspeakers 5 and 6 are placed in this room, see *Figure 26* and *27* for positions.

Figure 26. Placing of loudspeaker 5.

Figure 27. Placing of loudspeaker 6.

The different test music was playing during the following three weeks from monday-sunday and on the fourth week, baseline was evaluated. Since there was very little results submitted from this test period, an information occasion was held at the morning meeting at the veterinary clinic on Monday tenth of January to present the objectives and promote the advantages of the test and hence the tests were started over during January and the beginning of February.

2.5 Participants

The following chapter describes the participants of the sound test in terms of age, gender and breed.

2.5.1 Dogs daycare

Thirty five family pet dogs, 14 females and 21 males, aged between 1 and 11 years, with a mean of 4,07 years participated in the study. They were of varying breeds

including pincher, lagotto, Shi-Zhu, french bulldog, Corgi, Miniature schnauzer, schäfer, whippet, barbet, Golden retriever, Labrador, Irish setter, Toller and about half of the dogs were of mixed race. Not all dogs were spayed or neutered, the proportion varied between 29 to 83 % in the six test groups depending on day. The quota of females and males was of great variation depending on gender and behaviour and the amount of dogs in each room was varying from three to eight during the weeks. As far as the caregivers knew, all dogs were of good health and had normal hearing.

2.5.2 Veterinary waiting room

The dogs planned to be included in the study were coming to the veterinary station to get their yearly vaccine. It was said to be about 10-15 bookings per day. However there was only one participant, a Dalmatian named Charlie.

2.5.3 Veterinary personnel dogs

The four dogs participating are owned by the staff including receptionists, veterinarians and nurses at the veterinary station. There are two females and two males. The dogs are of different ages and breeds. Ages were varying from eight months to nine years. Breeds were Australian Shepherd, Border terrier, Cockerspaniel and mixed race.

2.6 Design of the forms

The design and the content of the forms are presented in this chapter. They were made exclusively for each test location, to provide as accurate data as possible. The statistical analysis method is explorative, which means a combination of performing calculations with visualisations and manual observations.

2.6.1 Dogs daycare

The form, see *Appendix BI-B*, was done to be filled in by caregivers during the work day. It was sent by e-mail to the dog scientists named “Hundvetarna” in Gothenburg. The feedback given from Hundvetarna was that the form looked good and was concise. The form was also tested by the caregivers on the week before the test start to see if it could be optimised. It was thereafter edited to suit the workflow better and hence divided into five smaller forms so that each judgement could be sent in straight after it was done. It includes the mood and stress level of the employee, the mood, stress level and behaviour amongst the dogs collectively and also on a randomly chosen dog. The judgement is done continuously from the opening at 05:30 to the time for turning the test sound off at 16:00. In between there are further investigations where the heart rate and breathing frequency are measured at 09:00, 11:00, 13:00 and 15:00. The fifth form is done first thing in the

morning and is based on questions regarding the balance of dogs. It includes practical questions about what day and time it is, how many males respectively females there are in each room, how many of them are neutered and what size they are. The forms are done and collected electronically from Google Forms.

2.6.2 Veterinary waiting room

The forms were initially planned to be two; one to the veterinary nurse and one to the dog's owner. However, the veterinary nurse resigned from the study two weeks before the intended start and hence only the form intended for the owners was used. The form, see *Appendix CII*, was placed as a QR-code in the reception but also printed if needed. It includes practical questions such as what day and time it is and what chair they sit in while waiting. Furthermore, there are questions based on the owner's mood and stress level, the dog's mood and stress level, gender, age, size, if it's neutered or not. The questions regarding mood and stress level are repeated three times during, in total, ten minutes of sitting down in the waiting room. The owner is asked to check what time it is and wait three minutes before answering the questions and then repeat it two times. The dog's name is asked for but it's mentioned that it might be made up if the owner wants it to be anonymous. The form is collected electronically as a Google form and the personnel in the reception are saving the eventual physical forms in a folder.

2.6.3 Veterinary personnel dogs

The form, see *Appendix CIII*, was developed to be filled out by the personnel that have their dogs in the back of the veterinary station while at work. It is designed to be filled a couple of times a day. First time when they get to work and put their dog in the dogs' rooms, second time in the lunch break and third time when picking up the dog before leaving for the day. The form was splitted into three shorter for ease of use so that it could be sent in straight away at each assessment.

2.7 Ethics

The following section describes how ethics was taken into account while performing the study. The methods were chosen to be non-invasive to have as little negative impact on the dogs' experience and stress levels as possible. The sound pressure level of the sound tests was set from 40 to 65 dB, and preferably around 60 dB which is the level of normal speech, taking into consideration that the sound elements never would be damaging, since they play for about eight hours a day.

2.7.1 Dogs daycare

The dogs participating in the study were family pet dogs. The owners were informed about the sound tests a couple of weeks before the start by the daycare's communication app and gave their consent in the same. The mounting of the loudspeakers was done in the afternoon when few dogs are there, not to disturb them (since no one but the care givers are allowed in the rooms normally). What is positive for the dogs' experience of the test is that they did not have to go into any lab or other test location, but be in their "natural habitat" at the daycare. The assessment was 100 percent non-invasive. It mainly consisted of visual assessment on the chosen groups and individuals, that did not disturb the dogs at all. The individuals were also evaluated for heart and respiratory rate, where respective value was measured during one minute four times a day.

2.7.2 Veterinary waiting room

The owners were said to be asked by telephone, while booking the vaccination slot, if they wanted their dog to participate in the study. If they agreed they got the form when arriving at the veterinary station. The evaluation of the dogs was planned to be carried out by the owner and the veterinary nurse and take about ten minutes. To begin with, both would do visual assessments on behaviour and the nurse would measure the heart rate as complement, which is a non-invasive method.

2.7.3 Veterinary personnel dogs

The personnel having their dog at work were asked by their boss if they wanted to participate in the study. The positive ones were further informed about the study and the forms that were to be filled in. The dogs participating did not have to go anywhere new to do the test, but remained in their everyday environment. The assessments were 100 percent non-invasive. The main focus was heart and respiratory rate that was measured three times a day, if the dogs accepted the interplay with their owner. Being evaluated by the owner is also a lenient way of carrying out the evaluation, since the dogs are used to being handled by them, and hence it would probably not disturb the dogs psychologically.

2.8 Data processing

Following chapter describes how the results have been handled and calculated.

2.8.1 Quantitative analysis

At the dogs daycare, the data is gathered four times per day during one, two or three days of each week resulting in a maximum of twelve data points per assessed behaviour, which brings a total of 48 data points for each behaviour/activity throughout the four test weeks. The veterinary waiting room did not yield any usable data for calculations. The personnel dogs at the veterinary station were planned to give three data points per day for heart rate respectively respiratory rate and be repeated two times each week, resulting in six data points per week and test sound. All data originates from direct observations.

The first evaluation of the results were calculations of change in each variable at the dogs daycare. They were calculated from subtracting the baseline level from the mean of the week of each test sound and dividing it by the baseline mean level, to obtain the percentage change. Mean values and standard deviations of heart rate and respiratory rate were calculated for each individual: A,B,C,D,E & F and 1, 2,3 & 4 regarding all four cases of baseline, nature sound, ambient sound and classical music. The results are presented in chapter **3.1.6 Heart rate and respiratory rate** and in chapter **3.3** for the personnel dogs. Further, t-tests were performed on the mean values, to compare the baseline with the three respective test sounds on the variables at the dogs daycare in chapter **3.1.7 Music versus baseline in each individual** and **3.1.8 Baseline and music in groups.**

Regarding the veterinary, there was just one dog that had handed in correct data and hence could be used for t-test in chapter 3.3.6 Heart- and respiratory rate of dog 1.

2.8.3 Qualitative analysis

A qualitative analysis was done on free text answers from the assessors observations. The dogs' behaviour was assessed in short, four times each day. The "comments" were categorised in Relaxation, Excitement and energetic behaviour, Impact of negative stress and General impact of the test sounds. This method is derived from an inductive perspective (bottom-up), hence it does not originate from a deductive method, starting from theory and performing hypothesis testing, which is the most common. The results are presented in chapter **3.1.9 Qualitative categorising of the assessors utterances from direct observations.**

3. Results

The results of the sound tests will be presented separately below for each test location.

3.1 Dogs daycare

The variables included in the performed assessment are presented in *Table 2* and will be referred to as the name of the activity.

Table 2. Description of the assessed activities at the dogs daycare

Activity	**Description**
Walking around	How much movement is performed
Barking	How much barking is performed
Sitting & standing	How much sitting & standing is done
Laying down	How much laying down is done
Vocalising	How much vocalisations, for example howling, whining or crying are done
Heart rate	What the heart rate is at the specific time for assessment (bpm)
Respiratory rate	What the respiratory rate is at the specific time for assessment (bpm)

Since **group** A,B and C are in one large room and group D,E and F are in one, the bundled results of groups A,B and C respectively D,E and F are presented separately. The variation in frequency of each activity is presented compared to baseline. The mean values of baseline that are used for the calculations of difference are shown in *table 3* for the groups and *table 4* for the individuals. The assumed variation depending on weekday (calmer on wednesdays and fridays) could not be confirmed by the gathered data and therefore the results are based on each weeks (monday, wednesday and friday) mean, and not seperating the days.

In *table 3* and *table 4,* the basline means for each group and merges of groups A,B & C and D,E & F are presented to show what values have been used for calculating the difference of each activity in the following chapters: **3.1.1 to 3.1.5**.

Table 3. The calculated means of each variable and all groups during baseline.

Baseline	Walking around	Barking	Sitting & standing	Laying down	Vocalising
Group A	**3**	**1.125**	**4.125**	**7.125**	**1**
Group B	**5.625**	**4.125**	**6.625**	**3.625**	**2.125**
Group C	**2.125**	**1**	**3.125**	**7.625**	**1.375**
Groups A,B,C	**3.583**	**2.083**	**4.625**	**6.125**	**1.5**
Group D	**2.875**	**2.125**	**4.5**	**7**	**2.75**
Group E	**3.25**	**4**	**6.5**	**6.875**	**3.75**
Group F	**2.375**	**3.75**	**4.25**	**7**	**3.125**
Groups D,E,F	**2.833**	**3.292**	**5.083**	**6.958**	**3.208**

Table 4. The calculated means of each variable and all individuals during baseline.

Baseline	Walking around	Barking	Sitting & standing	Laying down	Vocalising
Individual A	**3.375**	**1**	**4**	**6.5**	**1**
Individual B	**5.5**	**5.5**	**5.875**	**3.875**	**2.875**
Individual C	**1.25**	**1**	**1.5**	**9.25**	**1**
Individuals A,B,C	**3.375**	**2.5**	**3.792**	**6.542**	**1.625**
Individual D	**3.25**	**2.75**	**5.125**	**6**	**3.25**
Individual E	**3.875**	**3**	**5.875**	**6.25**	**3.625**
Individual F	**2.625**	**3.125**	**4.25**	**7.75**	**2.875**

Baseline	Walking around	Barking	Sitting & standing	Laying down	Vocalising
Individuals D,E,F	**3.25**	**2.958**	**5.083**	**6.667**	**3.25**

3.1.1 Nature sound

The results seen from nature sound have variations in between the groups. To begin with, Group A was seen walking around six percent less during the week when nature sound was playing compared to the week of no music. Group B had a small difference of one percent between the weeks and Group C was seen to be walking 69 percent more with nature sound. When merging the groups into one, their movement is jointly twelve percent increased. Group D had a small increase of nine percent, Group E was walking around less by eight percent and Group F remained unchanged. This resulted in zero change when viewing the three groups as one.

All three groups A, B and C were barking more due to nature sound. However, Group A has an increase of 41 percent while Group B and C have five- respectively eight percent rise. This gives a bundled increase of twelve percent. Group D barked 41 percent more while Group E had a decrease by 34 percent and Group F remained unchanged.

The impact of the dogs' sitting and standing habits are stretched by 21, one and 52 percent of groups A, B and C. Group D and E reduced by 17 respectively 38 percent and group F stayed the same. The total change in the three groups is minus 35 percent. Group A and C decreased their laying down by four respectively nine percent while group B increased it by 13. The total of all three groups equals a decrease by three percent. Group D has a reduction of 13 percent, group E is unchanged and group F has an increase of 23 percent, giving a four percent increase on the total.

Further, group A increased vocalising by eight percent while group B and C decreased it by 50- respectively three percent and when looking at all three groups as one, the decrease is 22 percent. The vocalisation in groups D,E and F decreased by respectively five, 17 and 48 percent giving a total reduction of 23 percent. These results can be seen in a summary in *table AI* in Appendix A.

When looking at the results of the **individuals**, A and B has decreased their walking around by eleven respectively 15 percent, while Individual C increased it by seven percent when nature sound was playing compared to baseline. This resulted in a bundled result of eleven percent in decrease. Individual D increased it by twelve percent while E and F decreased by six respectively five percent. This led to a zero percent change when putting all three groups together.

Individuals A and C had no change in barking, but B decreased it by 41 percent during naturesound compared to baseline, which resulted in 30 percent decrease when putting all three individuals together. Individual D had an increase of nine percent while E and F had a decrease of 21 respectively 56 percent, which resulted in minus 24 percent for all three together. Individual A and B increased their sitting & standing by 35 respectively eight percent and C had a decrease by 22 percent, giving a total decrease of 14 percent. Individual D, E and F had a decrease by 24, 23 and 34 percent, resulting in minus 28 percent.

Individual A and B decreased their laying down by four respectively three percent and C had an increase of seven percent. The bundled result of these three was hence plus one percent. Individual D increased it by six percent, E remained unchanged and F increased by three percent, which resulted in a gathered increase of three percent. Individual A and C remained unchanged in vocalising while B decreased it by 62 percent, resulting in a gathered decrease of 37 percent. Individual D, E and F decreased vocalising by 8, 31 and 30 percent resulting in a total decrease of 23 percent. These results can be seen in a summary in *table AII* in Appendix A.

3.1.2 Ambience

Group A and D are seen walking around less due to ambient sound, namely a decrease by 31 respectively 43 percent. while The other groups increased in walking; group B by eleven percent and E by eight. Group C and F who had an increase of 100 respectively 53 percent. Groups A, B and C did increase their barking by three point seven, 15 and 233 percent respectively. Merged together their increase is 48 percent. Group D and E decreased their by 35 and 31 percent, and group F remained unchanged. Bundled together, it decreased by 20 percent.

Sitting and standing was decreased by groups A, B, D and E by 19, zero point six, 14 and 23 percent while groups C and F increased their by 71 respectively 29 percent. The bundled result of A, B and C is an increase of ten percent and D,E and F a decrease of six percent. All groups **except** C was seen laying down more while ambient sound was playing. A and B by 15, C by minus 30 resulting in a decrease of four percent when merging the groups together. D, E and F increased it by 29,

nine and two percent, giving a total increase of 13 percent. Vocalisations were increased by groups A, C and F by eight, three and twelve while groups B and D decreased their by 29 and one percent and E remained unchanged. The aggregate result of A, B and C was a decrease by eleven percent and for D, E and F it was 22 percent decrease. These results can be seen in a summary in *table AIII* in Appendix A.

When looking at how the **individuals** changed from baseline during the week of ambient sound, it was seen that A decreased walking around by 53 percent, B increased it by nine and C decreased it by 20, resulting in a merged decrease of 15 percent. Individual D and E decreased it by 50 respectively three percent and F increased it by 33. This resulted in a decrease of nine percent together. Individual A and C had no change in barking while B decreased it by 18 percent, resulting in a total decrease of 13 percent. D and E decreased by 59 respectively 13 percent and F increased by 16 percent, giving a total of minus nine percent.

Sitting & standing was decreased by 15 percent when looking at individual A, increased by eleven regarding individual B and decreased by 33 percent for individual C, resulting in a decrease of four percent. Individual D and E had a decrease of 22 respectively 23 percent and F increased it by 26, resulting in a total of minus nine percent. Laying down increased by 24, ten and eight percent of individuals A, B and C, resulting in a common increase of 14 percent. D and E increased by 40 respectively 20 percent. Individual F decreased by two percent, resulting in a total of the three of 18 percent increase.

The level of vocalising remained the same for individual A and C, while B decreased it by 30 percent, resulting in a common decrease of 18 percent. D and E decreased it by 58 respectively 31 percent and F increased it by 13 percent. The total change of the three was a decrease of 27 percent. These results can be seen in a summary in *table AIV* in Appendix A.

3.1.3 Classical music

Group A has no change in the frequency of walking around during classical music. However groups B, D, E and F show a decrease of 15, 57, eight and 37 percent respectively while group C increases their movement by 124 percent. There is a total increase of 16 percent in group A,B and C and a total increase of 32 percent in group D, E and F. Groups B, D, E and F had a decrease in barking by 52, 53 and 66 percent, and one percent in group F. Group A and C had an increase of 33 respectively 475 percent. A,B and C together had an increase of 48 percent while D,E and F decreased their barking by 65 percent.

Groups A, B, D and E had a decrease in sitting and standing by 21, 13 and 22 percent. Group C had an increase of 92 percent and group F remained unchanged.

The total of groups A, B and C is an increase of eight percent while D, E and F had a decrease by 18 percent. Laying down was increased by all groups except for group C that decreased by 48 percent. Group A, B, D, E and F increased by nine, 38, 13, four and 17 percent respectively. Groups A, B and C had a total decrease of nine percent and D, E while F had a decrease of eleven percent.

An increase in vocalisation was seen in groups A and C by 25 respectively 45 percent and group B had a decrease by 5,9 percent. This resulted in a total increase of 17 percent. Groups D,E and F had a decrease by approximately 60-70 percent each, resulting in a total of minus 65 percent. These results can be seen in a summary in *table AV* in Appendix A.

Individual A was the only one increasing its walking around, and it was by 26 percent. Individual B and C decreased their by 32 respectively 20 percent. Together, resulting in a decrease of 28 percent. Groups D, E and F decreased their walking around by 54, 32 and 24 percent, resulting in a total decrease of 37 percent. Individual A and C remained unchanged regarding barking and B decreased by 55 percent, resulting in a total decrease by 40 percent. Individuals D, E and F decreased their barking by 59, 50 and 64 percent, resulting in a total decrease of 58 percent. A, B and C decreased their sitting & standing by six, eleven respectively 33 percent, resulting in a total decrease of twelve percent. D, E and F decreased their by 27, 21 and 24 percent, resulting in a common decrese of 24 percent.

All individuals increased their laying down during the week of classical music. Individuals A, B and C by 19, 55 and eight percent, resulting in a total of 21 percent. Individuals D, E and F increased their by 54, 14 and six percent, resulting in a total of 23 percent. Individual A and C kept their level of vocalisations unchanged and B decreased it by 13 percent, resulting in a three percent decrease for all three individuals put together. Individuals D, E and F had a decrease of 65, 62 respectively 52 percent, which results in a common decrease of 60 percent. These results can be seen in a summary in *table AVI* in Appendix A.

3.1.4 All music together

When looking at music as the mean of the three sounds merged compared to baseline, groups A, B and D have reduced their walking around with twelve, one and 30 percent. Groups C, E and F increased theirs by 97, three and five percent. The total change of groups A, B and C is an increase of 15 percent and group D, E and F had a decrease by ten percent. Barking was increased by groups A and C by 26 and 239 percent, while groups B, D, E and F decreased it with ten, 16, 44 and one percent. The total change in groups A, B and C is a decrease of 36 percent and

D, E and F had a total decrease of 35 percent.

Sitting & standing decreased by all groups, except for group C and correspondingly, group C decreased their laying down while the other groups increased their. A, B, D, E and F decreased sitting & standing by six, four, 18, 29 and seven percent. Group A, B and C had a total change of twelve percent increase and D, E and F had a decrease of 20 percent. Vocalising was seen increasing amongst group A and C by 14 respectively 15 percent while the other groups decreased theirs by 28, 39, 38 and 33. Groups A, B and C had a total decrease by six percent in total and D, E and F had an decrease by 37 percent. These results can be seen in a summary in *table AVII* in Appendix A.

Regarding the individuals, A, B and C reduced their walking around by 30, 13 and eleven percent, resulting in a total of minus 18 percent. D and E reduced their by 31 and 14 percent, while F increased by two percent. This resulted in a total decrease by 15 percent. Individuals A and C remained unchanged in the level of barking and C decreased it by 38 percent, resulting in a gathered decrease of 28 percent. Individuals D, E and F decreased their by 36, 28 and 35 percent, giving a total decrease of 33 percent.

Sitting & standing was increased by individuals A and B by five and three percent. C had a decrease by 30 percent resulting in a gathered change of minus one percent. Individuals D, E and F had a decrease by 24, 26 and seven percent, resulting in a total of minus 20 percent. Laying down increased in all individuals by 13, 20 and eight percent resulting in a total increase of twelve percent and 33, eleven and three percent giving a total increase by 15 percent. Vocalisations increased by eight in individual A, decreased by 35 in individual B and remained unchanged for C, resulting in a total decrease of 19 percent. Individuals D, E and F decreased it by 44, 41 and 23, giving a gathered result of minus 37 percent. These results can be seen in a summary in *table AVIII* in Appendix A.

3.1.5 Graphical presentation of each assessed parameter

The change (within the scale 1-10) of each assessed activity is presented for all six groups including laying down, movement (walking around), sitting & standing, barking and vocalising. The blue bar shows the assessed level of each activity during the weeks of music playing and the red line shows the baseline of each group or individual. Remember that groups A, B and C are in the inner room and hence separated from D, E and F in the outer and can hence only influence within the rooms.

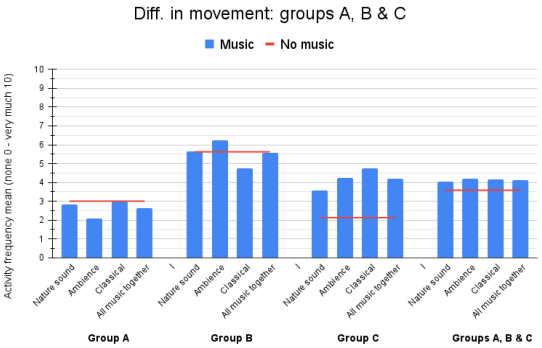


Figure 28. Difference in movement: groups A, B & C.

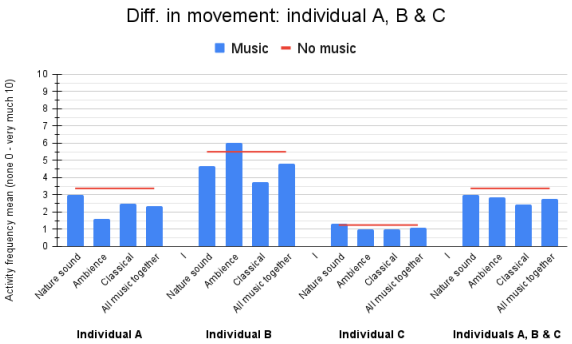


Figure 29. Difference in movement: individuals A, B & C.

Group A, see *Figure 28,* had a small decrease in walking around from a baseline of level 3 to 2,1 during the week of ambient sound. Nature sound and classical stayed close to 3. Group B stayed unchanged on 5,6 during nature sound, had a small increase when ambient was playing and a decrease during classical to 4,75. Group C had a baseline of 2,1 and increased their walking around during all test sounds: 3,58 (nature sound), 4,25 (ambience) and 4,75 (classical). Individual A decreases walking around during all test sounds, from a baseline of 3,4 to 3 (nature sound), 1,58 (ambience) and 2,5 (classical), see *Figure 29*. Individual B, with a baseline of 5,5 decreases during nature sound to 4,7, ambience increases slightly to 6,0 and classical reduced the level to 3,75. Individual C has a baseline of 1,25 and shows little variation: 1,33 (nature sound), 1,0 (ambience) and 1,0 (classical).

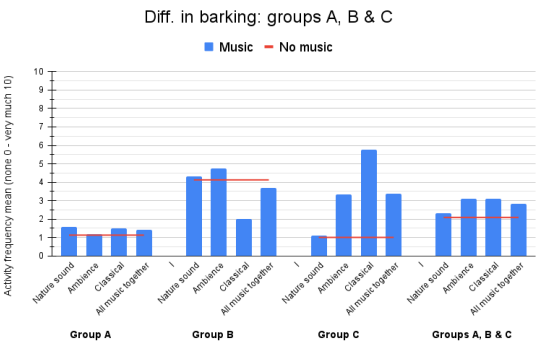


Figure 30. Difference in barking: groups A, B & C.

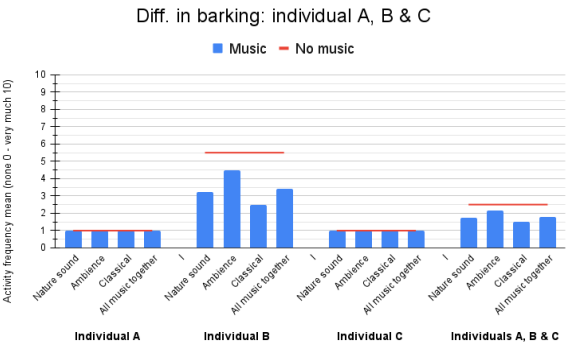


Figure 31. Difference in barking: individuals A, B & C.

Group A, see *Figure 30,* had a baseline in barking of 1,1 and increased to 1,6 during nature sound, 1,2 with ambience and 1,5 when classical music was playing. Group B had a baseline of 4,1 and had a change to: 4,33 (nature sound), 4,75 (ambience) and 2,0 (classical). Group C has a baseline level of 1,0 and a small increase to 1,1 during nature sound, 3,3 for ambience and 5,75 when classical music was playing. Individuals A and C, see *Figure 31,* remains unchanged from a

baseline of 1,0 while individual B decreases from baseline 5,5 to 3,25 in nature sound, 4,5 in ambience and 2,5 during classical music.

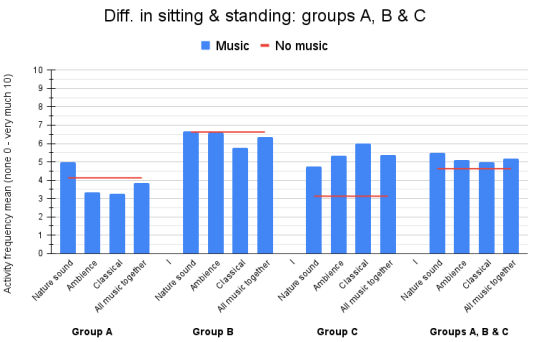


Figure 32. Difference in sitting & standing: groups A, B & C.

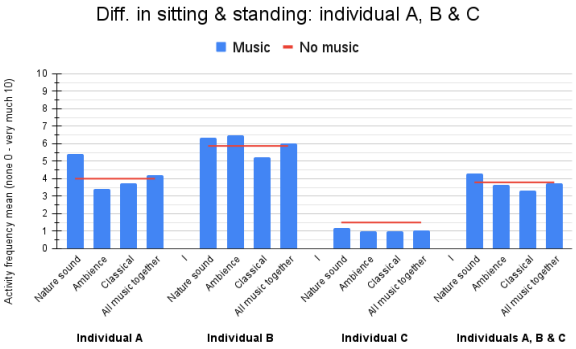


Figure 33. Difference in sitting & standing: individuals A, B & C.

Group A had a baseline of 4,1 and an increase in sitting & standing during nature sound to 5, see *Figure 32*. Ambience and classical music led to sitting & standing at a level of 3,3 respectively 3,25. Group B remained unchanged during nature sound and ambience at 6,6 and had a small decrease to 5,75 when classical music was playing. Group C had a baseline of 3,1 and increased all sounds to: 4,75 (nature sound), 5,3 (ambience) and 6,0 (classical). Individuals A and B have similar change as their respective groups, see *Figure 33,* with approximately the same baselines. Individual C however, had a baseline of 1,5 and changed to: 1,17 (nature sound), 1,0 (ambience) and 1,0 (classical).

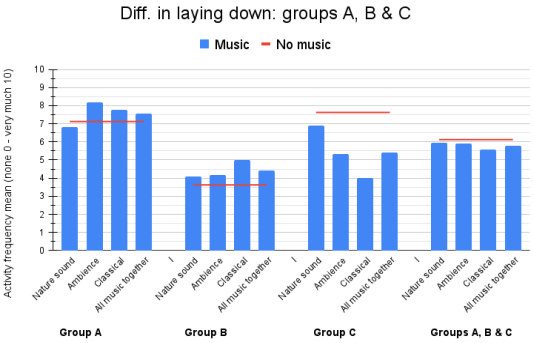


Figure 34. Difference in laying down: groups A, B & C.

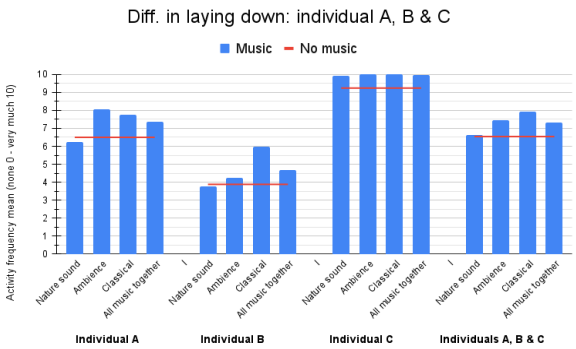


Figure 35. Difference in laying down: individuals A, B & C.

Group A had a baseline of 7,1 in laying down and decreased during nature sound to 6,8 while ambience and classical increased to 8,2 respectively 7,8, see *Figure 34.* Group B had an increase in all kinds of music: 4,1 (nature sound), 4,2 (ambience) and 5,0 (classical) compared to baseline of 3,6. Group C showed an increase in all

kinds of test music to: 6,9 (nature sound), 5,3 (ambience) and 4,0 (classical) compared to baseline of 7,6. Individual A and B have results close to the ones of their respective groups, see *Figure 35*. Individual B has a little higher increase in laying down during classical music, where it reaches 6,0 compared to its baseline of 3,9. Individual C had a baseline of 9,3 and increased its laying down during all kinds of music to: 9,9 (nature sound), 10 (ambience) and 10 (classical).

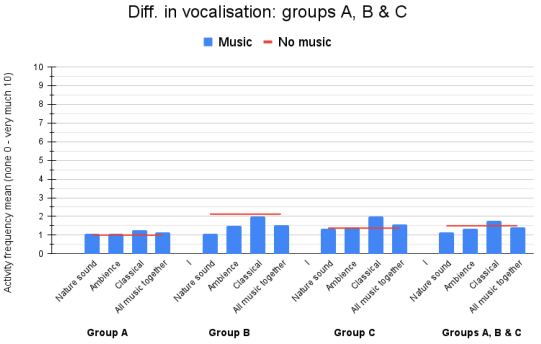


Figure 36. Difference in vocalisation: groups A, B & C.

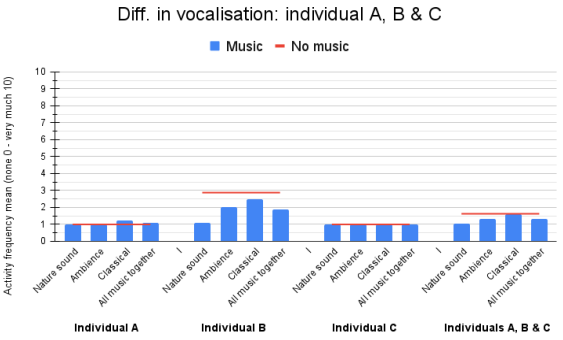


Figure 37. Difference in vocalisation: individuals A, B & C.

Group A had a baseline in vocalising of 1,0 and had a small increase in nature sound and ambience of 1,1 and classical of 1,25, see *Figure 36*. Group B had a baseline of 2,1 and decreased in all test sounds: 1,1 (nature sound), 1,5 (ambience) and 2,0 (classical). Group C had a baseline of 1,4 and decreased in nature sound to 1,3. Ambience had a small increase in vocalisations to 1,4 and classical to 2,0. Individual A has similar results as its group with nature sound and ambience of 1,0 and classical of 1,25, see *Figure 37*. Individual B also has similar change as its group, with a baseline of 2,9 and to 1,1 (nature sound), 2,0 (ambience) and 2,5 (classical). Individual C had a baseline of 1,0 and stayed unchanged regardless of test music.

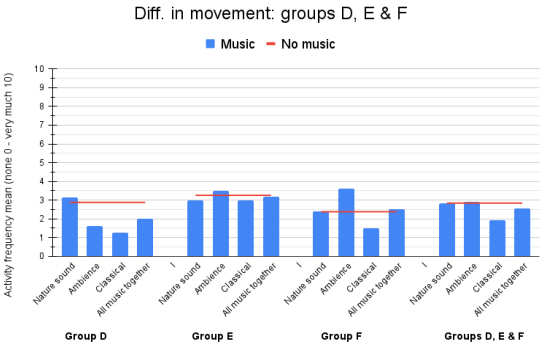


Figure 38. Difference in movement: groups D, E & F.

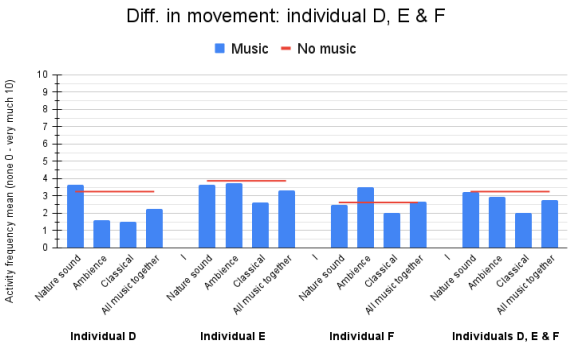


Figure 39. Difference in movement: individuals D, E & F.

Group D had a small increase in movement during nature sound, see *Figure 38*. Ambient and classical sound decreased from baseline with a movement level of 2,88 to 1,63 and 1,25. There is not much difference in the behaviour of Group E. However nature sound and classical showed a small decrease from 3,25 to 3,0 and ambience increased to 3,5. Group F had a small increase from 2,4 to 3,6 in ambience and a decrease to 1,5 during classical music. The behaviour of the respective individual of the groups are accordingly, but has small variations in some sounds, see *Figure 39*.

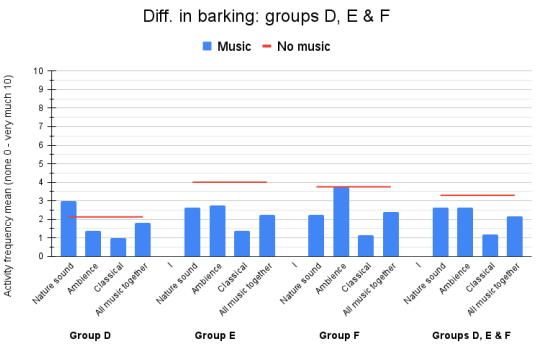


Figure 40. Difference in barking: groups D, E & F.

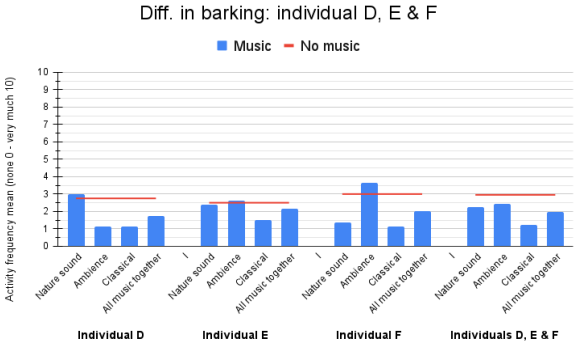


Figure 41. Difference in barking: individuals D, E & F.

Group D had a small increase in barking from baseline of 2,125 to nature sound of 3,0. Ambience and classical decreased to 1,38 respectively 1,0, see *Figure 40*. Group E decreased barking from 4,0 to 2,63, 2,75 and 1,38 respectively. Group F had no change in barking when comparing ambient to baseline of 3,75. However barking increased to 2,25 in nature sound and 1,13 in classical. The individual of Group D, see *Figure 41.*, had a corresponding reaction to all kinds of music, although it had higher baseline from start resulting in a bigger change. Individual E on the other hand has a lower baseline but very similar levels on all kinds of music, see *Figure 41*. Individual F had slightly lower barking level than its group during baseline, performing little less barking during nature sound and a little more in ambience.

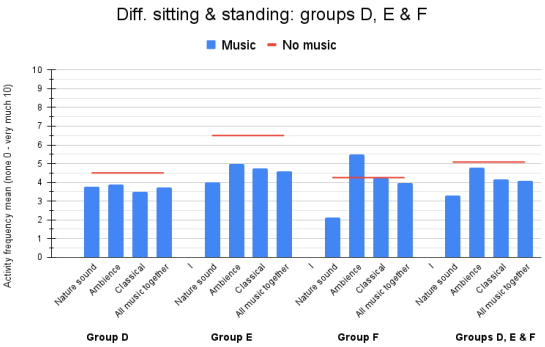


Figure 42. Difference in sitting & standing: groups D, E & F.

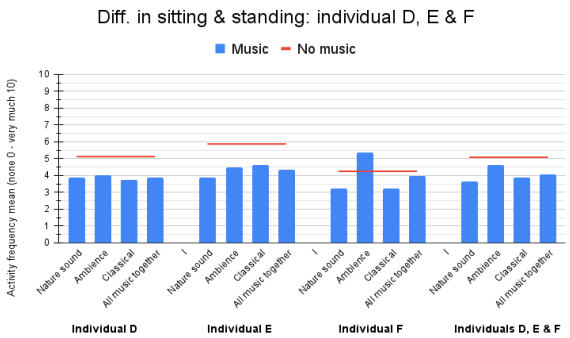


Figure 43. Difference in sitting & standing: individuals D, E & F.

As seen in *Figure 42,* Sitting & standing decreased in Group D no matter the test sound compared to baseline of 4,5. Same thing happened in Group E whose baseline level was 6,5. Group F had a mixed behaviour where the level of sitting & standing increased to 2,13 from baseline of 4,25 during nature sound and an increase of 5,5 while ambience was played. *Figure 43.* shows that individuals D and E has similar change in behaviour as their groups. However group E has a bit higher baseline than its individual. Individual F, see *Figure 43.* shows little less variation in nature sound and classical music, compared to its group.

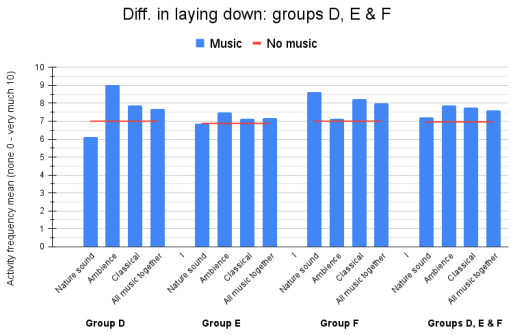


Figure 44. Difference in laying down: groups D, E & F.

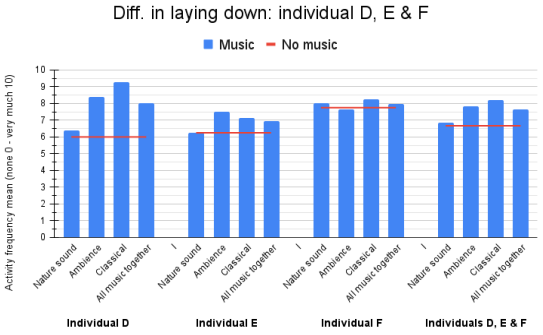


Figure 45. Difference in laying down: individuals D, E & F.

Laying down was increased or unchanged in all test musics for groups D, E and F, except for nature sound that decreased from 7,0 to 6,1 in group D, see *Figure 44*. The corresponding individuals behaved similarly, except for individual D that did not decrease laying down during nature sound but had a small increase from baseline of 6,0 to 6,38, see *Figure 45*.

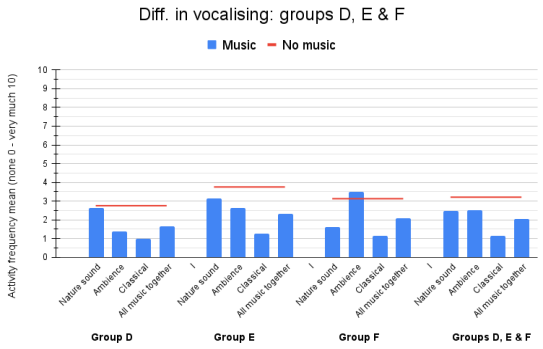


Figure 46. Difference in vocalising: groups D, E & F.

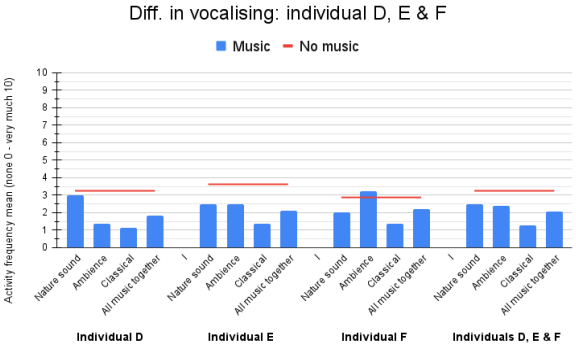


Figure 47. Difference in vocalising: individuals D, E & F.

Groups D, E and F decreased their vocalisations compared to baseline in all kinds of music, except for group F who had a small decrease from baseline of 3,13 to 3,5

during ambience, see *Figure 46.* All three individuals D, E and F showed similar changes as their respective groups, see *Figure 47*.

3.1.6 Heart rate and respiratory rate

The mean heart- and respiratory rate are presented in *Table 5*. They were measured four times a day (09:00, 11:00, 13:00 and 15:00) on one predetermined individual of each group. The assessments were repeated for one to three days during the four test weeks, depending on outer circumstances such as burglary attempt or sickness where the tests could not be carried out. The standard deviation is given for both parameters for each sound. The values are rounded up to the nearest hundredth.

Table 5. The mean heart and respiratory rates during the weeks of the test sounds.

Music type	Baseline	Nature sound	Ambient sound	Classical music
Individual A				
Heart rate mean (HR)	71	72	75.8	85
HR Standard deviation	4.61	1.70	5.17	3.46
Respiratory rate mean (RR)	31.56	28.67	32.36	34.5
RR Standard deviation	5.34	3.23	5.71	6.61
Individual B				
Heart rate mean (HR)	80.5	79.25	84.5	92.67
HR Standard deviation	3.46	2.45	3	4.16
Respiratory rate mean (RR)	43.14	53.8	49.33	46
RR Standard deviation	8.07	6.60	5.77	-
Individual C				
Heart rate mean (HR)	67.33	70.67	75.09	81.5
HR Standard deviation	13.49	1.30	2.74	5.74
Respiratory rate mean (RR)	24.89	23.5	23.45	28
RR Standard deviation	7.17	1.73	2.02	2.83

Individual D				
Heart rate mean (HR)	83.89	75.5	72.25	81.75
HR Standard deviation	18.54	12.77	6.80	5.92
Respiratory rate mean (RR)	27.67	31.38	28.88	29.38
Standard deviation RR	5.83	3.62	3.44	3.07
Individual E				
Heart rate mean (HR)	85.22	67.75	76.13	87.88
HR Standard deviation	18.77	6.43	6.64	7.22
Respiratory rate mean (RR)	26.78	30.63	31.13	29.75
RR Standard deviation	1.58	4.10	2.03	1.39
Individual F				
Heart rate mean (HR)	83.78	71.13	82	81.25
HR Standard deviation	12.63	7.12	13.74	5.92
Respiratory rate mean (RR)	25.11	34.5	32.13	29.88
RR Standard deviation	9,0	6.93	3.52	1.96

When looking at the heart rate for nature sound, ambient sound and classical music, it is seen that for all individuals except for one (F) the heart rate is highest when playing classical music. However, the heart rate of individual F is almost as high during ambient and classical music and about two beats per minute higher during baseline. Individual F has a ten beats lower pulse during nature sound. The standard deviation is varying over the sounds while it seems to be high during baseline for all individuals except A and B that shows a low variation in standard deviation generally. Individual F has the highest standard deviation in ambient sound where it reaches 13,7.

Individuals B, D, E and F have higher respiratory rate while exposed to music compared to baseline. Individual A has a decrease in respiratory rate during nature sound and individual C has an increase during classical music. Individuals B, C, D and F have highest standard deviation during baseline and individual E with nature

sound. Individual A has the largest standard deviation during classical music (6,6) closely followed by 5,5 regarding ambient sound and 5,3 in baseline.

3.1.7 Music versus baseline in each individual

The indata is the variables that were measured four times a day (09:00, 11:00, 13:00 and 15:00) on one predetermined individual of each group. It was carried out for one to three days during the four test weeks, depending on outer circumstances such as burglary attempt or sickness where the tests could not be carried out. The following results (p-values), see *Table 6*., are given from the t-tests of the means with baseline and the three test sounds, for all individuals. The significance level is 0,05 (5%) and M stands for mean and SD for standard deviation.

Table 6. P-values from t-tests for all individuals and test sounds.

Individual	*A*	*B*	*C*	*D*	*E*	*F*
Nature sound	p=	p=	p=	p=	p=	p=
Heartate	0.495	0.356	0.402	0.301	0.025	0.025
Respiratory rate	0.140	0.007	0.522	0.099	0.191	0.031
Ambience	p=	p=	p=	p=	p=	p=
Heartate	0.045	0.078	0.078	0.115	0.214	0.785
Respiratory rate	0.750	0.270	0.532	0.617	0.109	0.057
Classical	p=	p=	p=	p=	p=	p=
Heartate	0.001	0.001	0.073	0.760	0.713	0.613
Respiratory rate	0.410	-*	0.428	0.470	0.253	0.164
		*Too few values				

Regarding nature sound, the comparison with baseline is shown to be significant in heart rate of individual E where baseline (M=85,22 , SD=18,77), nature sound (M=67,75 , SD=6,43) and t=2,497 and p=0,0246 which indicates that nature sound had a decreasing effect on the heart rate of individual E. Significant result is also found for individual F where baseline (M=83,77 , SD=12,63) and nature sound (M=71,12 , SD=7,12) with t=2,496 and p=0,0246. It indicates that its heart rate had decreased while nature sound was playing. However individuals A-D are not found with any significance regarding the heart rate.

When looking at respiratory rate, individual B and F has significant results while A, C, D and E have not. Individual B has baseline (M=43,14 , SD=8,07) and nature sound (M=53,82 , SD=6,61) together with t=-3,07 and p=0,007. Individual F had baseline (M=25,11 , SD=8,99) and nature sound (M=34,5 , SD=6,93) with t=-2,39 and p=0,030.

For ambient sound, there is only the comparison of heart rate in individual A that is significant, with baseline (M=71 , SD=4,61) and ambient (M=75,82 , SD=5,17) and t=-2,16 and p=0,045. None of the corresponding comparisons of respiratory rate are significant however.

When looking at classical music, the heart rate comparisons of individual A and B are significant, while none of the respiratory rate comparisons are. For Individual A, the results from baseline (M=71 , SD=4,61) compared to classical music (M=85 , SD=3,46) indicates to highering the heart rate: t=-5,38 and p=0.0002(~0.001). For Individual B, the baseline (M=80,5 , SD=3,46) and classical music (M=92,67 , SD=4,16) indicates that the classical music lead to increasing the dog's heart rate: t=-4,949 and p=0,000792(~0,001). Both individuals had increased heart rate when classical music was playing.

3.1.8 Baseline and music in groups

In the following chapter, the significant results for the behavioural variables are presented, while the non-significant results are marked with a line. If one behavioural variable is non-significant in all groups, it's not included in the table. The indata is the variables that were measured four times a day (09:00, 11:00, 13:00 and 15:00) on one predetermined groups.

Table 7. P-values for t-tests between baseline and music in all groups and test sounds.

Group	*A*	*B*	*C*	*D*	*E*	*F*
Nature sound	p=	p=	p=	p=	p=	p=
Movement	-	-	0.019	-	-	-
Sitting & standing	-	-	0.041	-	0.019	0.022
Ambience	p=	p=	p=	p=	p=	p=
Movement	-	-	0.002	0.029	-	-
Barking	-	-	0.035	-	-	-

Sitting & standing	-	-	0.026	-	-	-
Laying down	-	-	0.050	-	-	-
Classical	p=	p=	p=	p=	p=	p=
Movement	-	-	0.003	0.002	-	-
Barking	-	-	0.001	-	0.002	-
Sitting & standing	-	-	0.011	-	-	-
Laying down	-	-	0.009	-	-	-
Vocalisation	-	-	-	0.015	0.001	0.019

Groups A and B did not yield any results of significance and are hence not treated below.

Group C

Taking t-tests of the mean in each of the groups showed significance in all three test sounds regarding movement in group C. Baseline (M=2,12 , SD=1,13) compared to nature sound (M=3,58 , SD=1,31) with t=-2,57 and p=0,19 as seen in *Table 7*. Baseline (M=2,12 , SD=1,13) compared to ambient sound (M=4,25 , SD=1,36) with t=-3,66 and p=0,002. Baseline (M=2,12 , SD=1,13) compared to classical sound (M=4,75 , SD=0,96) and t=-3,976 and p=0,003. It indicates that group C performed more movement or “walking around” all three weeks while the sounds were playing, compared to baseline.

When doing t-test on the variable barking, it showed that the ambient and classical sounds were significant with baseline (M=1,0 , SD=0) and ambient sound (M=3,33 , SD=2,87) together with t=-2,27 and p=0,035, and baseline (M=1,0 , SD=0) compared to classical music (M=5,75 , SD=2,06) with t=-6,869 and p=0,001. This indicates that the dogs of group C were barking more during the weeks of ambient and classical sound compared to baseline.

Regarding sitting & standing the t-tests were significant for all three test sounds where baseline (M=3,12 , SD=1,8) and nature sound (M=4,75 , SD=1,485) with t=-2,20 and p=0,041. Baseline (M=3,12 , SD=1,8) compared to ambient sound (M=5,33 , SD=2,10) with t=-2,43 and p=0,026. For baseline (M=3,12 , SD=1,8) compared to classical sound (M=6 , SD=0) the t=-3,104 and p=0,011.
All three t-tests indicate that group C is sitting & standing more during the weeks of test music compared to baseline.

Further, the variable laying down gave significant results in group C for ambient and classical sounds. When comparing the means of baseline (M=7,62 , SD=2,134) and ambient sound (M=5,33 , SD=2,535) with t=2,10 and p=0,050. Baseline (M=7,62 , SD=2,134) compared to classical sound (M=4,0 , SD=0,816) had t=3,22 and p=0,009. These results both indicate that the dogs of group C were laying down less during the weeks of ambient and classical sound compared to baseline.

Group D

Significance was found regarding movement with ambient and classical sounds. Baseline (M=2,88 , SD=1,126) compared to ambient (M=1,62 , SD=0,916) with t=2,436 and p=0,030, and baseline (M=2,88 , SD=1,126) and classical (M=1,25 , SD=2,134) with t=3,775 and p=0,002. This indicates that the dogs in group D were moving/walking around less during ambient and classical music compared to baseline. Group D also had a significant result regarding vocalisation where baseline (M=2,75 , SD=1,908) and classical (M=1,0 , SD=0) with t=2,762 and p=0,015 indicates that the dogs of group D were vocalising less during classical music compared with baseline.

Group E

The variable barking gave significant results in group E for classical sound: the means of baseline (M=4,0 , SD=1,85) and classical sound (M=1,38 , SD=0,517) with t=3,86 and p=0,002 indicates that the dogs in group E were barking less during classical music than baseline. Regarding sitting & standing, the t-test showed that the mean of group E in baseline (M=6,5 , SD=1,77) and nature sound (M=4,0 , SD=2,0) with t=2,65 and p=0,019. Group E also had a significant result when comparing baseline (M=3,75 , SD=1,58) to classical music (M=1,25 , SD=0,46) with t=4,29 and p=0,001 in vocalisation. This indicates that the dogs of group E were sitting & standing less during nature sound compared to baseline and vocalising less during classical music compared to baseline.

Group F

Significance was found in the t-test comparison for sitting & standing between baseline (M=4,25 , SD=2,12) and nature sound (M=2,12 , SD=0,99) with t=2,57 and p=0,022 and in vocalisation with baseline (M=3,12 , SD=2,10) and classical music (M=1,12 , SD=0,35) with t=2,66 and p=0,019. These results indicate that the dogs of group F were sitting & standing less during nature sound compared to baseline and vocalising less during classical music compared to baseline.

3.1.9 Qualitative categorising of the assessors utterances from direct observations

Figure 48 is a summary of the free text answers on the experienced behaviour of the dog groups in both the inner and outer room. It is evaluated four times (09:00, 11:00, 13:00 and 15:00) each day but it will not be stated what comment comes from each time. However, the comments are gathered under its specific week and test sound.

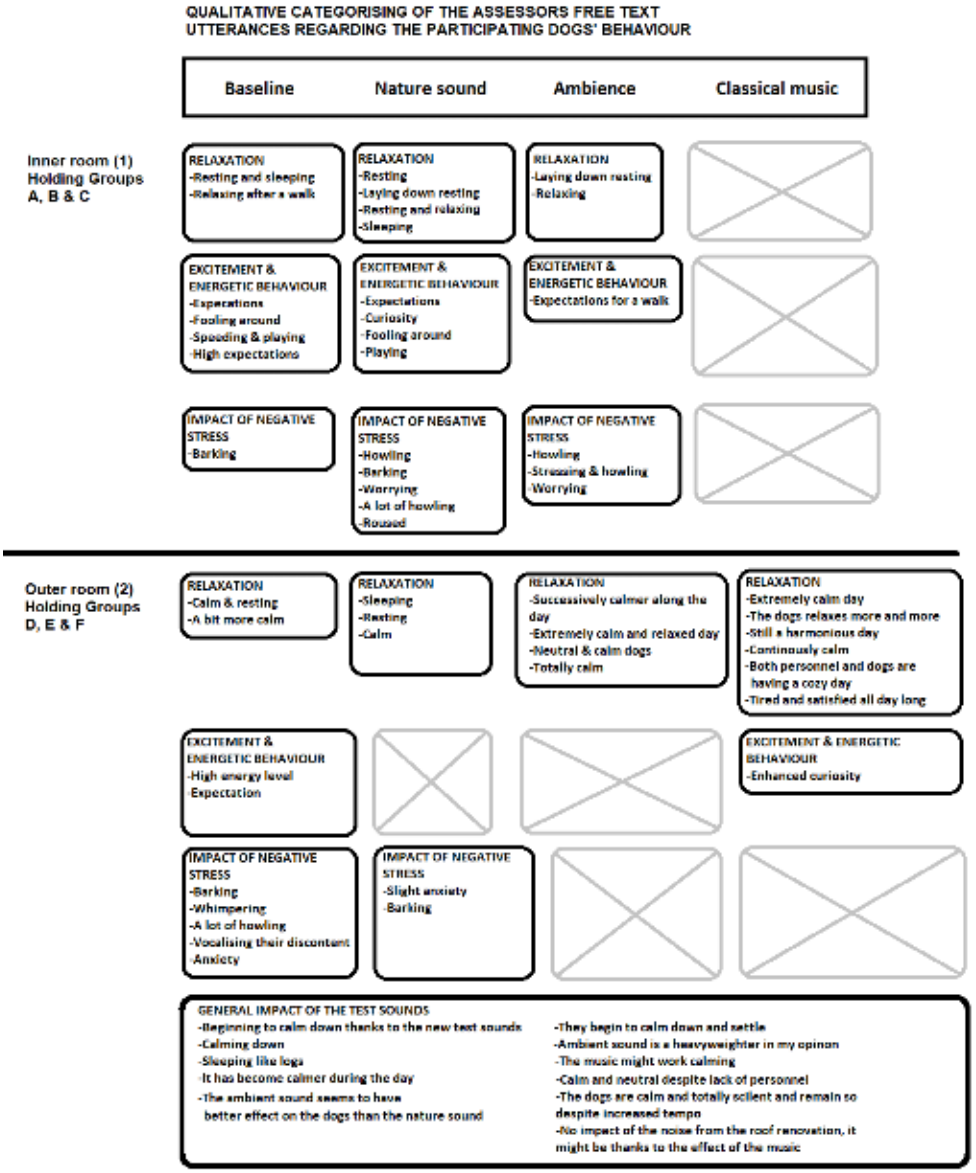


Figure 48. Qualitative categorising of the assessors' free text utterances

3.2 Veterinary waiting room

There are no results other than that the Dalmatian Charlie was very relaxed and not showing any clear signs of stress on his visit to the veterinary station during baseline. Therefore, no subheadings will be treated.

3.3 Veterinary personnel dogs

In December, the first test month, there was only one dog that participated two times during the first week, the other six participated once and one among those participated one time during the second week, but that was the last time. This did not give any results of value since the dogs participated only during the week of nature sound playing. When the test was repeated for four weeks from January to February, a few (four) dogs participated and hence some results were possible to analyse and evaluate. Below are the results from the second period of testing the sounds in those places presented together with the baseline.

In *Table 8,9* and *10* the mean heart- and respiratory rates are presented for each of the four dogs that participated in the sound test. These are used to calculate the percental change in each activity/behaviour.

3.3.1 Nature sound

Table 8. shows the mean heart- and respiratory rates of dogs 1-4 during the weeks of baseline and nature sound.

Table. 8 The mean heart- and respiratory rates of dogs 1-4 during baseline and nature sound.

Parameter	**HR** Baseline	**HR** Nature	**RR** Baseline	**RR** Nature
Dog 1	**78,04**	**87,33**	**18,17**	**20,0**
Dog 2	**97**	**87,75**	**29**	**28**
Dog 3	**100**	**105,83**	**20**	**20,33**
Dog 4	**80**	**79,06**	**20**	**33,44**

Dog 1 had a twelve percent increase in heart rate and ten percent in respiratory rate during the week of nature sound compared to baseline. Dog 2 decreased ten respectively 3 percent in heart- and respiratory rate. Dog 3 increased by six percent in heart rate and two in respiratory rate. Dog 4 decreased by one percent in heart rate and increased by 67 percent in respiratory rate.

3.3.2 Ambient sound

Table 9. shows the mean heart- and respiratory rates of dogs 1-4 during the weeks of baseline and ambient sound.

Table. 9 The mean heart- and respiratory rates of dogs 1-4 during baseline and ambient sound.

Parameter	**HR** Baseline	**HR** Ambient	**RR** Baseline	**RR** Ambient
Dog 1	**78,04**	**100,0**	**18,17**	**21,33**
Dog 2	**97**	**76,44**	**29**	**30,22**
Dog 3	**100**	**133,33**	**20**	**22**
Dog 4	**80**	**-**	**20**	**-**

The heart- and respiratory rate of Dog 1 increased by 28 respectively 17 percent. Dog 2 decreased heart rate by 21 percent and increased respiratory rate by four percent. Dog 3 increased its heart rate and respiratory rate by 13 respectively ten percent. Dog 4 did not participate during the week of ambient sound.

3.3.3 Classical music

Table 10. shows the mean heart- and respiratory rates of dogs 1-4 during the weeks of baseline and classical music.

Table. 10 The mean heart- and respiratory rates of dogs 1-4 during baseline and classical music.

Parameter	**HR** Baseline	**HR** Classical	**RR** Baseline	**RR** Classical
Dog 1	**78,04**	**89,33**	**18,17**	**15,75**
Dog 2	**97**	**80,22**	**29**	**27,78**
Dog 3	**100**	**-**	**20**	**-**
Dog 4	**80**	**78**	**20**	**20**

During the week of classical music playing, Dog 1 increased its heart rate by 14 percent and decreased its respiratory rate by 13 percent. Dog 2 had a decrease in both heart- and respiratory rate of 17 respectively four percent.
Dog 3 did not participate during the week of classical music. Dog 4 had a decrease in heart rate of two point five percent and unchanged respiratory rate.

3.3.4 All music together

Table 11. shows the mean heart- and respiratory rates of dogs 1-4 during the weeks of baseline and all music merged together.

Table. 11 The mean heart- and respiratory rates of dogs 1-4 during baseline and all music merged.

Parameter	**HR** Baseline	**HR** All	**RR** Baseline	**RR** All
Dog 1	**78,04**	**92,22**	**18,17**	**19,03**
Dog 2	**97**	**81,47**	**29**	**28,67**
Dog 3	**100**	**109,58**	**20**	**21,17**
Dog 4	**80**	**78,53**	**20**	**26,72**

When comparing music to baseline with all music put together as a mean, Dog 1 increased their heart- and respiratory rate by 18 respectively five percent. Dog 2 had a decrease of 16 percent in heart rate and one percent lower in respiratory rate. Dog 3 increased its heart- and respiratory rate by ten respectively six percent. Dog 4 had a decrease of two percent in heart rate and an increase by almost 34 percent in respiratory rate.

3.3.5 Visual presentation of change in heart- and respiratory rate for baseline compared to music

Figure 49 and *50* show the change from baseline to respective test music in the four dogs that participated in the music test.

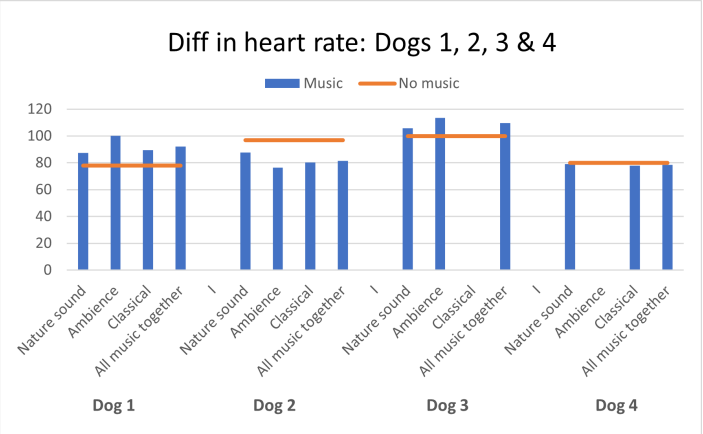


Figure 49. Difference in heart rate of baseline compared to music.

Figure 49 shows that the heart rate of Dog 1 increased from 78 bpm to 87, 100 and 89. Dog 2 had a baseline of 97 bpm, and decreased to 88, 76 and 80. Dog 3 had a baseline of 100 bpm and increased to 106 during nature sound and to 113 for

ambient and did not participate during classical music. Dog 4 had a baseline of 80 bpm and had a small decrease to 79 during both nature sound and classical and did not participate during the week of ambience. *Figure 50* is showing the correlating change in respiratory rate of each dog, measured at the same time.

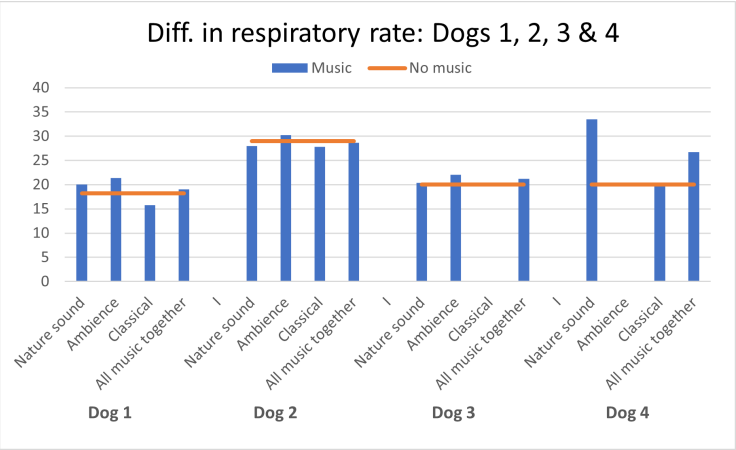


Figure 50. Difference in respiratory rate of baseline compared to music.

Figure 50 shows that the respiratory rate of Dog 1 increased from 18 breaths per minute to 20 respectively 21 in nature sound and ambience, it decreased to 16 when classical music was played. Dog 2 had a baseline of 29 br.pm and decreased in nature sound to 28 during nature sound and classical music. It increased to 30 when the ambience was played. Dog 3 had a baseline of 20 br.pm and stayed unchanged during nature sound, increased to 22 br.pm when ambience was played and did not participate during classical music. Dog 4 had a baseline of 20 br.pm and had an increase to 33 during nature sound. Classical music did not provide any change and Dog 4 did not participate during the week of ambience.

3.3.6 Heart- and respiratory rate of dog 1

The forms of Dog 1 were the only ones which were filled out as promised and hence it is the one that t-tests was carried out for. In *Table 12* the p-values for the t-tests are presented.

Table 12. The p-values as results of t-tests on Dog 1.

P-value of Dog 1	*Nature sound*	*Ambience*	*Classical*
Heart rate	0,15	0,03	0,0527
Respiratory rate	0,625	0,596	0,387

One of the t-tests calculated showed significant results on heart rate during ambience which gave p=0,03 and t=-2,46 together with baseline (M=79,18 , SD=9,22) and (M=79,18 , SD=20,78).

4. Analysis and discussion

This chapter contains analysis and discussion about the results in the different test sounds, the forms and data gathering.

4.1 Dogs daycare

This chapter will analyse and discuss the method and results of the sound tests at the dogs daycare.

4.1.1 Nature sound

The results are showing great variation between the groups during the whole test period. For example, group C is the only group that has an increase of above nine percent (69 percent) in walking around during nature sound. One could argue that the large increase is due to their relatively low baseline level that is the lowest amongst all groups, but on the other hand they and group D are the only groups whose movement level increases when comparing baseline to average over all music. However group D was not triggered to the same extent as group C from nature sound, since their difference compared to baseline was nine percent. The relatively large activity increase of group C might be a sign of acute stress as stated in Beerda et al. (2000).

Nature sound is seen to increase the barking in all groups except for group E where it decreased by 34 percent. It is possible to claim that nature sound had a triggering effect actually making the group decrease their behaviour in four variables and keeping the amount of “laying down” unchanged. In a similar way, groups A, B, C and F increased their sitting and standing during the week while group D and E reduced theirs. Although neither group D or E did increase their laying down so according to this data, they would not be considered to relax more due to nature sound. However, group E was not seen to increase any of the variables and hence it is possible to claim that the sound made them calmer in some manner. Group B and F were the only groups to be laying down more with nature sound compared to baseline, which goes well with their slight or no difference in walking around due to the sound. All groups have a small reduction in vocalising except group A that instead has a small increase, this might indicate that the new sound had them focused on listening and barking more than anything else.

Individual A shows similar behaviour as its group. The largest difference is that it did not change its frequency of barking at all while its group increased it by 41 percent. Hence, the group might be triggered by the sound but the individual did not get

affected. The other variables has a small variation of minus four percent in laying down, which does not say that much. Individual A also increased its sitting & standing by 35 percent. Individual B had larger decreases of 41 respectively 62 percent in barking and vocalising, where the group increased barking by five percent and had a similar decrease by 50 percent. This might indicate reduced levels of stress, as in Beerda et al. (1998) where acute stress is detected from excessive vocalisations such as growling and whimpering, which are included in the assessment variable “vocalisation” in this test.

Individual C had a small increase in walking around by seven percent compared to its group that had 69 percent. It also decreased sitting and standing by 22 percent compared to the group's increase by 52 percent, which indicates that this dog is not always compliant to the group's behaviour. When merging the three individuals of the inner room together it indicates lowering the activity level of the room a bit where barking and vocalising is decreased by 30 respectively 37 percent, walking around is reduced by 11 percent and sitting & standing has a 14 percent increase corresponding to 18 percent regarding the groups merged change.

Individual D differs from its group by increasing barking less (by 9 percent compared to 41). The other changes are rather small in both individual and group of around 6-10 percent each which does not give any clear indications. Individual E follows the pattern of its group since all variables, except for laying down that stayed unchanged, decreased from six to 31 percent while the group's variables decreased by eight to 38 percent.

Individual F, however, has opposite changes compared to its group. It decreases walking around, barking, sitting & standing and vocalising by 5, 56, 34 and 30 percent and has a small increase of three percent in laying down. Its group, on the other hand increased barking and sitting & standing by 40 respectively 50 percent and reduced vocalising by 48 percent. When comparing the merged results of groups D,E and F by the ones of their corresponding individuals, they are very similar: No change in walking around, decrease of 20 respectively 24 percent in barking, decrease in sitting & standing by 35 respectively 28 percent, a small increase in laying down by four respectively three percent and a common decrease by 23 percent in vocalising.

4.1.2 Ambience

Group A and D decreased their walking around by 31 respectively 43 percent. The other groups increased theirs and group C by 100 percent, and also seen barking 233 percent more and sitting and standing 71 percent more and is the only group that reduced laying down during the week of ambient sound. Hence, they might be negatively affected by the sound and their increased activity may be explained as

stress, according to Beerda et al. (2000). Groups A, D and E follow a relatively similar pattern where they have a decrease in walking around or a small increase (group E) together with decreasing or a small increase in barking (group A), a decrease of sitting and standing, an increase of laying down while the change in vocalising is none or small.

Group B seems to be affected by the sound since they are both walking around and barking more, however they also increase their frequency of laying down and decrease vocalisations. Group E walk around slightly more and bark and sit & stand less and lay down slightly more, which can be seen as a positive response to the sound. Group F seem rather activated by the sound since they increase both walking around, sitting and standing, vocalising and slightly laying down. However, they did not change in barking frequency at all.

Individual A follows the pattern of its group in behavioural change. It decreased walking around more (with minus 53 percent) and had no change in barking and vocalising where the group had a small increase. It increased laying down just a little more than its group, by 24 percent. Individual B is, on the contrary to its group, reducing its barking by 18 percent and increasing sitting & standing a little bit by eleven percent while the group had almost no change at all. Laying down was increased by ten percent and vocalising reduced by 30 percent, almost exactly the same as the groups minus 29 percent.

Individual C seems to have another experience of ambient sound than its group since it actually is less active: minus 20 percent in walking around and minus 33 percent in sitting & standing, a small increase by eight percent in laying down and no change in neither barking or vocalising. This says that individual C is not a big influencer of its group, but has its own expressions and reactions. The common result of individuals A,B and C is small changes in all variables: minus 15 and minus four percent in walking around and sitting & standing, minus 13 percent in barking and minus 18 in vocalising. Laying down has increased by 14 percent. This summing up of the inner rooms individuals is of desirable signs (-/+), however since the changes are relatively small it is hard to say if the music is the main reason or if it is due to something else.

Individual D seem to be affected by the music since it decreased walking around, barking and vocalising by 50, 59 and 58 percent each. It also decreased sitting & standing by 22 percent and increased laying down by 40, which are all larger changes compared to its group. However, the signs are the same for all variables and might indicate that group D including individual D actually decreased general activity (Beerda et al., 2000) and hence was calmed by the ambient sound.

Individual E has similar results as its group, however a bit smaller change in barking: minus 13 percent and larger in vocalisation: minus 31 percent. It increased laying down by 20 percent, and its group had a 9 percent increase.

Individual F seems to have got more active, but not with as high percentage points as its group. It had 33 percent in walking around, 16 in barking, 26 in sitting & standing and 13 in vocalising. It had a small decrease by 2 percent in laying down. It seems like ambient sound had a slight activating effect on individual F. The gathered result of the dogs in the outer room is small changes in decreasing signs of activity. They decreased walking around and sitting & standing by minus 9 percent each, barking by 17 percent and vocalising by 27 percent. Laying down was increased by 18 percent. Their changes correlate to the ones of merging their respective groups together as described above.

4.1.3 Classical sound

Group A had a mixed behaviour when classical music was playing. They seem to be less active since their walking around is unchanged, sitting and standing is decreased and laying down is slightly increased. However, they increase barking and vocalising which could indicate irritation and stress (Beerda et al., 1998). Group B, on the other hand has a different approach to the classical sound and are decreasing all categories except for laying down which increased and can hence be assumed to be calmed by it. Group C behaves in opposite from group B where all categories except for laying down are increasing much. Barking is definitely standing out since it increased by 475 percent and together with an increase of almost 125 percent in walking around, it can be assumed that the classical sound had a triggering effect on this group.

All groups in the back room: D, E and F follow the same pattern as group B where all categories are decreased except for laying down which is increased at some point. However, the increase is rather small but together with the decrease in the three first categories it might be considered as an effect from the sound playing. Moreover, what is important to remember regarding the result of group C is that they are the least active group when looking at baseline and that might be a reason for why the increase looks very large in comparison to the other groups, however it is clear that they are affected by the music and in this case gets activated by it.

Individual A is not following the pattern of group A entirely. It increased walking around and did not change in barking or vocalising, hence it is probably not a dog that reacts vocally to music. It decreased in sitting & standing by six percent which is less than its group's result. Laying down was increased by ten more percentage points than the group, namely plus 19 percent. Individual B behaves very much

connected to its group where there is a decrease in all four “active” variables varying from minus eleven to minus 55 percent. Laying down is increased by 55 percent, compared to the group's change of 38 percent and could be a sign of stress relief according to Kogan et al. (2017).

Individual C is not a very talkative dog and it has no change in barking and vocalising. It decreases walking around and sitting & standing by 20 respectively 33 percent and has a small increase in laying down of eight percent which is the opposite to the behaviour of its group that increased all variables except laying down by large percentages. Hence, the gathered result of dogs A, B and C does not stand out but is showing a decrease in the four variables except for laying down that increased by eight percent.

The change in behaviour of individual D is very coherent with its group, the percentage of change matches rather well in all variables except that it increased laying down by 55 percent when the group had 13 percent. Group E does a little less walking around (minus 32 percent) than its group. Otherwise, the changes correlate. Individual F does less barking than its group (minus 64 percent) and less sitting & standing (minus 24 percent) which indicates an decrease in acticity and probably a calmed behaviour. The collective result of individuals D, E and F is similar to the one of the groups and the maximum deviation is seen in laying down where the individuals increased it by 23 percent and the groups by eleven. The other variables have no more than a few to seven percentage points variation from their groups gathered result.

As discussed above, some of the groups and individuals are showing larger changes in decreasing stressed behaviour during classical music and some do not. It is possible to make a parallell to Bowman et al. (2015) and Kogan et al. (2017) where it was showed that classical music led to increased sleeping. However a follow-up study by Bowman et al. (2017) including more genres, showed little effect from classical, motown and pop. This study saw more relaxed behaviours from playing reggae and soft rock in a consecutive order. What if it is the variation itself that is favorable? According to Bowman et al. (2015) the variation reduces the effect of habituation that was seen already on the second day. This could be a reason to play several genres during one day to find out what works best for relaxation and de-stressing.

4.1.4 All music together

When putting all three music types together, the results changed a little bit. Group A seem to be slightly calmed since their walking around and sitting & standing is increased by twelve respectively six percent, and their laying down is increased by

six percent. However, they seem to be affected by music in some way since they increase in both barking and vocalising. Nevertheless, it is hard to put a final verdict on what is the impact since the results are varied. The behaviour of group B is relatively small increases in all variables except for laying down that was increased by 22 percent. This could indicate that music had a good “over all” impact on the group compared to baseline since they actually behaved less actively during music.

Group C, that showed the opposite behaviour to group B, has the largest percental changes, which is partly explained by their very calm behaviour during baseline. They increased walking around by 97 percent, barking by 239 percent, sitting & standing by 72- and vocalising by 15 percent. The only variable that decreased was laying down, which confirms the increase of walking around. As seen in (Kogan et al., 2012), some music have a negative impact on the dogs, making them show signs on stress and more activation than normally. The mean over all three groups shows an increase in walking around by 15, barking by 36 and sitting & standing by twelve percent. They also reduced laying down by 5- and vocalising by six percent. However, this merged result is strongly affected by the large percental changes of group C, which makes it less reliable as a sum up of the inner rooms behaviour.

Group D decreased walking around, barking and sitting & standing by 30-,16 and 18 percent percent and also reduced vocalising by 39 percent. Laying down was increased by ten percent. Group E and F have a similar behavioural pattern but they increased walking around by three and five percent and group F’s decrease in barking and sitting & standing were rather small of just one respectively seven percent. Group E had a larger percental change since barking was decreased by 44- and sitting & standing by 29 percent. Their decrease in vocalising, group E by 38 and group F by 33 percent indicate that music might have had a stress relieving effect since the opposite might have implied dissatisfaction. The merged result saying that all parameters (-10,-35,-20,+9 and -37 %) except for laying down are decreasing is satisfactory in a sense, where it could tell something about the music working in a calming way for the three groups of the outer room.

The behaviour of individual A follows in the same directions (increase or decrease) as the group A. However this individual did not increase its barking as the rest of the group and hence we know that this individual did not incite the others. It also had a small increase in sitting & standing which do not correspond to the small decrease of six percent of its group. Individual B has a similar behavioural pattern as the rest of its group except that it had a larger decrease in walking around (13 percent) than the group that is only changing minus one percent. It also decreases more in barking (38 percent) where the group has a decrease of ten percent. It had a small increase of sitting & standing while the group decreased it by four percent, which is not a very big difference.

Laying down and vocalising are in the same order of magnitude: plus 22 and plus 20 in laying down while vocalising was minus 28 respectively minus 35. Individual C does not seem to be very affected by its group since its results are the opposite. It has no vocal changes and decreases walking around slightly by eleven percent and sitting & standing by 30 percent. It also increases laying down by eight percent. When taking a short look at the individuals' change merged together the change is desirable if talking in terms of activity. Music hence makes the dogs of the inner room decrease walking around, barking and vocalising between 18 to 28 percent each. Sitting & standing had almost no change (-1%) and laying down increased by twelve percent.

When considering a decrease in activity as a desirable result, individual D and E both perform eligible behaviour. Individual D behaves similarly to its' group, with a decrease in walking around, barking, sitting & standing and vocalising from minus 24 to minus 44 percent and laying down was increased by 33 percent. Individual E had a decrease in the same variables from minus 14 to minus 41 percent and a small increase of eleven percent in laying down. Individual F has a difference in barking, where it decreased its barking more (minus 35 percent) than group F. It has a very small increase in laying down of three percent and vocalisations correspond since it decreased by 23 percent. The gathered results of individuals D,E and F says that they decreased in activity level in a range from minus 15 to minus 37 percent for the four active variables and increased laying down by 15 percent.

4.1.5 Analysis and discussion of graphical presentation of each assessed parameter

Groups A, B & C

As seen in *Figure 28* the assessed values of movement did not change a lot in groups A and B. Group A had an decrease from 3 to 2,1 in ambient sound and Group B went from 5,6 to 4,75. It is not possible to give a distinct reason for these changes. They might of course be due to effect from the music, but it could also be by chance or from variation in the assessors estimation. However, group C had an increase from 2,1 to 3,6, 4,3 and 4,8 which indicates increased activity regardless of test sound. The individual of each group, see *Figure 29,* is mainly used as a spot-check to measure heart rate and respiratory rate. Nevertheless, it is interesting to look at the behavioural assessments as well. Individual A and B did follow the same pattern as their respective groups, however individual C does not seem to be bothered by the activity rise in its group and has a noticeably lower baseline and just slight deviation from it during the test sounds. This individual is probably not affected by the music at all.

The same pattern is shown in *Figure 30* where Group A has small deviation compared to baseline and Group B is seen decreasing barking during classical music. Group C increases barking with both ambience and classical music compared to its baseline of 1,0 that says they did not bark at all before the test music. In *Figure 31* it is seen that individuals A and C does not bark at all, since they are graded 1 for baseline and all test sounds. Individual B on the other hand, had an increase during all test sounds which might tell that some dogs bark less when exposed to music. *Figure 32* shows that Groups A and B has small deviations in sitting & standing compared to baseline. Group A had a decrease during ambience and classical music and Group B follows its former pattern with a decrease during classical music, and stays unchanged during nature sound and ambience. Group C, with a baseline of 3,1 had increased sitting & standing during all test sounds, indicating increased activity also in this variable. Individuals A and B, see *Figure 33* follows the behaviour of their respective groups with small variations and individual C had a baseline of 1,5 which was decreased during all test sounds to around 1, which is a too small change to conclude an effect due to the test music. As mentioned before, individual C does not seem to be affected by the test music.

Groups A and B also had small variations in laying down, see *Figure 34. However* Group C decreased it during all test sounds, but mostly during classical music. This strengthens the other variables that said they got more active. Individuals A and B have similar change as their respective groups, with mainly increased laying down, see *Figure 35.* Group C keeps going against its group's behaviour by having a higher baseline above 9,0 and also increasing the frequency to the maximum of 10. If it is an effect from the music or by chance has to do with the assessors evaluation method is not possible to point out. However, individual C seems to be resting a lot more than its group. The level of vocalisations is small in all three groups. Groups A and C had a slight increase during classical music see *Figure 36.* Group B showed little increase in all sounds compared to its baseline of 2,1. This variable shows that the all three individuals follow the same pattern as their respective groups, see *Figure 37.*

Groups D, E & F

Group D had a decrease from a baseline in movement of 2,9 to 1,6 and 1,3 during ambience respectively classical music, which indicates that they were less active during those test sounds, see *Figure 38*. Group E had little deviation from its baseline of 3,25 which could be a result of the music but also affected by other circumstances such as the state of the assessors or be due to chance. All three groups decreased their walking around during classical music, even though E had very small change. All individuals have very similar behavioural patterns as their respective groups, see *Figure 39*.

Barking is seen to decrease for all groups and all sounds except for Group D where nature sound had an increase and Group F where ambience stayed unchanged. Classical music has the largest decrease for all three groups, see *Figure 40*. Individuals A, B and C, see *Figure 41,* have similar behavioural patterns as their respective groups except that D has a higher baseline and E and F had lower baselines. In summary, classical music seems to have the most decreasing effect of all sounds and all individuals.

Group D show a small decrease in sitting & standing during all test sounds, see *Figure 42.* This applies to group E as well, but they have a larger change and baseline. In group F, nature sound halved the sitting & standing while ambience increased it to about 5,5 compared to 4,3. Classical music remained unchanged. The individuals of each group have similar patterns but small individual variations, see *Figure 43*. Group D had a small decrease in laying down during nature sound and went from 7,0 to 9,0 during ambient sound, see *Figure 44*. It also had a small increase in classical music. Group E had even smaller changes, where it is hard to say whether the music has any direct impact on the dogs' frequency of laying down. Group F also showed small increases in laying down for all test sounds. Individual D has, unlike its group, a small increase during nature sound, a little bit bigger increase during ambience and bigger increase during classical music, see *Figure 45*. Individual E has similar pattern as its group, but higher increase during both ambience and classical music. Individual F has a bit smaller increase during nature sound and classical but are close in level to its group.

All groups decreased vocalisations during all test sounds except for in group F where ambience led to a small increase see *Figure 46*. The same pattern is seen for the individuals, see *Figure 47.* This might be explained as a coincidence or indicate that music playing makes the dogs of the study less prone to vocalise themselves.

4.1.6 Heart rate and respiratory rate

Classical music leads to higher pulse in all six individuals compared to nature sound and ambient sound. That means the music and its distinct rhythm and chords may affect the state of the dogs. However it is not completely certain that the dogs are negatively affected by it. A bias that came up was that there were renovations going on at the roof during the week of classical music. This makes it harder to say if it is the music itself that increased the heart rate during this week or if it is connected to the unpredictable noise coming from the roof. Nevertheless, something that really is interesting, none of the dogs increased barking or vocalisations during classical music, which might indicate that the renovations did not disturb significantly. All

individuals, except A and C that remained unchanged, decreased their barking with between 40 to 64 percent. A and C stayed unchanged in vocalisation as well, while B had a small decrease of 13 percent and D, E and F decreased somewhere between 52 to 65 percent each. This, in combination with the fact that all individuals increased laying down, tells that the increased heart rate did not correlate to increased physical activity during this study. In this case, the dogs might have been stressed by either the music or the renovations on the roof, but it did not show in the "visible physical parameters", only as increase in heart rate.

The level of respiration is also consistently higher when classical music is played compared to baseline, which might indicate stress in the dogs. However, this reaction may also be a result of the roof renovations.

As presented in chapter **3.1.7 Music versus baseline in each individual**, there were a few individuals whose comparisons between baseline and music gave significant results. There could be a couple of reasons for this, and a main reason might be that the tests were not carried out as initially planned. This, because unforeseen events such as a burglary attempt, sickness amongst the assessors and an ambulance ride, disturbed the data collection and limited its extent. Another crucial thing about the significant results is that the repeated measurements or assessments are not independent, compared to an effect that would be solely dependent on music or no music, hence there are multiple factors that might affect the dogs at the same time, leading to non-equivocal results.

Other than this, there is an effect called "multiple testing problem" that on a 5 percent significance level, will bring five percent significant results independent of any underlying effects in the data. This makes it impossible/incorrect to trust the significant results, since they might be random in this manner.

4.1.7 Comparing the mean of the groups behaviour

The t-tests done on the variables show no significant results in group A or B. Group C has a majority of significant results and D, E and F had two to three each. Even though it is difficult to draw any conclusions due to "the multiple testing problem" the significance might tell something about the size, consistency and repeatability of some effects. For example, since group C has as many as ten significant results, this might indicate that they actually were affected by the music and had some perceptible changes in behaviour. Groups D, E and F have two or three significant results each. This might be a random result, but the fact that all groups have significant results in vocalisations during classical sound, might indicate a behaviour linked to that test sound. Else it might be a result of the renovations, and its associated disturbances.

The fact that groups E and F had significant results regarding sitting & standing during nature sound might be due to their distinct decrease by 38 percent (group E) and increase by 50 percent (group F) or it could be a result of “the multiple testing problem” giving random but non-reliable significant results.

4.1.8 Qualitative categorising of the assessors utterances from direct observations

Except for measuring heart and respiratory rate and grading each behavioural variable, the assessors have expressed themselves in free text answers. This was used as a complement to the grading assessments and to see what the experienced caregivers would express without further guidance. The request of the form was “describe shortly in free text how the dogs are behaving right now”.

The answers gotten sometimes included thoughts about the actual test music and were for instance: “The music might work calming”, “Beginning to calm down thanks to the new test sounds”, “The ambience seem to have better effect on the dogs than nature sound” and “-No impact from the noise of the roof renovations, might be thanks to the effect of the music”.

This gives some hints about the dogs reaction on the test music, since the sayings come from experts of high credibility who have long experience and know the participants and their usual behaviour well.

4.1.9 Forms, data gathering and possible biases

One could argue that the forms were somewhat long since they were the first to be designed and by the device “rather gather more than less”. However, since the work pace at the daycare was seen to always be high, it could have been efficient to create shorter forms that would have had less questions included to shorten the time for the caregivers. What on the contrary was very good about the forms was that they were tested during the week before the actual start and hence the personnel gave feedback of what worked and what did not work in filling them out, and the forms were divided into five shorter ones for the different assessment occasions instead of one large that was sent in by the end of the day. In this manner, each form could be sent in straight away after each assessment was done. Getting the forms sent in by the end of the day also enabled for double checking day by day that all questions were filled in and if something was missing it was possible to get in touch with the assessors at short notice to not miss out on any data.

To begin with, there are a couple of things that can be disturbing for the study in the

dogs daycare. For instance, in the back room, the washing machine is running most times of the day. This might be changing, and hence giving another sound image than the one obtained in the former room. This results in half of the dogs (D,E & F) having an unaffected sound image while the other half will get the test sound together with the sounds of the washing machine (A, B & C). However, it is not certain that the dogs in the back room are disturbed by the sound of the washing machine, since they are exposed to it daily.

The limited space in the isles at the dogs daycare led to four out of six loudspeakers: two of three in each room being placed in corners. However, they could advantageously be placed in corners or close to a wall since the musical productions that were tested did not include that much bass or low frequency and hence the +6-12 dB amplification was not a problem in this case. On the contrary the positions might be beneficial, since the bass amplifying effect might give the music fuller and richer sound.

The evaluation of data was not possible to perform as planned since the test design was exploratively developed in cooperation with the daycare personnel and hence did not suit a common sound test design. This resulted in too few data points since there were only two assessors generating 12 data points for each variable (walking around, barking, sitting & standing etc.) every day for their three groups of dogs. Depending on different circumstances, the assessments were not carried out for three days for each type of music, and hence the total number of data points varies from 12-24-36 depending if some day(s) had to be cut out. The data was seen varying a lot which according to Roland Sottek (personal communication, february 11, 2022) can be a result of tiredness or disappointment of the assessors. Hence it is not possible to describe the Gaussian distribution and is therefore hard to make any fruitful statistics and distinct conclusion. The changes that are discussed below are also summarised in *table AI* to *table AXX* in Appendix A.

4.2 Veterinary waiting room

Unfortunately, there was only one dog participating in the study of the baseline (without music) and hence the full study could not be carried out as planned. This could be due to inadequate information in the invitation process since there are several receptionists working at the veterinary station. The receptionists were informed about the invitation via email from their boss but it was not controllable to follow up if they actually invited all vaccination bookings and how it proceeded. However the receptionists' boss was given a description about the study and the practicalities of it. For instance, the owners had to be asked in advance since they usually arrive just a few minutes before the booked time slot, which would not be sufficient to perform the study of ten minutes.

One explanation for the low participation might also be that the dog owners did not consider the study interesting. They might just want to come to the clinic for the vaccine and then leave, without having to fill in the form about their dog.

4.3 Veterinary personnel dogs

It was hard to get participants amongst the personnel dogs, probably due to stress and a high workload. However, after the presentation about the study and participation at the Monday morning meeting in January, the participation increased a little. Unfortunately there were not more than three or four persons who carried out the assessment on their dogs as promised, hence the data is scant.

4.3.1 Nature sound

There are rather small changes seen in the personnel dogs when comparing baseline to nature sound. It is also calculated on means coming from varying assessment times, since the work hours vary during a week. However, a small increase in heart rate, for example twelve percent of Dog 1, ten percent of Dog 2 and six percent of Dog 3 might of course have to do with nature sound activating them, yet it is not possible to say it for sure. The respiratory rates on the other hand deviated with just a few percent in all dogs except for in Dog 4 who had an increase of 67 percent. It could be a consequence from the music playing, but it could also be due to decreased activity level from getting in from a walk. However, Dog 4 is the only one with any significant change in respiratory rate and it could say something about the sound working activating for this dog.

4.3.2 Ambience

For ambient sound there are clearer variations compared to baseline. Dogs 1, 2 and 3 increased their heart rate by 28, 21 respectively 13 percent which could indicate some activation due to ambience. Not to forget, the rise could also be a coincidence due to outer circumstances. The change in respiratory rate has variation amongst the dogs. However it is higher, 17, four and 10 percent, than the variation during nature sound. It might indicate that these three dogs got more active from ambient sound, since both parameters were increased in all dogs. However it is not possible to exclude the possibility of chance or outer factors that might have played a significant role to the results.

4.3.3 Classical sound

The week of classical music showed varying results where Dog 1 had an increase in heart rate and decrease in respiratory rate by 14 respectively 13 percent. Still, the changes are small and it is hence not possible to say if they come as a result of the

music or outer factors. Dog 2 had a decrease in heart rate of 17 percent and a four percent decrease in respiratory rate and Dog 4 had a decrease in heart rate of barely three percent and no change in respiratory rate, which could indicate that it is unaffected by the music. In summary, it is not possible to draw any conclusions whether these relatively small changes comes from the classical music.

4.3.4 All music together

The merged result of music versus baseline shows a conclusion of the means of each dog. The increases in heart rate of Dog 1 and Dog 3 are 18 respectively ten percent. Dog 2 had a decrease of 16 percent and Dog 4 only two percent. This might say something about individual preferences, or it can also be results affected by outer circumstances that have nothing to do with the music playing. The changes are small, and the respiratory rates changed by just a few percent in all dogs except Dog 4 that had a 34 percent increase. Nevertheless, it did not participate during ambience, so the result is not speaking for all test sounds, only nature sound and classical music, which might have had an activating effect on the individual.

4.3.5 Visual presentation of change in heart- and respiratory rate for baseline compared to music

The results vary from individual to individual. There is a rise in heart rate in Dog 1 and Dog 3 and it might be due to the music or for other reasons. However, as seen at the dogs daycare, some of the dogs that had highest heart rate did not increase in activity at the same time and hence it is not certain that this dog got more stressed, and if it can be derived from the effect of the music. Although, (Hórvath et al., 2007) showed that animals, that by cortisol level were considered highly stressed, did not show any typical signs on stress in their behaviour. Hence, there is a possibility that the music playing might have worked as a stressor to Dog 1 and 3.

Dog 2 showed more consistent behaviour where all kinds of test music led to decreased heart rate. This might indicate that Dog 2 is affected by the test music, and mostly from ambience and classical where it decreased to 76 respectively 80 bpm. Its reaction could also be random, since the baseline of 100 is rather high: it could indicate that those measurements were affected by some external influence, making the consecutive weeks of sound test look like a decrease, when they really are not. In the end, it does not bring any clues about what music will have the best calming effect on a broader perspective, but it might be a preference of an individual. Dog 4 has none or very little variation from baseline, which might indicate that it does not get affected by the test sounds. It might also be so that the dog had high levels of internal stress, but if it reacting like Group 1, who was seen using a *passive management strategy* (Hórvath et al., 2007), it might not show on the heart rate since these dogs were low in activity despite ascertained stress levels.

When viewing the results of the respiratory rates and their respective baselines, it is clear that there are no marked differences. What actually stands out is the response of Dog 4 on nature sound that went from 20 breaths per minute to 33. This might indicate increased stress from the actual test sound, but it could also be due to outer circumstances such as high energy from coming in from active walks, encountering other individuals in the corridor or simply from the atmosphere at the dog rooms, that potentially could be increased in activity level due to something unrelated to the sounds.

4.3.6 Evaluation of Dog 1

The significant result of the heart rate increasing from the mean of 78 bpm in baseline to 100 bpm during ambient sound can be a sign that Dog 1 got stressed or activated by that test sound. It could also be a random result due to errors like “multiple testing problem” or having too few data points when computing the t-test.

4.3.7 Forms and data gathering

At the point of creating the forms to the personnel dogs at the veterinary station, it had been discovered that the forms from dogs daycare were somewhat long, and hence these forms were purposely shortened to put focus on heart- and respiratory rate. After discussion with the veterinary hospital manager, it was confirmed that for the data to be gathered it was rather crucial that the forms were short and concise. The forms that were split into three, one for each assessment, however seemed to confuse the coworkers. This led to a lot of puzzling when gathering the data, since some sent all their three evaluations of one day on form 1, in spite of written descriptions of which form that were to be used at what occasion. Suspicions are that the misunderstandings and difficulties might not be due to the forms itself, but from lack of information about how the assessments were to be carried out because of irregular work times and not everyone of the staff having the whole information about it.

4.4 General discussion regarding all three test locations

The following discussion is general and can be applied on all three test sites, however it will include some examples from the different test locations.

4.4.1 Advantages and disadvantages from using noninvasive methods

Using noninvasive methods is a prerequisite to lower the risk of influencing the response of the dogs. If stress levels were to be evaluated by blood tests, it would result in having to take into account the contribution of the discomfort that the needle might entail. However, there would be reliable data that could have worked

confirmative in relation to the observations that were done, hence strengthening the reliability of the results of the dogs daycare. Though, this was not feasible due to the time constraints and the non existent budget of the work. Thus, there was no possibility of having blood tests evaluated at a laboratory. A clear advantage of performing only non-invasive methods for evaluation is the flexibility of them, not being bound to said laboratory or other experimental setting for carrying out the test.

Another possible way of evaluating stress with a non-invasive, as in Csoltova et al. (2017) method would be measuring ocular outer temperature. This since the group that also got physical interaction with humans had lower outer ocular temperature and heart rate, although they showed similar stress related behaviours as the group who did not have the physical contact. This could have been a confirmative evaluation method to strengthen the behavioural assessment and the heart rates, that yet are viewed upon as possible true results but also might be due to chance.

4.4.2 Difficulties in measuring stress in dogs

It is not without difficulty assessing stress levels in dogs. Not only practically, in terms of what evaluation methods are used but also, according to Beerda et al. (1997), because behavioural and physiological signs on stress vary from individual to individual. For instance, Rooney et al. (2009) said that dogs that were perceived as quiet and calm still were affected by inherent stress. This was seen in all individuals during the test week of classical music, where all visual behaviours and signs were toned down and decreased, however, all the dogs had increased heart rate compared to baseline during this week. Hence, one can not be sure that assumed judgemental parameters suit for assessing all dogs in the end. For instance, the study by Horváth et al. (2007), showed that the most aggressive dogs did not possess the highest stress levels, but the lowest. This complicates assessing the stress levels of the dogs, especially if the dogs do not show typical visual signs of stress.

Another factor that is important to take into consideration is who performs the evaluation of the dog's emotional state. For example in the study by Mariti et al. (2015), the owners were not as good at assessing signs of stress as the veterinary who is educated and has expertise in ethology. However, the dog owner plays an important role in the assessment process since they are the ones who can tell what is the usual behaviour and when the dog is deviating from it. The dog's change in placement of ears and tail is not obvious for an outsider to detect, nor the change in activity level. Therefore it could be of importance that both parts participate in studies and associated assessments. There will always be a uncertainty due to the jury and hence it would be interesting to evaluate parameters such as skin conductance, ocular temperature and heart rate measured by electric equipment,

hence these would not be dependent on human factors as work related stress or for example tiredness due to lack of sleep or anything else related to the form of the day that might affect the results from day to day.

4.4.3 Bias in test groups

The groups of dogs that were studied at the dogs daycare were not balanced for factors like breed, gender or age. They consisted of large variations in all three categories, and hence there will be no further discussion considering this. The personnel dogs at the veterinary station that gave some data were 8 months, 4, 6 and 9 years old and since the test group was so small, no conclusions are drawn regarding the influence of age. However, generally, high age might be a problem when testing sound in dog environments since they might have had hearing losses and hence will be less affected by the auditory enrichment. It is also important to consider the presence of external biases. For example, the dogs may be affected by each other in terms of temper and pheromones that has nothing or little to do with the music playing, but what happened during the morning at home, on the way to daycare or veterinary station or during the lunch walk.

4.5 Suggestions for improvement

This chapter suggests possible improvements for sound tests at each test location.

4.5.1 Dogs' daycare

The design of the sound tests was exploratively created in dialogue with the caregivers, hence the design was not optimal to suit conventional statistical evaluation methods. For example, since the dogs of the daycare were assessed in groups and not individually, they generated too little data to be used in classical sound test evaluations. The test could have provided more interesting results if each dog would have been assessed and hence given lead to implementing more thorough statistical evaluation methods such as ANOVA. Another proposal that would generate more data could be playing all kinds of music during one day, for several days, this would have increased the significance of the t-tests. Further, one way of improving the test would be to use dogs that are known to react similarly (being active or inactive) to receive constant data.

Further it could be interesting evaluating skin conductance and heart rate with electric equipment to extend the data and to establish data that is not depending on human assessment. One thing that could have been profitable for the results is switching assessor between the six groups, namely asking assessor 1 to evaluate group A,B,C and assessor 2 to do the same with group D,E,F. This could be advantageous to control if the evaluations are reliable or have to be normalised to match each other.

Something that was detected in the phase of installing the equipment, that could have been done differently, is performing the mounting after closing hours. It was seen that some of the dogs were stressed by the presence of strangers in their environment. A couple of them were barking and some that had their room close to a loudspeaker that was mounted were seen shaking and whining. The installation was scheduled during the last opening hours not to bother the dogs, however it would have been better to have it after closing time so that no dogs were disturbed by the visit. As stated before, the forms could have been shortened a little bit to provide for faster execution and hence facilitate the caregivers' work.

4.5.2 Veterinary waiting room

Improving the sound test at the veterinary waiting room would have been enabling it to be carried out as planned. The best way of getting participants would probably be to work out a plan on how the owners are contacted, and invited. This would for instance be personally by telephone and by text message to their phone, to give a personal invite, explain and answer questions about how the test would be performed.

4.5.3 Veterinary personnel dogs

The main difficulty was the low participance (only four dogs) which made it impossible to do any statistical evaluation due to too little data in the end. If there would have been more dogs participating in the test, it would have been interesting to compare the baseline for all individuals to the weeks of music and in the best case scenario there would have been one person doing the assessments of all dogs, to prevent mutual variation and that the dogs are affected by the fact that their owner did the assessment, which may influence the dog in both directions: increase or decrease stress variables, depending on their relationship. A lowering of the heart rate due to physical interaction might be a bias as stated by Csoltova et al. (2017). Hence, measuring outer ocular temperature without physical interaction with the dogs would have been a way of investigating stress levels while minimising the biases of interactions. For example, the personnel assessing their own dogs at the veterinary station might not have been the best option, since the very presence of the owner may directly affect the behaviour and stress level of the dog in either one way or the other.

4.5.4 General suggestions

A general and important suggestion for improvement of the test method and hence results is performing the assessments on a larger scale. Ideally, it would have required that to participate in the sound test, the test location would have had to be

able to do individual evaluations of 20 or more dogs. This would in turn revail more reliable data that would yield better, more distinct and significant results. However, it is not difficult to see that these large scale evaluations would demand financial facilitations to provide for more personnel, to perform the fundamental chores to free up time for the respective assessors.

Further research has to be done on what music would be preferred in a majority of dogs as well as the possibility that the variety of genre itself might be favourable since it counteracts the effect of habituation according to (Bowman et al, 2015).

5. Conclusion

The dogs at the daycare gave proof of the most reduced level of activity during Ambience and Classical music compared to baseline. The largest decrease of heart rate was seen during Nature sound and Ambience.

It was not possible to draw any distinct conclusions from the result of the personnel dogs at the veterinary station. However, the variation in their results gives a hint about behavioural influence and might strengthen the theory that preferred audio content has great individual variation.

It was not possible to find significant differences between the three test sounds and tell which is preferable for making dogs calmer. This was because of the lack of data due to too few test participants.

To sum up, the results of this study fortify those of previous studies where auditory stimulation is seen to be an effective enrichment tool. However, the challenge for further studies is to identify the form of sound that a majority of dogs would prefer, to be used for several purposes. Hence, further research and experiments are needed to cater for each dog's need for stress reducing measures.

References

Alm. M. (2015). *Musikens Historia, Forntid - nutid.* Tiunda musik. http://tiundamusik.weebly.com/uploads/5/2/6/2/5262180/musikhistoria_%C3%A5k_8_vt_2015.pdf.

American Kennel Club. (2018). *Dogs Don't Have a Sixth Sense, They Just Have Incredible Hearing.*
https://www.akc.org/expert-advice/lifestyle/sounds-only-dogs-can-hear/.

Arriaga, G. & Jarvis, E. D. (2013). Mouse vocal communication system: Are ultrasounds learned or innate?. *Brain & Launguage, 124*(1), 96-116. https://doi.org/10.1016/j.bandl.2012.10.002.

Barber, A., Montealegre-Z, F., Ratcliffe, V. & Wilkinson, A. (2020). A Comparison of Hearing and Auditory Functioning between Dogs and Humans. *Comparative Cognition & Behavior Reviews. 15*(2020), 2-24. DOI:10.3819/CCBR.2020.150005E.

Beerda, B., Schilder, M. B. H., van Hooff, J. A. R. A. M. & de Vries, H. W. (1997). Manifestations of chronic and acute stress in dogs. *Applied Animal Behaviour Science*, *52*(3), 307–319. http://www.sciencedirect.com/science/article/pii/S0168159196011318.

Beerda, B., Schilder, M. B. H., van Hooff, J. A. R. A. M., de Vries, H. W. & Mol, J. A. (1998). Behavioural, saliva cortisol and heart rate responses to different types of stimuli in dogs. *Applied Animal Behaviour Science*, *58*(3), 365–381. http://www.sciencedirect.com/science/article/pii/S0168159197001457.

Beerda, B., Schilder, M. B., Van Hoof, J. A., De Vries, H.W. & Mol, J. A. (2000). Behavioural and hormonal indicators of enduring environmental stress in dogs. *Animal Welfare. 9*(1), 49-62. https://www.researchgate.net/publication/40151127_Behavioural_and_hormonal_indicators_of_enduring_environmental_stress_in_dogs.

Bergamasco, L., Osella, M. C., Savarino, P., Larosa, G., Ozella, L., Manassero, M., Badino, P., Odore, R., Barbero, R. & Re, G. (2010). Heart rate variability and

saliva cortisol assessment in shelter dogs: Human–animal interaction effects. *Applied Animal Behaviour Science*, *125*(1), 56–68. http://www.sciencedirect.com/science/article/pii/S0168159110000985.

Bilchick, K. C. & Berger, R. D. (2006). Heart rate variability. *Journal of Cardiovascular Electrophysiology. 17*(6), 691-694.

Bodnariu, A. (2008). Indicators of stress and stress assessment in dogs. Lucrari Stiintifice - Universitatea de Stiinte Agricole a Banatului Timisoara, Medicina Veterinara, 41, 20-26.

Boone, A. & Quelch, V. (2003). Effects of harp music therapy on canine patients in the veterinary hospital setting. *The Harp Therapy Journal. 8*(2), 1, 4-5. https://holisticvetpractice.com/wp-content/uploads/2017/12/harp-study.pdf.

Bowman, A., Scottish SPCA., Dowell, F. J. & Evans, N. P. (2015). 'Four Seasons' in an animal rescue centre; classical music reduces environmental stress in kennelled dogs. *Physiology & behaviour, 143*, 70-82. https://doi.org/10.1016/j.physbeh.2015.02.035.

Bowman, A., Scottish SPCA., Dowell, F. J. & Evans, N. P. (2017). The effect of different genres of music on the stress levels of kennelled dogs. *Physiology & behaviour, 171*, 207-215. DOI: 10.1016/j.physbeh.2017.01.024

Brayley, C. & Montrose, T. (2016). The effects of audiobooks on the behaviour of dogs at a rehoming kennels. *Applied Animal Behaviour Science*, *174*, 111–115. DOI: 10.1016/j.applanim.2015.11.008.

Brucker, M. J., Patel, J. & Sullivan, P. G. (2003). A Morphometric Study of the External Ear: Age- and Sex-Related Differences. *Plastic and Reconstructive Surgery, 112*(2), 647-652. DOI:10.1097/01.PRS.0000070979.20679.1F.

Csoltova, E., Martineau, M., Boissy, A. & Gilbert, C. (2017). Behavioral and physiological reactions in dogs to a veterinary examination: Owner-dog interactions improve canine well-being. *Physiology & Behavior*, *177*, 270–281. DOI: 10.1016/j.physbeh.2017.05.013.

Fletcher, H. & Munson, W. A. (1933). Loudness, Its Definition, Measurement and Calculation. *The Journal of the Acoustical Society of America, 5*(2), 82. https://doi.org/10.1121/1.1915637.

Genelec. (2021). How to place your monitors. https://www.genelec.com/monitor-placement.

Handlin, L. (2010). Human-human and human-animal interaction – some common physiological and psychological effects. [Doktorsavhandling, Institutionen för husdjurens miljö och hälsa, Sveriges Lantbruksuniversitet, Skara]. SLU library. https://pub.epsilon.slu.se/2423/.

Harrison, D. (2019). Så länge har hunden varit vår bästa vän. *Svenska Dagbladet*. https://www.svd.se/a/rAbJxA/sa-lange-har-hunden-varit-var-baste-van.

Horn, L., Huber, L & Range, F. (2013). The Importance of the Secure Base Effect for Domestic Dogs – Evidence from a Manipulative Problem-Solving Task. *Journals Plos One, 8*(5), 1-9. DOI: 10.1371/journal.pone.0065296.

Horváth, Z., Igyártó, B.-Z., Magyar, A. & Miklósi, Á. (2007). Three different coping styles in police dogs exposed to a short-term challenge. *Hormones and Behavior*, *52*(5): 621–630. DOI: 10.1016/j.yhbeh.2007.08.001.

Holistic Vet Practice. (2021). *Music Studies.* https://holisticvetpractice.com/rescue-animal-project/music-studies/.

Hyper Physics (n.d). The piano. http://hyperphysics.phy-astr.gsu.edu/hbase/Music/pianof.html.

International Organization for Standardization. (2014). *Acoustics - Soundscape - Part 1: Definition and conceptual framework.* (ISO 12913-1:2014). International Organization for Standardization. https://www.iso.org/standard/52161.html.

Ito, I., Imada, M., Ikeda, M., Sueno, K., Arikuni, T. & Kida, A. (2001). A morphological study of age changes in adult human auricular cartilage with special emphasis on elastic fibers. *The Laryngoscope*, *111*(5), 881–886. DOI:10.1121/1.427150.

Kogan, L. R., Schoenfeld-Tacher, R & Simon, A. A. (2012). Behavioral effects of auditory stimulation on kenneled dogs. *Journal of Veterinary Behaviour, 7*(5), 268-275. DOI:10.1016/J.JVEB.2011.11.002.

Kuttruff, H. (2007). *Acoustics: An introduction.* Taylor and Francis.

Köster, L., Sithole, F., Gilbert, G & Artemiuo, E. (2019). The potential beneficial effect of classical music on heart rate variability in dogs used in veterinary training. *Journal of Veterinary Behaviour, 30*, 103-109.

Mariti, C., Raspanti, E., Zilocchi, M., Carlone, B. & Gazzano, A. (2015). The assessment of dog welfare in the waiting room of a veterinary clinic. *Animal Welfare*, *24*(299):305. DOI: 10.7120/09627286.24.3.299.

Naturhistoriska riksmuseet. (9 mars 2020). Hunden. https://www.nrm.se/faktaomnaturenochrymden/djur/daggdjur/rovdjur/hunden.1239.html.

Palestrini, C., Previde, E. P., Spiezio, C. & Verga, M. (2005). Heart rate and behavioural responses of dogs in the Ainsworth's Strange Situation: A pilot study. *Applied Animal Behaviour Science*, *94*(1), 75–88. DOI:10.1016/j.applanim.2005.02.005.

Perego, R., Proverbio, D. & Spada, E. (2014). Increases in heart rate and serum cortisol concentrations in healthy dogs are positively correlated with an indoor waiting-room environment. *Veterinary Clinical Pathology*, *43*(1), 67–71. DOI: 10.1111/vcp.12118.

Rooney, N., Gaines, S. & Hiby, E. (2009). A practitioner's guide to working dog welfare. *Journal of Veterinary Behavior*: *Clinical Applications and Research*, *4*(3), 127–134. DOI: 10.1016/j.jveb.2008.10.037.

SLU Universitetsdjursjukhuset (9 mars 2021). *Hjälp ditt djur till ett trevligt veterinärbesök.* https://www.universitetsdjursjukhuset.se/smadjurskliniken/hjalp-ditt-djur-till-ett-trevligt-veterinarbesok/.

Söderström, B. (2017). *Hur tänker din hund?* Bonnier Fakta.

Virbac. (2019). *12 symptom på stress eller oro hos hundar.* https://tinyurl.se/4TE.

Warner, T. (2007). *Dog Body Language Phrasebook*. Salamander books, An imprint of Anova Books Company Ltd.

Zubedat, S., Aga-Mizrachi, S., Cymerblit-Sabba, A., Shwartz, J., Leon, J., Rozen, S., Varkovitzky, I., Eshed, Y., Grinstein, D. & Avital, A. (2014). Human–animal interface: The effects of handler's stress on the performance of canines in an explosive detection task. *Applied animal behaviour science*, *158*, 69–75. DOI: 10.1016/j.applanim.2014.05.004.

Zwicker, E. & Fastl, H. (1999). *Psychoacoustics: Facts and models* (2). Springer Berlin / Heidelberg.

Appendix A

Table AI to *table AVIII* presents the changes in frequency of each assessment activity or variable from baseline in percent. The uneven tables are presenting the result of group A-F and the even present it of the individuals A-F.

Table AI.

Nature sound	Walking around	Barking	Sitting & standing	Laying down	Vocalising
Group A	-6 %	+41 %	+21 %	-4 %	+8 %
Group B	+0,7 %	+5 %	+0,6 %	+13 %	-50 %
Group C	+69 %	+8 %	+52 %	-9 %	-3 %
Groups A,B,C	+12 %	+12 %	+18 %	-3 %	-22 %
Group D	+9 %	+41 %	-17 %	-13 %	-5 %
Group E	-8 %	-34 %	-38 %	0 %	-17 %
Group F	0 %	+40 %	+50 %	+23 %	-48 %
Groups D,E,F	0 %	-20 %	-35 %	+4 %	-23 %

Table AII.

Nature sound	Walking around	Barking	Sitting & standing	Laying down	Vocalising
Individual A	-11%	0 %	+35 %	-4 %	0 %
Individual B	-15 %	-41 %	+8 %	-3 %	-62 %
Individual C	+7 %	0 %	-22 %	+7 %	0 %
Individuals A,B,C	-11 %	-30 %	+14 %	+1 %	-37 %
Individual D	+12 %	+9 %	-24 %	+6 %	-8 %

Nature sound	Walking around	Barking	Sitting & standing	Laying down	Vocalising
Individual E	-6 %	-21 %	-23 %	0 %	-31 %
Individual F	-5 %	-56 %	-34 %	+3 %	-30 %
Individuals D,E,F	0 %	-24 %	-28 %	+3 %	-23 %

Table AIII.

Ambient sound	Walking around	Barking	Sitting & standing	Laying down	Vocalising
Group A	-31 %	+3,7 %	-19 %	+15 %	+8 %
Group B	+11 %	+15 %	-0,6 %	+15 %	-29 %
Group C	+100 %	+233 %	+71 %	-30 %	+3 %
Groups A,B,C	+17 %	+48 %	+10 %	-4 %	-11 %
Group D	-43 %	-35 %	-14 %	+29 %	-1 %
Group E	+8 %	-31 %	-23 %	+9 %	0 %
Group F	+53 %	0%	+29 %	+2 %	+12 %
Groups D,E,F	+3 %	-20 %	-6 %	+13 %	-22 %

Table AIV.

Ambient sound	Walking around	Barking	Sitting & standing	Laying down	Vocalising
Individual A	-53 %	0 %	-15 %	+24 %	0 %
Individual B	+9 %	-18 %	+11 %	+10 %	-30 %
Individual C	-20 %	0 %	-33 %	+8 %	0 %
Individuals	-15 %	-13 %	-4 %	+14 %	-18 %

Ambient sound	Walking around	Barking	Sitting & standing	Laying down	Vocalising
A,B,C					
Individual D	-50 %	-59 %	-22 %	+40 %	-58 %
Individual E	-3 %	-13 %	-23 %	+20 %	-31 %
Individual F	+33 %	+16 %	+26 %	-2 %	+13 %
Individuals D,E,F	-9 %	-17 %	-9 %	+18 %	-27 %

Table AV.

Classical	Walking around	Barking	Sitting & standing	Laying down	Vocalising
Group A	0 %	+33 %	-21 %	+ 9 %	+25 %
Group B	-15 %	-52 %	-13 %	+38 %	-5,9 %
Group C	+124 %	+475 %	+92 %	-48 %	+45 %
Groups A,B,C	+16 %	+48 %	+8 %	-9 %	+17 %
Group D	-57 %	-53 %	-22 %	+13 %	-64 %
Group E	-8 %	-66 %	-27 %	+4 %	-67 %
Group F	-37 %	-1%	0 %	+17 %	-64 %
Groups D,E,F	-32 %	-65 %	-18 %	+11 %	-65 %

Table AVI.

Classical	Walking around	Barking	Sitting & standing	Laying down	Vocalising
Individual A	+26 %	0 %	-6 %	+19 %	0 %
Individual B	-32 %	-55 %	-11 %	+55 %	-13 %
Individual C	-20 %	0 %	-33 %	+8 %	0 %
Individuals	-28 %	-40 %	-12 %	+21	-3 %

A,B,C					
Individual D	-54 %	-59 %	-27 %	+54 %	-65 %
Individual E	-32 %	-50 %	-21 %	+14 %	-62 %
Individual F	-24 %	-64 %	-24 %	+6 %	-52 %
Individuals D,E,F	-37 %	-58 %	-24 %	+23 %	-60 %

Table AVII.

All music together	Walking around	Barking	Sitting & standing	Laying down	Vocalising
Group A	-12 %	+26 %	-6 %	+6 %	+14 %
Group B	-1 %	-10 %	-4 %	+22 %	-28 %
Group C	+97 %	+239 %	+72 %	-29 %	+15 %
Groups A,B,C	+15 %	+36 %	+12 %	-5 %	-6 %
Group D	-30 %	-16 %	-18 %	+10 %	-39 %
Group E	+3 %	-44 %	-29 %	+4 %	-38 %
Group F	+5 %	-1 %	-7 %	+14 %	-33 %
Groups D,E,F	-10 %	-35 %	-20 %	+9 %	-37 %

Table AVIII.

All music together	Walking around	Barking	Sitting standing	Laying down	Vocalising
Individual A	-30 %	0 %	+5 %	+13 %	+8 %
Individual B	-13 %	-38 %	+3 %	+20 %	-35 %
Individual C	-11 %	0 %	-30 %	+8 %	0 %
Individuals A,B,C	-18%	-28 %	-1 %	+12 %	-19 %

Individual D	-31 %	-36 %	-24 %	+33 %	-44 %
Individual E	-14 %	-28 %	-26 %	+11 %	-41 %
Individual F	+2 %	-35 %	-7 %	+3 %	-23 %
Individuals D,E,F	-15 %	-33 %	-20 %	+15 %	-37 %

Figure AI to Figure AX shows the same changes in percent graphically, divided in groups and activity and *Figure AXI to Figure AXX* shows the corresponding changes regarding the six individuals A-F.

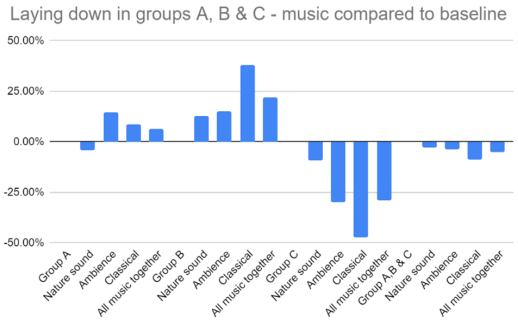


Figure AI. Changes from baseline in percent for laying down in groups A,B and C.

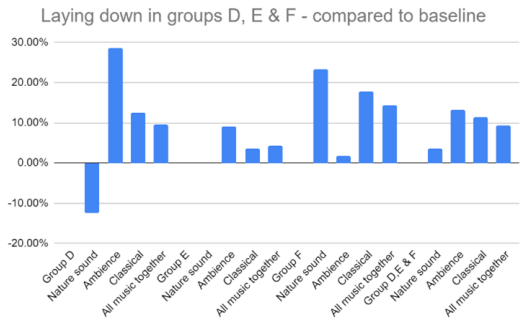


Figure AII. Changes from baseline in percent for laying down in groups D, E and F.

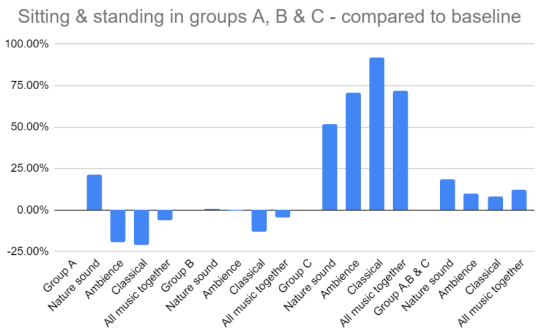


Figure AIII. Changes from baseline in percent for sitting & standing in groups A,B and C.

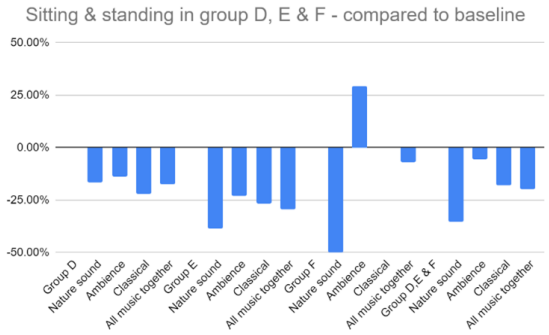


Figure AIV. Changes from baseline in percent forsitting & standing in groups D, E and F.

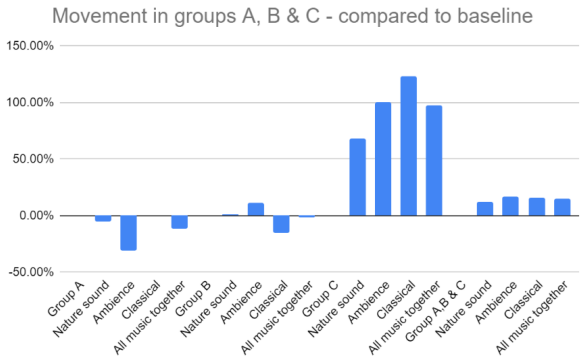


Figure AV. Changes from baseline in percent for movement in groups A,B and C.

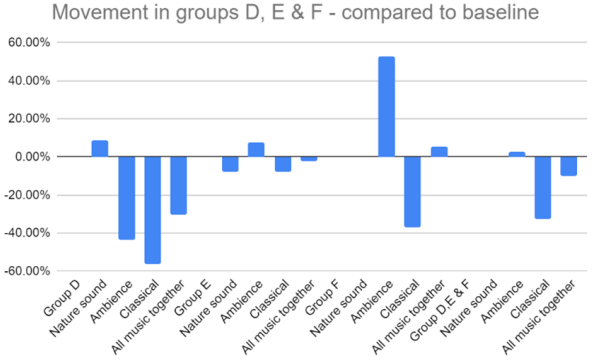


Figure AVI. Changes from baseline in percent for movement in groups D, E and F.

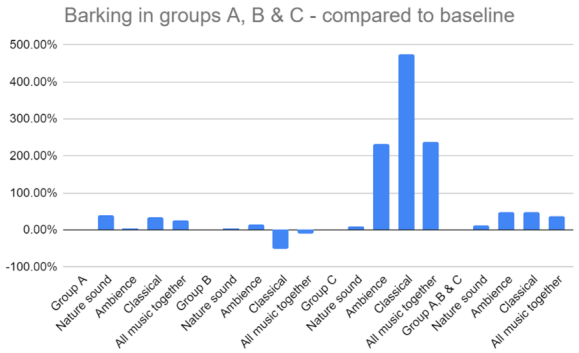


Figure AVII. Changes from baseline in percent for barking in groups A,B and C.

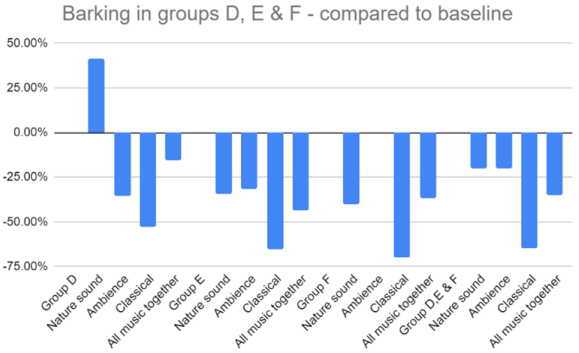


Figure AVIII. Changes from baseline in percent for barking in groups D, E and F.

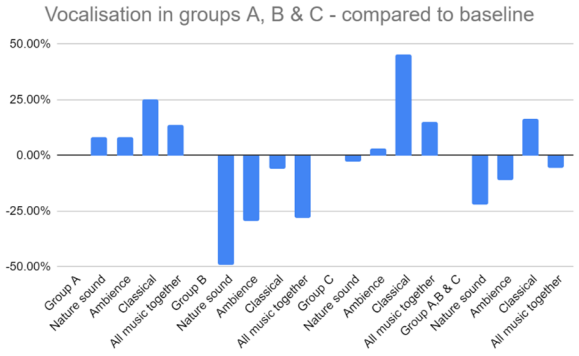


Figure AIX. Changes from baseline in percent for vocalisation in groups A,B and C.

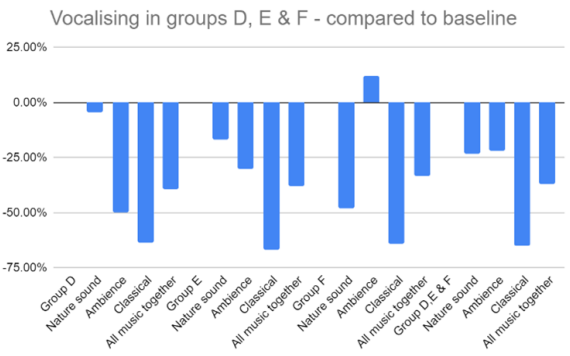


Figure AX. Changes from baseline in percent for vocalisation in groups D, E and F.

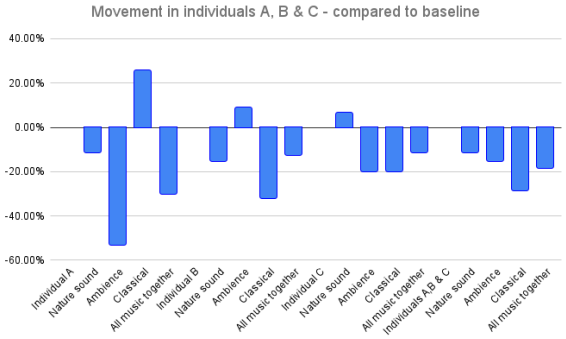


Figure AXI. Changes from baseline in percent for movement in groups A,B and C.

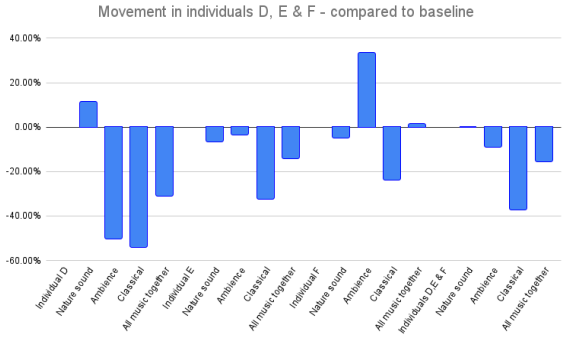


Figure AXII. Changes from baseline in percent for movement in groups D, E and F.

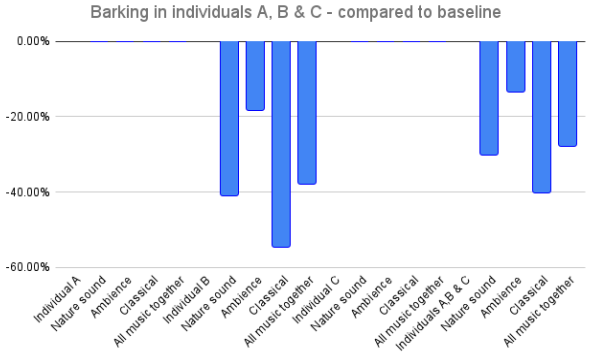


Figure AXIII. Changes from baseline in percent for barking in groups A,B and C.

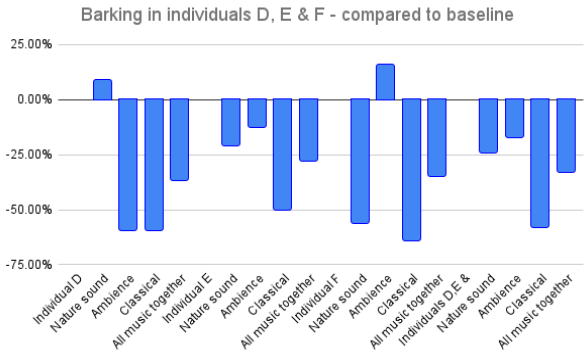


Figure AXIV. Changes from baseline in percent for barking in groups D, E and F.

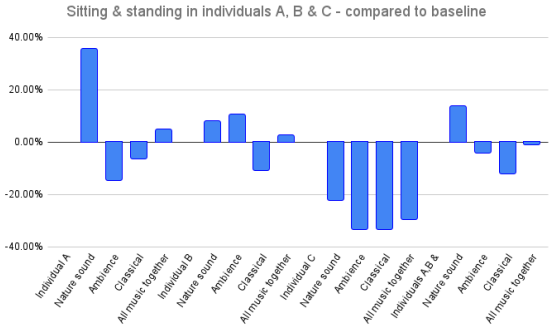


Figure AXV. Changes from baseline in percent for sitting & standing in groups A,B and C.

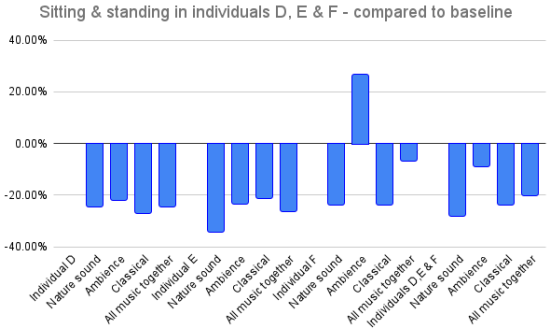


Figure AXVI. Changes from baseline in percent for sitting & standing in groups D, E and F.

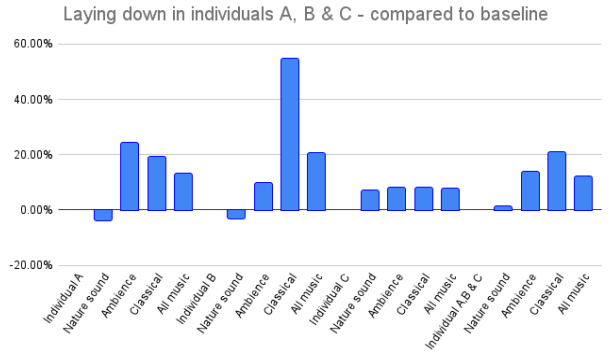


Figure AXVII. Changes from baseline in percent for laying down in groups A,B and C.

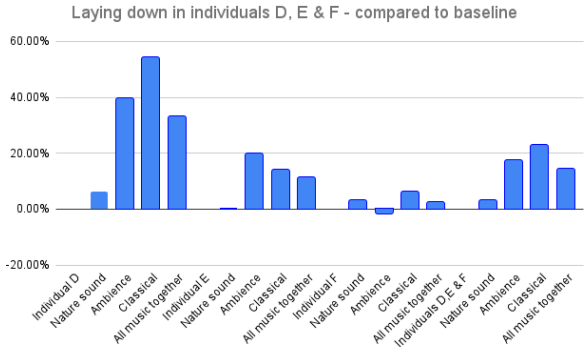


Figure AXVIII. Changes from baseline in percent for laying down in groups D, E and F.

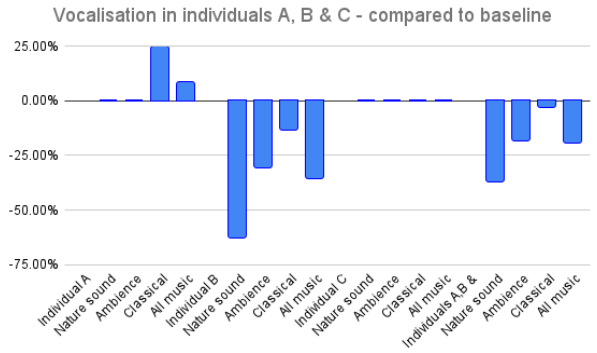


Figure AXIX. Changes from baseline in percent for vocalisation in groups A,B and C.

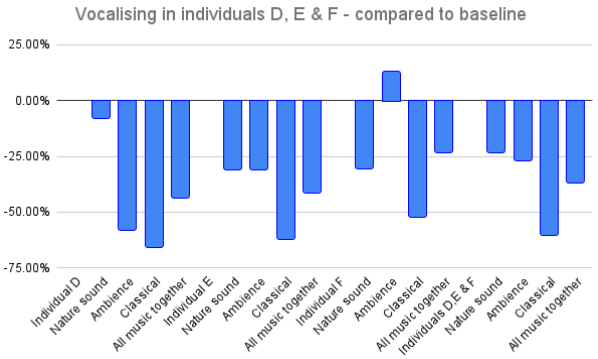
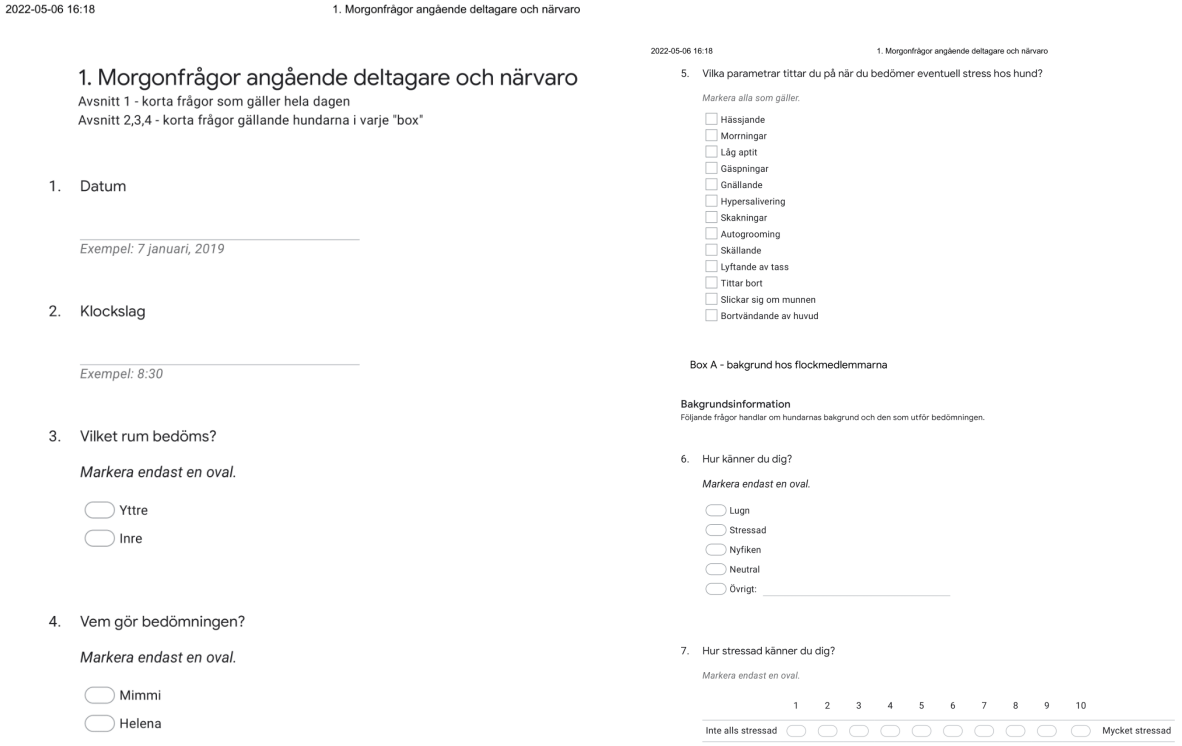


Figure AXX. Changes from baseline in percent for vocalisation in groups D, E and F.

Appendix B

Following are the forms that were given to the assessors via Google forms. *Forms under BI* belongs to the dogs daycare and *Forms under BII* to the veterinary station.

BI



2022-05-06 16:18 1. Morgonfrågor angående deltagare och närvaro

1. Morgonfrågor angående deltagare och närvaro

Avsnitt 1 - korta frågor som gäller hela dagen

Avsnitt 2,3,4 - korta frågor gällande hundarna i varje "box"

1. Datum

Exempel: 7 januari, 2019

2. Klockslag

Exempel: 8:30

3. Vilket rum bedöms?

Markera endast en oval.

- Yttre
- Inre

4. Vem gör bedömningen?

Markera endast en oval.

- Mimmi
- Helena

2022-05-06 16:18 1. Morgonfrågor angående deltagare och närvaro

5. Vilka parametrar tittar du på när du bedömer eventuell stress hos hund?

Markera alla som gäller.

- Hässjande
- Morrningar
- Låg aptit
- Gäspningar
- Gnällande
- Hypersalivering
- Skakningar
- Autogrooming
- Skällande
- Lyftande av tass
- Tittar bort
- Slickar sig om munnen
- Bortvändande av huvud

Box A - bakgrund hos flockmedlemmarna

Bakgrundsinformation

Följande frågor handlar om hundarnas bakgrund och den som utför bedömningen.

6. Hur känner du dig?

Markera endast en oval.

- Lugn
- Stressad
- Nyfiken
- Neutral
- Övrigt: _____

7. Hur stressad känner du dig?

Markera endast en oval.

	1	2	3	4	5	6	7	8	9	10	
Inte alls stressad											Mycket stressad

8. Hur många hundar kommer totalt att vara i rummet idag?

9. Hur många hundar kommer att vara i boxen idag?

Markera endast en oval.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ Övrigt: _____

10. Hur många är tikar?

Markera endast en oval.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ Övrigt: _____

11. Hur många är hanar?

Markera endast en oval.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ Övrigt: _____

12. Hur många av 1). tikarna och 2). hanarna är kastrerade?

13. Hur många av hundarna väger 1). <7 kg, 2). 7-12 kg, 3). 12-17 kg, 4). >17 kg

Box B - bakgrund hos flockmedlemmarna

Bakgrundsinformation
Följande frågor handlar om hundarnas bakgrund och den som utför bedömningen.

14. Hur känner du dig?

Markera endast en oval.

- ◯ Lugn
- ◯ Stressad
- ◯ Nyfiken
- ◯ Neutral
- ◯ Övrigt: _____

15. Hur stressad känner du dig?

Markera endast en oval.

	1	2	3	4	5	6	7	8	9	10	
Inte alls stressad	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Mycket stressad

16. Hur många hundar kommer att vara i boxen idag?

Markera endast en oval.

- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ Övrigt: _____

17. Hur många är tikar?

Markera endast en oval.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ Övrigt: _____

18. Hur många är hanar?

Markera endast en oval.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ Övrigt: _____

19. Hur många av 1). tikarna och 2). hanarna är kastrerade?

20. Hur många av hundarna väger 1). <7 kg, 2). 7-12 kg, 3). 12-17 kg, 4). >17 kg

Box C - Bakgrund hos flockmedlemmarna

Bakgrundsinformation
Följande frågor handlar om hundarnas bakgrund och den som utför bedömningen.

21. Hur känner du dig?

Markera endast en oval.

- ◯ Lugn
- ◯ Stressad
- ◯ Nyfiken
- ◯ Neutral
- ◯ Övrigt: _____

22. Hur stressad känner du dig?

Markera endast en oval.

	1	2	3	4	5	6	7	8	9	10	
Inte alls stressad	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Mycket stressad

23. Hur många hundar kommer att vara i boxen idag?

Markera endast en oval.

- 1
- 2
- 3
- 4
- 5
- Övrigt: _____

24. Hur många är tikar?

Markera endast en oval.

- 1
- 2
- 3
- 4
- 5
- Övrigt: _____

25. Hur många är hanar?

Markera endast en oval.

- 1
- 2
- 3
- 4
- 5
- Övrigt: _____

26. Hur många av 1). tikarna och 2). hanarna är kastrerade?

_____

_____

27. Hur många av hundarna väger 1). <7 kg, 2). 7-12 kg, 3). 12-17 kg, 4). >17 kg

_____

_____

BII

Ljudstudie Evidensia

Första bedömningen, vid ankomst

1. Dagens datum?

Exempel: 7 januari, 2019

2. Vad heter hunden?

3. Hur gammal är hunden?

4. Vilken ras är hunden?

5. Är hunden tik/hane och kastrerad/okastrerad?

Markera alla som gäller.

- [ ] Tik
- [ ] Hane
- [ ] Kastrerad
- [ ] Okastrerad
- [ ] Övrigt:

6. Vad är klockan vid ankomst? (första bedömningen)

Exempel: 8:30

7. Hur känner du dig?

Markera endast en oval.

- ◯ Lugn
- ◯ Stressad
- ◯ Nyfiken
- ◯ Neutral
- ◯ Övrigt:

8. Hur stressad känner du dig?

Markera endast en oval.

	1	2	3	4	5	6	7	8	9	10	
Inte alls stressad	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Mycket stressad

9. Hur upplevs hunden?

Markera endast en oval.

- ◯ Lugn
- ◯ Stressad
- ◯ Nyfiken
- ◯ Neutral
- ◯ Övrigt:

10. Hur stressad upplevs hunden?

Markera endast en oval.

	1	2	3	4	5	6	7	8	9	10	
Inte alls stressad	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Mycket stressad

11. Förklara med fria ord hur hunden agerar för tillfället

Mätning av hjärt- och andningsfrekvens i 1 minut vardera

Närma dig hunden på ett så neutralt sätt som möjligt.

12. Vad har hunden för 1). hjärtfrekvens & 2). andningsfrekvens?

CHALMERS
UNIVERSITY OF TECHNOLOGY

Department of Architecture and Civil Engineering
Division of Applied Acoustics
Chalmers University of Technology
together with *Efterklang* part of AFRY
Gothenburg, Sweden 2022