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Comparison of Stress and Learning Effects of Three Different Training Methods: Electronic Training Collar, Pinch Collar and Quitting Signal

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To My Father

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1. Introduction

A bright orange sun is setting on a prehistoric horizon. A lone hunter is on his way home from a bad day at hunting. As he crosses the last ridge before home, a quick movement in the rocks off to his right catches his attention. Investigating, he discovers some wolf pups hiding in a shallow den. He exclaims, "Wow...cool! The predator...in infant form."

After a quick scan of the area for adult wolves, he cautiously approaches. The pups are all clearly frightened and huddle close together as he kneels in front of the den . . . all except one. The darkest colored pup shows no fear of the man's approach. "Come here you little predator! Let me take a look at you, he says. After a mutual bout of petting by the man and licking by the wolf, the man suddenly has an idea. "If I take you home with me tonight, maybe mom and the kids will forgive me for not catching dinner . . . again."

GRANDIN and DEESING (1998)

The partnership between human and the domestic dog *(Canis familiaris)* has had deep roots ever since the first taming of the wolf. Nowadays, a great number of dogs are kept by humans and, thus, the dogs are accepted as one of the most popular companion animals all over the world. It is for sure that the most of the dogs are trained by using a large variety of training methods. These methods used to train dogs range from the utilization of reward-based methods in the form of ‘’positive reinforcement’’ to the use of training aids as aversive stimuli such as electronic shock collars, ultra sonic devices, pinch collars etc. in the form of ‘’positive punishment’’ and ‘’negative reinforcement’’. The application of aversive stimuli, in particular via electronic training collars, in training is, however, a highly controversial issue. Even though the use of these devices is forbidden in several European countries, the debate on this issue still continues all around. On one hand, supporters claim that with respect to producing physical damage to the skin and/or the body, electronic training collars are relatively safe than the mechanical training aids (TORTORA 1982, LINDSAY 2005) and, further, they have no adverse effects at all (CHRISTIANSEN *et al.,* 2001b).

Opponents, on the other hand, argue that the use of electronic training collar is painful, unethical and unnecessary regardless of the severity of the training situation or problem behavior (OVERALL, 2007). In addition, British Small Animal Veterinary Association (BSAVA) (2003) claim that even highly motivated behaviors such as chasing prey can be elicited without using electronic training collars.

There are some scientific researches examined effects of electronic training collars in the area of dog training. The studies conducted by SCHILDER and van der BORG (2003) and SCHALKE *et al.,* (2006) should be particularly mentioned. Both scientific researches conclude that using electronic training collars is only in accordance with animal protection principles if the following criteria are met: The user must have sufficient practical and theoretical knowledge of these devices and must have undergone a test showing his capability to use them. Nevertheless, even if these criteria are met, the devices may only be used in specifically designated training situations.

All in all, both scientific studies conclude that alternative training methods imply less stress on the animal, thus they comply with animal protection policies. Up to this day, however, no detailed scientific research has been conducted that could prove this hypothesis.

The aim of this study is to investigate whether any stress is caused by the use of specific conditioned signal, *quitting signal*, and/or pinch collars as alternatives to electric training collars, and if they do so, whether the stress produced in the process is comparable to the one with electric training collars. Therefore, we set out to investigate the direct behavioral reactions of the dogs upon administration of above mentioned training methods. We are especially interested in finding out which method leads to less stress in dogs by comparing their behavioural effects.

Furthermore, this study will examine the learning effects of the above mentioned training methods, *i.e.,* electronic training collar, the pinch collar and the quitting signal. Thus, the compatibility of the learning effect of the quitting signal with the learning effect of the pinch- and the electronic training-collar, namely the compatibility of effectiveness of ‘’negative punishment’’ method with the ‘’positive punishment’’ method, in a training with high level of arousal and motivation will be assessed.

2. Literature review

2.1 Stress

2.1.1. Definitions - Theories

Over the years, many researchers from different scientific fields have focused on investigation of stress. As a result, many different stress theories have been developed.

According to the Shorter Oxford English Dictionary, the word *''stress''* came into the language partially from the middle French term *''distresse''* (distress) and partially from the old French word *''estrece''* (narrowness, oppression). The Shorter Oxford English Dictionary also states that in the earliest records in 1440 *''stress''* has been defined as ''the physical pressure exerted on an object'' and also as ''the strain of a load or weight''.

The use of the word *''stress''* as a scientific term, was coined from physical sciences (STOTT 1981, MOBERG 1987). In the 17th century physicist-biologist ROBERT HOOKE (1635-1703) used the term *''stress''* as ''the area over which the load impinged'' and ''strain'' as ''the deformation of the structure created by the interplay of both load and stress''. Hooke's findings had strong influence on early 20th century models of stress (BROOM and JOHNSON 1993, LAZARUS 1993).

CLAUDE BERNARD (1957), who is considered as the father of modern physiology, first introduced the concept of ''internal environment'' which is the basis of homeostasis. According to this concept animals have two environments: *''a milieu extérieur''* in which the organism is situated, and *''a milieu intérieur''* in which the tissue elements live. BERNARD (1957) emphasized that the "constancy of the internal milieu is the essential condition to a free life".

The term *''homeostasis''*, however, was proposed by physiologist WALTER B. CANNON who is known as the pioneer of stress research. Moreover CANNON (1915) coined the term *''fight– or flight-responses''* that is also called the *''acute stress response''*.

HANS SELYE (1977), who is the pioneer of the studies on the biological mechanisms in the stress response, first used the term *''stress''* for biological sciences, which had long been used in physical sciences, and named it *''biological stress''*. However, he later emphasized that what is called *''stress''* in biology corresponds not to *''stress''* but to *''strain''* in physics. According to SELYE (1977), regardless of the characteristic of the stressor, the one nonspecific response-secretion of adrenal corticosteroids occurs. Therefore he changed the concept of *''stress''* from a number of specific homeostatic responses to a nonspecific syndrome (FRIEND 1991).

He also formulated a model called the *''General Adaptation Syndrome''* (G.A.S) or *''SELYE's Syndrome''*, in which the hypophyseal-adrenal axis plays the central role. The syndrome develops in three consecutive stages: during the first stage called the *''alarm reaction''*, producing of high amount of ACTH results in considerable corticoid secretion. Under the condition of prolonged exposure to similar agents, a second stage called the *''stage of resistance''* occurs. During this stage the organism adapts to the stressor and ''animals can meet demands with little increase in their basic ACTH and corticoid production'' (SELYE 1977). Finally, *''the stage of exhaustion''* in which the adaptation energy and capability is lost sets in. SELYE (1977) also identified that under such circumstances several stress related diseases, which he called *''stress diseases''* or *''diseases of adaptation''* (such as gastrointestinal peptic ulcer, heart accidents, nervous exhaustion etc.) develop.

Contrary to SELYE's concept (1977) proposing that there is one non-specific response for all stressors, MASON (1968) showed that biological responses are stimulus-dependant, and that both *''physical''* and *''psychological''* stimuli are capable of regulating adrenal cortical activity.

MASON (1968) also emphasized that predictability; novelty and fear have great influence on adrenal cortex responses.

BREAZILE (1987) defined *''stress''* as an internal (physiologic or psychogenic) or environmental stimulus eliciting stress response or resulting in adaptation in an animal.

According to BREAZILE (1987), there are three forms of stress:

''Eustress'' is a good stress which is beneficial to the animal's comfort, well-being and / or reproduction,

''Neutral stress'' is neither harmful nor helpful to the animal's comfort, well-being and / or reproduction,

''Distress'' causes harmful responses that interfere with the animal's comfort, well-being and / or reproduction, regardless of whether distress itself is harmful or not.

On the other hand, MOBERG (1987) described the term *''stress''* as the biological responses elicited by a threat to an individual's homeostasis, and the term *''distress''* as the situation when stress response truly threatens the animal's well-being. According to the ''MOBERG's Model of Animal Stress'', four types of biological responses are available to the animal for coping with stress. When an animal is subjected to stress, the first and easiest response is a behavioral one, which means avoiding the stressor by moving away from the threat. The animal's second defense system during stress is an autonomic nervous system that affects the number of biological systems including the cardiovascular system, the gastrointestinal system, the exocrine glands and the adrenal medulla. MOBERG (1987) emphasized that despite the relatively short-lasting effects of the autonomic nervous system, the hormones released from the hypothalamic-pituitary system, which is the third biological response to the stress, had a long- lasting effect on the body, and also that the immune system plays an important role in responding to stressor.

LAZARUS (1966) primarily focused on *''psychological stress''* and defined it as ''a relationship with the environment that the person appraises as significant for his or her well-being and in which the demands tax or exceed available coping resources''.

According to his stress theory two concepts were important: *appraisal*, i.e., ''universal process in which people (and other animals) constantly evaluate the significance of what happening for their personal well-being'' and *coping*, i.e., ''person's ongoing efforts in thought and action to manage specific demands appraised as taxing or overwhelming'' (LAZARUS 1991).

LAZARUS' stress concept emphasizes the relationship between individuals and their environment (LAZARUS 1991). Thus, it is separated from the other stress definitions referring to ''a specific stimulus eliciting the biological response''.

HOBFOLL (1989) offered a new theory called the *''conservation of resources''* (COR) theory which is also based on the *''psychological stress''*. He furthermore states that the loss of resources is the primary source of stress. According to the COR theory, stress occurs in cases of loss or threat of resources, or of a lack of gain following the investment (HOBFOLL 1989, HOBFOLL et al. 1996).

McEWEN and WINGFIELD (2003), however, discussed the stress concept within the framework of *allostasis* and defined stress as "events that are threatening to an individual and which elicit physiological and behavioral responses as a part of *allostasis* in addition to that imposed by normal life cycle". In this manner, they introduced two new concepts: *allostatic load*, i.e., adaptive responses to daily and seasonal individual demands such as migrating, breeding, molting etc. and *allostatic overload*, i.e., the state in which the energy requirements exceed the energy income of the individual, or the condition in which the organism continues to store energy though energy requirements are not exceeded, such as stress related food consumption.

URSIN and ERIKSEN (2004) recently developed a stress theory called the *''Cognitive Activation Theory of Stress''* (CATS) based on neurophysiological activation and arousal concepts. According to CATS, the stress response is ''an alarm which produces general and unspecific neurophysiological activation whenever homeostatic imbalance or threat to homeostasis and life of the organism occurs''.

ERIKSEN et al. (1999) emphasized that the stress response is dynamic and develops in phases and, also, that the time course of stress response is very important for evaluating relationships between the stressors and the observed physiological responses, as well as for any pathophysiological consequences of such relationships. CATS assumed that ''the initial stage of the response-characterized by positive feedback and feed-forward mechanism- is followed by the activation of the homeostatic mechanism, and subjects with efficient coping show the fast- and short-lasting catecholamine response, while subjects with high defense mechanisms (related to stimulus expectancies) may show more signs of prolonged activation''. URSIN and ERIKSEN (2004) proposed that when the expectancies, which are attached to the responses, are positive, there is no health risk in a healthy organism, and that the ill-effect only occurs in case the lack of coping.

2.1.2 Stress and Distress Concepts

SELYE (1976) proposed that ‘’any situation in life that makes demands upon our adaptive mechanism creates stress’’, namely, that both pleasant and unpleasant experiences elicit the same result – *stress* (SELYE 1976). He used the term *‘’eustress’’* to define the good stress resulting from events like great joy and ecstasy and the term *‘’distress’’* to define the bad stress resulting from events like frustration, failure and humiliation.
Thus, he considered *‘’stress’’* to become evident in two forms. SELYE (1976) also pointed out that although *‘’stress’’* is necessary for life and the total elimination of *‘’stress’’* is equal to the death, *‘’distress’’* must be diminished since it is harmful and unpleasant to the organism.

EWBANK (1985), on the other hand, discussed *‘’stress’’* as a general concept including three different phases which are *‘’physiological stress’’*- the harmless and fully adaptive level -, *‘’overstress’’*- the probably adaptive level which causes some damages to the animal -, and *‘’distress’’*- the possibly adaptive, harmful and unpleasant level which is outwardly expressed by behavior. Moreover, he claimed that an animal, which is not showing the obvious external behavioral signs, is not distressed, although it may still be suffering.
Another researcher who emphasized on the three forms of stress was BREAZILE (1987). He stated that *‘’distress’’* causes harmful effects on the animal’s well-being, and distress responses often play a determining role in inducing various disorders in animals, such as alterations in feeding behavior, hypertension, gastric ulceration, immune deficiencies etc.. BREAZILE (1987) furthermore emphasized that, although distress responses are often evoked by prolonged or intense eustress or neutral stress stimuli, in some cases, particularly in case of pain or discomfort, they can also be directly elicited.

On the other hand, MOBERG (1987) developed a hypothesis based on the biological cost of stress to separate *‘’distress’’* from non-threatening *‘’stress’’*. According to this hypothesis, the cost of stress is minimized and it is not important to the animal, as long as sufficient biological reserves exist to cope with the stressors. However, stress becomes distress ‘’when the stress response shifts sufficient resources to impair other biological functions’’.

2.1.3 Assessment of Stress

The central nervous system (CNS) is the key to stress response, since the perceiving and interpreting of the stressor and, consequently, the activation of neuroendocrine, autonomic, immunologic and behavioral responses are coordinated by this system. In this part two different indicators of stress, namely physiological and behavioral stress indicators, will be discussed in detail.

2.1.3.1 Physiological Indicators of Stress

As mentioned above the main physiological systems evaluated as stress indicators are neuroendocrine, autonomic and immunologic systems.

a. Neuroendocrine System

The important function of the neuroendocrine system during the stress response was first demonstrated by SELYE (1977) who showed that several noxious agents such as heat, cold or muscular exercise etc. are capable of activating this system. MASON (1968), on the other hand, emphasized that psychological stimuli are also capable of regulating the hypotalamus-pituitary-adrenocortical axis (HPA). Later studies showed that, although the pituitary-adrenal system is an essential and the best known regulator of stress response, many other neuroendocrine systems such as the systems involved in reproduction (i.e., follicle-stimulating hormone (FSH), luteinizing hormone (LH), prolactin (PRL), testosterone), in metabolism (i.e., growth hormone (GH), thyroid-stimulating hormone (TSH), insuline, oxytocin), as well as a number of peptides including beta endorphin, the enkephalins and substance P are involved in eliciting stress (ROSE 1984, MATTERI et al. 2000, WIEPKEMA and KOOLHAAS 1993).

To sum up, today it is evident that stress response is stress-specific. ‘’Many of the responses, however, particularly the pituitary adrenocortical responses, are common to a large number of stressful stimuli’’ (GANONG 1984). Therefore in this study, we will generally focus on the HPA response to the stress.

Stimulating of CNS through a number of different stressors causes the interleukin 1β stimulated secretion of corticotropin releasing factor or hormone (CRF or CRH) from the hypothalamus.

CRF, which is a neurohormone synthesized by neurons in the paraventricular nucleus (PVN) of the hypothalamus, reaches the pituitary by a series of portal-hypophysial vessels and initiates the release of adrenocorticotropic hormone (ACTH) from the anterior pituitary (adenohypophysis) (GANONG 1984, MATTERI et al. 2000, HARBUZ and LIGHTMAN 1992, BROOM and JOHNSON 1993).

The production of ACTH is regulated partly by hypophysiotropic hormones and partly by feedback of target organ hormones, i.e., glucocorticoids. Althogh CRF is the major regulatory factor inducing ACTH secretion, other hormones such as vasopressin, oxytocin and the catecholamines can also initiate ACTH secretion (AXELROD and REISINE 1984, MATTERI et al. 2000). Finally, an increase in plasma concentration of ACTH stimulates the secretion of glucocorticoids (cortisol and corticosterone), mineralocorticoids and androgens from the adrenal cortex.

MATTERI et al. (2000) stated that the stress response at the level of the adrenal gland is at least as complicated as at the level of the pituitary and the other upper mechanisms. Even though ACTH is the predominant hormone regulating glucocorticoid secretion, CRH and VP may also initiate glucocorticoid production and secretion by the paracrine way within the adrenal gland (MATTERI et al. 2000).

BREAZILE (1987) pointed out that the increased level of glucocorticoids is a well-recognized component of distress response and, also, that the increase of glucocorticoid hormones affects the bodily functions such as metabolism, inflammatory and immunity. Increased secretion of glucocorticoids leads to metabolic disorders such as ketosis, hyperlipemia, and metabolic acidosis due to the enhancement of hepatic gluconeogenesis, resulting in hyperglycemia, and also, the enhancement of lipid and protein catabolism and inhibition of glucose uptake in nonhepatic tissues.

Glucocorticoid hormones are also responsible for the production of lipocortins which are active in the migration of reactive cells into tissues, the activation of inflammation, the limiting of the phospholipase A-2 activation, thus limiting the activation of prostoglandins, thromboxanes and leucotrienes.

Therefore the increased level of lipocortins results in enhanced susceptibility to infections.

b. Autonomic Nervous System

The significant role of the autonomic nervous system in the acute stress response was first emphasized by CANON (1915).

The autonomic nervous system has two major components which both play active roles during stress - the sympathetic and the parasympathetic systems. When an organism is subjected to stressful stimuli, increased sympathetic activity and decreased parasympathetic activity occurs, resulting in cardiovascular changes such as enhanced heart rate, blood pressure and vasoconstruction, and, also, in metabolic changes such as an elevation of body temperature, contraction of the smooth muscle of the digestive system, and secretion of catecholamines, as well as vasopression and substance P (MOBERG 1985, PORGES 1985, BREAZILE 1987, WIEPKEMA and KOOLHAAS 1993). Epinephrine and norepinephrine play a role in the inhibition of gastrointestinal motility and secretion, leading to maldigestion and malabsorbtion, and induce immunosuppression (BREAZILE 1987).

Increased sympathoadrenal activity additionally causes the renin secretion which is an enzyme turning angiotensinogen into angiotensin I. Subsequently, angiotensin I cleave to active angiotensin II which stimulates the production of aldosterone, and, consequently causes enhanced water and sodium reabsorbtion and potassium excretion by renal tubules. Moreover, angiotensin II stimulates the synthesis and secretion of vasopressin which provides a positive feedback in the sympathoadrenal system, resulting in the enhancement of sympathoadrenal activity (BREAZILE 1987).

The autonomic system has a short-term effect on the cardiovascular system and the metabolism during stress, thus, it helps the animal to make quick physiological adjustments in response to acute stress (MOBERG 1985).

b. Immune System

Alterations in the immune system during stress response can be considered as another indicator of stress (GOLUB and GERSHWIN 1985, KELLEY 1980, BLECHA et al. 1984). Although this immunomodulation is mostly related to the enhanced plasma level of glucocorticoids, it is now known that the other mechanisms such as CNS, autonomic nervous system, catecholamines and endorphines play a vital role in the immune response to stress (GOLUB and GERSHWIN 1985).

The presence of glucocorticoid receptors on lymphocytes and monocytes was first shown by BURCHFIELD (1979). COMSA et al. (1982) later found that the receptor population on lymphocytes enhances during the stress response. In this manner, the importance of glucocorticoid hormones in immune response to stress has been demonstrated.

The effects of glucocorticoid hormones on the immune system are via causing lysis or margination of blood leucocytes, particularly T-helper lymphocytes, monocytes, and eosinophils and, also, via causing decreased antibody concentrations and inducing neutrophilia by releasing of marginated neutrophils into the circulation (GOLUB and GERSHWIN 1985, ROTH 1985, BREAZILE 1987). Moreover, glucocorticoids induce thymic involution or a reduction by their lytic effect on thymocytes (GOLUB and GERSHWIN 1985).

On the other hand, the autonomic nervous system induces immunomodulation through autonomic nerves extending to the lymph nodes, thymus, spleen, and blood vessels. CNS control of blood vessels is also considered as a factor that plays a significant role in the immune response to stress (GOLUB and GERSHWIN 1985).

2.1.3.2 Behavioral Indicators of Stress

The significance of behavioral indicators as a stress parameter has been emphasized by many different authors.

MASON (1971) stated that as the case maybe ‘’the only bodily response which might conceivably be equally appropriate, in a homeostatic sense, under conditions of both heat and cold would be a behavioral response of emotional arousal or hyper alerting preparatory to flight, struggle or other strenuous exertion which might serve to eliminate the source of heat or cold or remove the subject from its presence’’. As a result, he offered that the stress concept should be discussed primarily as a behavioral concept rather than as a physiological concept.

According to MOBERG (1985), the behavioral response, ‘’to simply remove itself from the treat’’ is the easiest and the most economic way in eliminating or coping with stress. Even in the case of lack of escape option, behavior may still help the animal ‘’to ameliorate the impact of the stressor by engaging in displacements’’. BROOM and JOHNSON (1993), also, suggested that the behavioral responses comprising startle responses, and defensive or flight reactions, which often follow orientation reactions are often the most obvious indicators of stress and pain. Therefore they also have an essential value as welfare indicators.

EWBANK (1985) further considered the external behavioral signs as the indicators of distress and particularly emphasized that an animal that is not exhibiting outwardly recognizable behavior is not distressed even though it may be suffering.
According to him, as long as four criteria are fulfilled, it is possible to show the interconnection between stress and behavior.

1) ‘’The stressor must be identified and (ideally) quantified.
2) The physiological responses (e.g. epinephrine and/ or corticosteroid hormone levels) must be quantified and (ideally) correlated with the stressor level and the degree of behavioral change.
3) The behavioral changes must be obvious, fully described and measured.
4) Damage to the physical and/ or psychological well-being of the animal must be demonstrated.’’

He also formulated the obvious abnormal behaviors into three categories:

1) Easily seen *self-evident abnormal behaviors* which cause pathological changes (signs of overstress and/or distress) and decrease in biological production (e.g. tail-biting in pigs),

2) Easily seen *minor abnormal behavior*s which cause little or co-existing pathological changes (few signs of overstress and/or distress) and also, which probably do not result in loss of biological production (e.g. bar gnawing in stall confined sows),

3) *qualitative/quantitative changes in otherwise normal behaviors* which include none of the signs of overstress or distress and cause unknown effect on biological production (e.g. increase in normal aggression) (EWBANK 1985).

In a study conducted by HICKS et al. (1998), it was shown that behavioral signs seem to be the most reliable and consistent stress indicators. In that study, weanling pigs exposed to acute stressors, such as shipping, heat and cold. As a result, it was found that physiological, endocrine and immune traits are not consistently changed by different acute stressors, whereas in every treatment behavioral changes can clearly be identified.

a. Coping and Coping Strategies

Coping and coping strategies in domestic animals have received growing attentions over the past several years. As a result, the term coping has been defined in many different ways by a number of researchers. For this study, however, the definition given by WECHSLER (1995) will be followed and thus, coping will be referred to ‘’a behavioral reaction to aversive situations, i.e, the situations inducing physiological stress reactions’’.

HENRY and STEPHENS (1977) proposed that two different behavioral coping strategies are available: an active and a passive strategy.

Subsequent studies conducted on three shrews (VON HOLST 1985), primates (SAPOLSKY and RAY 1989), rodents (BOHUS et al., 1987, BENUS et al., 1991), piglets (HESSING et al., 1993), sows (SCHOUTEN AND WİEPKEMA, 1991) and rats (KORTE et al., 1992) also confirmed the availability of two major coping strategies.

Behaviorally, the active response is based on CANNON's (1915) fight-flight response and characterized by aggression and territorial control, whereas the passive response known as the conservation-withdrawal response (ENGEL and SCHMALE 1972) is characterized by immobility (VON HOLST 1985, BOHUS et al., 1987, SAPOLSKY and RAY 1989, BENUS et al., 1991, HESSING et al., 1993, SCHOUTEN and WIEPKEMA 1991, HANSEN and DAMGAARD 1993, KOOLHAAS et al. 1999).

In a study conducted by BENUS et al. (1991), it was found that the animal performing active coping strategy, either tries to remove the stress source or to escape from it, whereas the passively coping animals seem to decrease their activity.

Another study examining adaptation to captivity in beech marten have found similar results for the distinction of two major coping strategies. In that study, it was showed that active animals are aggressive and react relatively independent from the external stimuli. They also attempt to change their surroundings when they are exposed to acute stress. These behavioral reactions are accompanied by the high activity in the sympathetic nervous system. Passive individuals, however, seem to react heavily on according to the external stimuli, and they show immobility under acute stress, in other words, ''they accept the surroundings rather than try to change them''. Concomitant to behavioral reactions, high parasympathetic activity, often in combination with the activation of hypophysial-adrenocortical axis, is observed in passively coping animals (HANSEN and DAMGAARD 1993).

As a result, the studies above have many findings in common, which support the idea that ''the characteristic of the passive coping style is to stop performing overt behavior when exposed to an aversive situation and to wait for a change while active individuals adopt various strategies'' (WECHSLER 1995).

KOOLHAAS et al., (1999), on the other hand, described the coping style as ''a coherent set of behavioral and physiological stress responses which is consistent over time and which is characteristic to a certain group of individuals'' and preferred to use terms proactive coping instead of active coping and reactive coping instead of passive coping.

According to KOOLHAAS et al. (1999) ''the terms active and passive coping do not properly describe the fundamental differences since the very fundamental difference seems to be the degree in which behavior is guided by environmental stimuli''. Thus, they hypothesized that the individual level of aggressive behavior depends on the way of animals' reaction to various environmental challenges and aggressive individuals show a more proactive type of behavioral response while reactive individuals are more adaptive and flexible. They further emphasized that different coping styles are based on a differential use of various physiological and neuroendocrine mechanisms. For instance, cortisol plays an essential role in fear-induced freezing behavior which is the part of the reactive coping response in rats.

COOLS et al. (1990) also pointed out that the apomorphine-susceptible rats exhibited more proactive coping behavior such as fleeing than the apomorphine-unsusceptible rats which exhibited more reactive behavior such as freezing reaction to an open-field.

Enhancing these two major coping strategies, WECHSLER (1995) classified the coping responses into four general groups: escape, remove, search and wait. He also confirmed that an animal which is exposed to aversive stimulus is either escapes from the stimulus or removes it. However, when there is a lack of possibility of performing neither of them, the animal may wait for a spontaneous change in the aversive situation to conserve the energy instead of repeating these coping strategies over and over (WECHSLER 1995).

This behavioral strategy is also known as apathetic behavior in laboratory and farm animals (FRASER 1975, WIEPKEMA et al. 1983). If the absence of a stimulus which release a specific behavior such as feeding leads to the aversive situation, the animal performs search behavior, which is also known as appetitive behavior (CRAIG 1918, HUGHES and DUNCAN 1988, WECHSLER 1995). ''Appetitive behavior is characterized by high levels of locomotory and exploratory behavior that enhance the probability of finding an absent stimulus'' (WECHSLER 1995).

b. Behavioral Indicators of Acute and Chronic Stress

BURCHFIELD (1979) defined acute stress as ‘’any event which occurs within a given (usually short) time period and does not reoccur frequently, if at all’’ and chronic stress as ‘’a stimulus to which the organism is continuously exposed’’.
FRIEND (1991), however, stated that differentiating between acute and chronic stress situations is difficult and there are no exact definitions for guidance. Yet, some generalized and largely duration-dependent distinctions in the reactions of animals can be made.

c. Behavioral Indicators of Acute Stress

Acute fear and pain can easily be recognized in most animals through behavioral signs: ‘’the animal’s posture will make it look smaller: it may crouch and perhaps even tremble or sweat. An animal in acute pain may vocalize in an intense manner, attempt to escape the source of the pain, and, if escape is not possible, become frenzied or aggressive towards the perceive source of pain. Animals also will turn their heads or avert their eyes from the source of fear and will often defecate. In some situations, overreaction to stimuli may occur, even showing fear toward stimuli that normally would not be frightening’’ (FRIEND 1991).

Different researchers emphasized on several behavioral elements of acute stress in different animals. In this part, however, mainly the acute behavioral stress indicators in dogs will be discussed since this study has been examined in dogs.

SOKOLOV (1960) pointed out that orientation reactions, namely the physiological changes alerting and preparing the animal for the action, are the first behavioral responses when an animal is subjected to environmental challenge. They are, however, not the indicators of a stress situation. When an animal is exposed to stress, startle responses and defensive or flight reactions often follow the orientation reactions.

Startle responses are acute responses comprising postural changes, jumps and vocalizations, which include ‘’cessation of previous activity such as resting, feeding or grooming, followed by initiation of immobility, a posture that allows flight, defense, a jump or other sudden movement, and often the production of characteristic sounds’’ (BROOM and JOHNSON 1993).

They may vary depending on the individual characteristics, the context in which it occurs, and also, on the previous experience (CORSON 1971, CORSON and CORSON 1976, DANTZER and MORMÉDE 1983a, GRAY 1987, BROOM and JOHNSON 1993, VINCENT and MICHELL 1996, BEERDA 1997).

GRAY (1987) categorized the fear eliciting stimuli into five groups and named them as novel stimuli, intense stimuli, stimuli relating to special evolutionary dangers, stimuli arising during social interactions with conspecifics and conditioned stimulus depending on in which context they occur.

The findings from BEERDA (1997) revealed that gender, breed, and age differences do not significantly affect hormonal and immunological measures although they do influence the behavior.

Another study conducted by CORSON (1971), in which the dog breeds of Fox Terrier and Beagle are subjected to anticipating unavoidable shock, demonstrated breed difference in canine stress responses. In that study, CORSON (1971) found significant differences in thermogenic responses between these two dog breeds and hypothesized that the differences in stress responses between breeds are derived from a predominant ‘’fight or flight’’ type of stress response (CANNON 1915) in Terriers compared to ‘’conservation-withdrawal’’ (ENGEL and SCHMALE 1972) type of stress response in Beagles (CORSON and CORSON 1976).

Other important modulators of the behavioral effects of the acute aversive situations are predictability and controllability. A study examining traumatic avoidance learning in dogs showed that in anticipation of electric shock, there was a strong tendency to develop stereotypic behaviors. Furthermore, in context that stereotyped behavior developed, many behavioral signs which had previously exhibited were often no longer evident (SOLOMON and WYNNE 1953).

In another experiment, DESS et al. (1983) demonstrated that dogs given signaled shocks were much less reactive to novel subsequent shocks than the dogs previously exposed to unsignaled shocks.

BEERDA (1997) also showed that the dogs which are not able to anticipate the stressors tended to exhibit a very low posture and trembling when exposed to stressors, whereas the dogs anticipating the stressors show a moderate lowering of body posture, body shaking and oral behaviors. In that study, it was also observed that anticipation of the stressor induces restlessness.

SOLOMON and WYNNE (1953) identified the profusely salivating, emitting a high-pitched screech, urinating and defecation which they call ‘’projectile elimination’’, rapidly and jerkily rolling eyes, pupillary dilatation, piloerection, trembling of small muscle groups all over the body and turning the breathing into short, irregular gasping as the components of a general intense fear reaction in anticipation of electric shocks in dogs.

In a study conducted by SCHWIZGEBEL (1982), yelping, snout licking, paw-lifting, lowered standing and crouched sitting postures have defined as stress indicators in response to acoustic and physical punishment. Although SCHWIZGEBEL (1982) considered these signs as submissive behaviors, BEERDA (1997) emphasized that these behavioral elements might be the expression of escape tendency.

BEERDA (1997) also reconfirmed that body shaking, oral behaviors, mouth opening, paw lifting, restlessness (including noising and locomotor activity), trembling, yawning, yelping, urinating and defecating and a low body posture are typical signs of acute stress in dogs. According to him, the lowered posture of dogs and trembling may indicate a relatively severe state of stress, while oral behaviors, yawning, open mouth, body shaking and a moderately lowered posture occur when an animal is exposed to a stressor in a social setting.

LINDSAY (2001) also confirmed that lowering and arching of the body, tucking the tail tightly between the legs, piloerection, intense muscular stiffening, and thigmotactic reactions involving efforts to lean on the owner or against some other object (including floor) are postural signs of fear in dogs.
He further stated that lowering head, averting eye contact, flattening ears, loudly whining, yipping, shrieking are often exhibited, when the dogs confront the fearful situation (LINDSAY 2001).

d. Behavioral Indicators of Chronic Stress

FRIEND (1991) stated that evaluating chronic psychological stress reactions is always problematic since the behavioral responses are dependant on characteristics of both the stressor and the individual subjected to it, and also, ‘’behaviors labeled as abnormal often can be considered normal responses to an abnormal environment’’.

On the other hand, HAVERBEKE et al. (2008) particularly emphasized that the behaviors, previously associated with chronic stress, depend on whether the animal has been challenged or not. In that concept, chronically stressed dogs which are challenged perform increased locomotor activity, circling, body shaking, nosing, yawning, displacement behaviors and ambivalent postures, whereas unchallenged dogs exhibit low body posture, increased auto grooming, intentions to change the state of locomotion, sighing, sitting, panting, caprophagy, vocalizing, paw-lifting, urinating and stereotypic behaviors (SOLOMON and WYNNE 1953, ELLIOT and SCOTT 1961, SCHWIZGEBEL 1982, BEERDA et al. 1999).

i. Rebound Behavior

Rebound behavior is the intensified redisplay of a particular behavior, after it has been prevented for a time. FRIEND (1991) defined rebound behavior as ‘’intensification of drives’’.

A study conducted by DELLMEIER (1985) is a good example of chronic close confinement stimulated hyperactivity in animals. In that study, the calves that had the most restricted housing conditions, showed the most locomotor behaviors during the open field tests. MARIN et al. (2006) also showed that the locomotor activity, which is induced by increased-novelty, develops in rats after being exposed to chronic restraint.

Another study conducted on dogs showed that the dogs, which are prevented from barking by wearing a muzzle for forty-three hours, exhibit an increase in time of excessive barking compared to the one in the pre-experiment condition, once the muzzles were taken off (CRONIN et al., 2003).

ii. Learned Helplessness

Another significant result of chronic stress is learned helplessness which was first defined by OVERMAIER and SELIGMAN (1967). Learned helplessness is a situation which develops when the animal is subjected to chronic and unavoidable stress.

OVERMAIER and SELIGMAN (1967) showed that the dog exposed to chronic unavoidable shock, later fails to learn to escape from the shock in a different situation although escape was possible. In this manner, that study proved that repeated unsuccessful attempts to avoid the aversive event can result in behavioral inhibition and a state of depression.

iii. Stereotypic behavior

MASON (1991) defined stereotypic behavior as a ‘’repetitive invariant behavior pattern with no obvious goal or function’’. LINDSAY (2001) pointed out that compulsive behaviors usually consist of ordinary behaviors expressed out of context, in excess, or in an exaggerated form and occur under unnatural conditions such as conflict and frustration. He further emphasized that ‘’ stereotypes have species-specific relevance and present similar forms in animals belonging to same species’’.

FRIEND (1991) stated that stereotypic behaviors such as tongue rolling in confined bulls or cribbing and stall weaving in horses, seem to help animals coping with stress by increasing their sensory stimulation, muscular and skeletal activity, and the sense of control over their relationship to the environment. On the other hand, in some cases the stereotypic behavior leads to undesirable effects like injury to the feed of chronically pacing animal.

2.2 Ethogram of Dog Behavior

Ethogram is a a concise, objective, and representative catalog or list of terms and descriptions of the species-specific behavioral patterns, vocalizations and odors of an animal under the determined environmental conditions (LEHNER 1979, BANKS 1982, GATTERMANN 1993, IMMELMANN et al. 1996, WARNOCK and ALLEN 2003).

2.2.1 Neutral Posture of the Dog

FEDDERSEN-PETERSEN and OHL (1995) defined the neutral posture of the dog as following: ‘’The body orientation is parallel to the ground while the legs are held in a normal straight position, the head is slightly raised so that the neck and the mouth establish a right angle, the tail is held relaxed and downwards (there are many different variations among the dogs from ‘not available one’ to ‘permanent imposing behavior’), the face is smooth (this characteristic depends on the dog breed), the lips are not tensed and the ears are principally noise-oriented. The ears in wolves and in dogs, which have straight ears, are held vertically whereby directed to the front. The eyes are blinked coordinately and softly.’’

2.2.2 Socio-Positive Behavior

HEYMER (1977) stated that ‘’social behavior begins when at least two individuals interact with each other in a friendly fashion’’. According to this definition, social behavior includes all forms of interaction between individuals in a friendly context.

Considering this concept, FEDDERSEN-PETERSEN and OHL (1995) discussed socio-positive behavior within the frame of social behavior and described it as ‘all forms of distance-decreasing behaviors, except play behavior’.

The behavioral elements of the social-positive behavior are shown in table 2.1.

Table 2.1 Behavioral elements of Socio-positive behavior *(Developed from HIRSCHFELD (2005))*

Behavioral Elements	**Authors**
Sniffing the coat	ZIMEN 1971, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000
Pushing the one's noise into the coat	FOX 1971 b, ZIMEN 1971, FEDDERSEN 1978, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000 EISFELD 1966, ALTHAUS 1982
Running ahead-''come on'' call to the friendly animal	FEDDERSEN-PETERSEN u. OHL 1995
Muzzle contact-the behaviors such as putting one's muzzle into the conspecific's mouth and licking at the muzzle	SCHENKEL 1947, FOX 1971 b, ZIMEN 1971, FEDDERSEN 1978, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000, FEDDERSEN-PETERSEN 2004
Biting at the coat	SCHENKEL 1947, ZIMEN 1971, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000
Licking the neck and the head hair of the conspecific and taking small bites from these parts by incisives	ZIMEN 1971, FEDDERSEN 1978, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000
Licking the coat	ALTHAUS 1982
Sniffing out the anal area	SCHENKEL 1947, TEMBROCK 1957, SCOTT and FULLER 1965, EISFELD 1966, FOX 1971 a, b, ZIMEN 1971, FEDDERSEN 1978, NOTT 1992, BRADSHAW and NOTT 1995, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000, FEDDERSEN-PETERSEN 2004
Sniffing out the supracaudal gland area	YOUNG and GOLDMANN 1944, SCHENKEL 1947, EISFELD 1966, FOX 1971 b, ZIMEN 1971, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000
Sniffing the gaita	TEMBROCK 1957, SCOTT and FULLER 1965 FOX 1971 a, ZIMEN 1971, FEDDERSEN 1978, NOTT 1992, BRADSHAW and NOTT 1995, FEDDERSEN-PETERSEN and OHL 1995
Sniffing the urine	TEMBROCK 1957, SCOTT and FULLER 1965 FOX 1971 a, ZIMEN 1971, FEDDERSEN 1978, NOTT 1992, BRADSHAW and NOTT 1995, FEDDERSEN-PETERSEN and. OHL 1995
Sniffing, licking and biting the genital area	SCHENKEL 1947, SCOTT and FULLER 1965, EISFELD 1966, FOX 1971 a, b, ZIMEN 1971, FEDDERSEN-PETERSEN and OHL 1995, FEDDERSEN-PETERSEN 2004

Jostling	ZIMEN 1971, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000
Chin resting-intends to snuggling up to the partner-it is also a behavioral element of the imposing behavior	BEKOFF 1972 a, GEORGE 1995
Shoving against the partner	ZIMEN 1971, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000
Wandering around the partner	FEDDERSEN-PETERSEN and OHL1995
Rubbing against the partner	ZIMEN 1971, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000
Snout licking	SCHENKEL 1947, ZIMEN 1971, FEDDERSEN-PETERSEN and OHL 1995
Licking at the muzzle of the partner	SCHENKEL 1947, ZIMEN 1971, FEDDERSEN-PETERSEN and OHL1995
Raising a front paw	SCHENKEL 1947, ZIMEN 1971, FEDDERSEN-PETERSEN and OHL1995
Muzzle pushing	SCHENKEL 1947, FEDDERSEN-PETERSEN and OHL 1995
Active submission	FEDDERSEN-PETERSEN and OHL 1995
Acceptance of the friendly contact	EISFELD 1966
Friendly approach	UMLAUF 1993, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000

2.2.2.1 Active Submission

According to the definition given by SCHENKEL (1967), active submission, which is one of the forms of socio-positive behavior, refers to the behavior pattern which includes the signals of inferiority with intent to contact with the individual(s). FEDDERSEN-PETERSEN and OHL (1995), on the other hand, gave a more detailed definition and described active submission as the greeting behavior exhibited between the individuals willing friendly contact with each other.

All in all, both definitions outlined intend of the individual towards friendly social integration, as the most distinguishing characteristics of active submission. This behavior pattern derived from an activity of the cub begging for food and the active submission exhibited by adult dogs during the social interaction, which includes the behavioral elements transformed from feeding and suckling activity (SCHENKEL 1967).

SCHENKEL (1967) mentioned that two variances of social role of active submission are particularly important, one of which is group ceremony, and *i.e.* a collective display allegiance to the leader (FOX 1974) and the other is the empty gesture, the nose-push, of the submissive individuals to the superior individuals which are at a distance.

FEDDERSEN-PETTERSEN and OHL (1995) furthermore stated that this behavior pattern is exhibited by the dogs or the wolves in order to demonstrate or to test the group harmony. According to them, the female dogs in heat also use active submission when confronting with the male dogs. In addition, the puppies exhibit this behavior pattern while greeting the adult dogs and /or human friends.

The signals of active submission can be described as following: ‘the ears are lowered while directing backwards or flattened on the head which is lifted up and slightly turned away from the partner. The body posture of the dog is crooked and slightly crouched. The muzzle is held at the same level as that of the partner. Pushing the corners of the partner’s mouth and licking at the partner’s lips or people’s hands, as well as licking at one’s mouth while looking at the partner at a distance are also observed as a common element of active submission. In addition, the lips are pulled back horizontally while covering the teeth-submissive grin (FOX 1971a). The corners of the eyes are also pulled back as a result of tense facial muscles while the eyes are directed to the partner. Wagging of the lowered tail is also one of the elements of active submission. Another characteristic element of this behavior pattern is lifting of the front paw which derives from the infantile-begging activity (SCHENKEL 1967, FOX 1971a, FEDDERSEN-PETERSEN and OHL 1995, OVERALL 1997, BEAVER 1999).

2.2.2.2 Allelomimetic Behavior

ABRANTES (1997) described allelomimetic behavior as a ‘’contagious behavior, i.e. behavior which influences another to do the same’’. BEAVER (1994), on the other hand, explained it as the behaviors supporting the group harmony, as well as the coexistence of members.

He further stated that the behaviors such as distance-reducing interactions, reproduction, grooming, hunting, namely the behaviors concerning with social interactions reflect the allelomimetic nature of the individual.

Behavioral elements of allelomimetic behavior are shown in table 2.2.

Table 2.2 Behavioral elements of allelomimetic behavior *(Developed from HIRSCHFELD (2005))*

Behavioral Elements	**Definitions**	**Authors**
Wandering around the partner		MURIE 1944, ZIMEN 1971, FEDDERSEN-PETERSEN and OHL 1995, ROTTENBERG 2000
Lying down together-sleeping together		MURIE 1944, VAUK 1954, SCHMIDT 1957, SCOTT and FULLER 1965, EISFELD 1966, FOX 1971 b, ZIMEN 1971, ALTHAUS 1982, HEINE 2000
Nestling	Intention of the individual to a body contact with its partner	EISFELD 1966
Sitting together		MURIE 1944, SCOTT and FULLER 1965
Nestling	Intention of the individual to a body contact with its partner	EISFELD 1966
Sniffing together		HIRSCHFELD 2005
Waiting together	Gathering of the dogs which have the same expectations at a determined point. In this situation body contact such as ‘’shoving’’ may occur.	HIRSCHFELD 2005

2.2.3 Passive Submission

Passive submission is performed by the inferior individual in case that it is strongly impressed by the dominant partner (SCHENKEL 1967). SCHENKEL (1967) also emphasized that ‘’*passive submission* expresses some kind of timidity and helplessness’’ though it also has a *begging quality* like active submission. Another difference from active submission is that ‘*passive submission*’ is rarely shown in a spontaneous manner. In fact, it can be described as a reactive behavior against ‘imposing behavior’ or ‘threatening behavior’ (FEDDERSEN-PETERSEN and OHL 1995).

In contrast to active submission, *passive submission* derived from suckling posture, namely from the passive role of the cub during mother-cub connection (SCHENKEL 1967). SCHENKEL (1967) further pointed out that the social scene, in which the passive submission is observed, is parallel to that in the mother-cub interaction during olfactory investigation and anogenital licking by the mother.

FEDDERSEN-PETERSEN and OHL (1995) stated that passive submission is often exhibited by the dogs/wolves when they pass into the defensive posture. The intensity of the submissive posture, however, depends on the sort of aggression shown by the superior or the expected attack.

In such cases, two characteristic behavioral elements of this behavioral pattern are observed in the inferior: *Rolling over* and *turning the head away* (*avoidance of direct eye contact)* while exhibiting a subdominant posture (ZIMEN 1971, FEDDERSEN-PETERSEN and OHL 1995).

Behavioral signals of passive submission can be defined as follows: Avoidance of direct eye contact is usually the first signal of passive submission, which is followed by more obvious signals in any order (BEAVER 1994, 1999). The head is lowered, direct eye contact is avoided and the ears are lowered and horizontally turned. This body posture will often placate the superior (FEDDERSEN- PETERSEN and OHL (1995).

In case that the inferior must perform more intensive body posture, the ears are flattened on the head. Due to the flattened ears and the tensed forehead, the head appears to be bigger and smooth. Narrowed eyes and *submissive grin* (FOX 1971a) are also observed. This facial expression was described as *''mask-puppy face''* by FEDDERSEN-PETERSEN and OHL (1995).

In addition to that, the tail is held lowered, even between the legs, and it may be wagged or held still. The inferior lowers its body posture that may range from slightly crouching to complete lying down. Lifting of the front paw in the direction to the superior is another characteristic element of passive submission.

Rolling over is exhibited by the dog which shows ultimate submission, so that the abdomen, only vital part that lacks bony protection, is exhibited. In this case, submissive urination can also be observed (FOX 1974, BEAVER 1994, 1999, OVERALL 1997, FEDDERSEN-PETERSEN and OHL 1995).

2.2.4 Agonistic Behaviors

Agonistic behaviors are all forms of behaviors including aggression, threat, fear, pacifying behavior, fight or flight, which exhibited against conspecifics (and humans) in conflict situations (GATTERMANN 1993, FEDDERSEN-PETERSEN and OHL 1995, ABRANTES 1997).

Agonistic behavior consists of two contrary parts which are *offensive* or *aggressive behavior* and *defensive behavior, i.e. flight* (IMMELMANN 1982). According to the Offensive / Defensive Model which developed by ARCHER (1988) and modified by BERNAUER-MÜNZ and QUANDT (1995), in a conflict situation an animal has four different options in order to increase the distance between the threat and itself, *fight, flight, freeze* or displacement behavior such as *flirt* or *playful-defense*.

Displacement activities are the ''activities apparently irrelevant and out of context with the current motivational state'' (DANTZER and MORMEDE 1985).
In many studies, it was found that in case of preventing an animal, which is under stress, to perform a behavior it is accustomed to perform, it may exhibit substitute behaviors known as displacement activities (TINBERGEN 1959, DANTZER and MORMEDE 1985, FRIEND 1991). ABRANTES (1997) defined displacement behavior as ''all activity performed to change the motivation in a given situation, in order to escape, and, further, explained the aim of this behavior as achieving a sense of security by performing an activity connecting with pleasure.

Shock induced fighting developed by pair of rats subjected to electric shocks, whereas freezing behavior developed by animals exposed singly to the same number of shocks (ULRICH and AZRIN 1962) and chain pulling exhibited by the pigs subjected to intermittent food delivery (DANTZER and MORMEDE 1983b) are significant examples of displacement activity in different animals.

BEKOFF (2002) stated that the dogs exhibiting behavioral elements of initial play in a conflict situation try to turn the aversive situation into harmless play session while ''the playtime is generally safe time''.

Enhancing the Offensive / Defensive Model, LINDSAY (2005) classified the behavioral reactions of dogs in conflict situations into five general groups:

1) ‘’Flee: Escaping from eliciting stimulus
2) Fight: Displacing the source of aversive stimulation
3) Flirt: Increasing vigilance or searching behavior
4) Freeze: Waiting for the situation to change
5) Forbear: Tolerating or accepting the situation.’’

Both *‘’flight’’* and *‘’fight’’* represent the behaviors which aim to increase the distance. *‘’Freeze’’*, on the other hand, is the sign of internal renunciation and escape which helps individual to avoid the struggle against the threat (HIRSCHFELD 2005).

2.2.4.1 Aggressive Behavior

IMMELMANN (1982) described *aggressive behavior* as the behavior pattern containing all elements of offensive, defensive and threat behaviors.

Considering the behavioral elements, o*ffensive*- and *defensive-aggression* can fundamentally be distinguished from each other. Offensive display is exhibited as a result of frustration that is aroused from the conflicts on the sources, whereas defensive display is performed against acute threat, fear and anxiety (LINDSAY 2000).
In fact, individuals’ exhibit mixed behavioral display in conflict situations. In other words, the roles of the attacker and the defensor can change many times during the fight (FEDDERSEN-PETERSEN and OHL 1995).

FEDDERSEN-PETERSEN and OHL (1995) divided aggressive behavior into different categories as follows:

- Non-stationary offensive-aggressive behavior
- Non-stationary defensive-aggressive behavior
- Stationary offensive-aggressive behavior
- Stationary defensive-aggressive behavior
- Offensive threatening behavior
- Defensive threatening behavior

ZIMEN (1971) cited that non-stationary aggressive behavior is observed only in a stabile pack during serious fights and can be identified from the lack of timidity while biting and of any kind of threat mimic.

FEDDERSEN-PETERSEN and OHL (1995), however, characterized all variations of biting as non-stationary aggressive behavior.

Behavioral elements of aggressive behavior and are given in table 2.3 and table 2.4 respectively:

Table 2.3 Categories and Behavioral Elements of Aggressive Behavior
Adapted from FEDDERSEN-PETERSEN and OHL (1995)

Aggressive Behavior			
OFFENSIVE		**DEFENSIVE**	
Threatening behavior	Sneaking up Eye contact Attack-threat Piloerection Growling Baring of front teeth Bite-threat position	**Threatening behavior**	Bite-clapping Looking away Defensive-snapping Piloerection Growling Total baring of one's teeth Submissive threat
Stationary	Muzzle biting Pushing, Shoving, Mounting, Pushing down, Encircling, Attack, Thrusting of the foreleg, Jumping over the opponent, Fighting on the hind legs, Biting of the opponent's back, Chasing	**Stationary**	To defense with a bent neck Defensive circling To defense while lying on one's back Defensive-thrust
Non-stationary	Attack Biting Serious fight	**Non-stationary**	Attack Biting Serious fight

Table 2.4 Acustic and optic signals of non-stationary offensive aggressive behavior developed from EISFELD (1966): (E), ZIMEN (1971): (Z) and VOTH (1988): (V), drawing on the example of *''Attack-behavior''* from EISFELD (1966)

Facial Expression	**Signals**
Corner of the mouth	pushed forward (E)
Muzzle form	slightly opened (E)
Lips shape	
Nose bridge	
Eyes	
Gaze direction	stared directly to the opponent (Z)
Forehead	
Head posture	slightly lowered (Z), held straight forward (Z), held up (Z)
Ears position	flattened (E)
Teeth	
Body Posture	**Signals**
Limbs/Joints	slightly crooked (Z)
Tail position	held horizantally backwards (Z), held in normal position (E)
Tail activity	wagging of one-third of the tail(E)
Hair	light piloerection on the back (Z)
Muscles	
Other behavioral elements	all facial structures addressed forward/ to the target (Z), no threatening mimic (Z)
Vocalizations	**Signals**
	growling, barking, squalling (V)

2.2.4.2 Threatening Behavior

EWER (1968) described *'threat'* as follows: ''A threat may be defined as a signal denoting that, contingent upon some act or failure to act on the part of the recipient of the signal, hostile action will be taken'. He further explained the function of threat as ''to deter the opponent; to drive him away in the first case, to prevent him from making an attack in the second. ''

Behavioral Signals of *Offensive*- and *Defensive*-*Threatening Behavior* are given in table 2.5 and table 2.6 respectively:

Table 2.5 Behavioral Elements of Offensive Threatening Behavior developed from SCHENKEL (1947): (S), ZIMEN (1971): (Z), FEDDERSEN-PETERSEN u. OHL (1995): (F-O) and FEDDERSEN-PETERSEN (2004): (F), drawing on the example of *''Position of biting threat''* from SCHENKEL (1947)

Attack-tendency: AT, Impose-tendency: IT

Facial Expression	**Signals**
Corner of the mouth	short and round (F)
Muzzle form	
Lips shape	lips are pulled up (F), Baring of front teeth (Z) (F), Baring of teeth (S), baring one's teeth (F-O)
Nose bridge	
Eyes	
Gaze direction	stared directly to the opponent (Z) (S) (F-O) (F)
Forehead	wrinkled (Z)
Head posture	held straight forward (during AT) (Z), held up (during IT) (Z), arisen (F-O) (Z), slightly lowered/ same level with the back (F)
Ears position	directed to the stimuli (S) (F-O), slightly turned out (S), Ear openings directed forward (F-O), forward directed ears (F)
Teeth	bared (see Lips-shape)
Body Posture	**Signals**
Limbs/Joints	slightly crooked (during AT) (Z), stiff and straight (during IT) (Z), tightened (S), stretched (F-O) (F)
Tail position	held horizantally backwards (during AT) (Z),arched up (during IT) (Z), lifted up and pushed through (S), erected (F-O), depending on th dog breed, held far above the back line to a greater or a lesser extent (F)
Tail activity	tension-shaking (S)
Hair	light piloerection on the back (during strong AT) (Z) (F-O), piloerection on the neck (F)
Muscles	
Other	threat behavior shown by dogs takes shorter than that shown by the others (wolf) (F)
Vocalizations	**Signals**
	growling (Z) (S) (F), barking (Z) (F), hissing (Z)

Table 2.6 Behavioral elements of defensive threatening behavior developed from SCHENKEL (1947): (S), ZIMEN (1971): (Z), FEDDERSEN-PETERSEN u. OHL (1995): (F-O) and FEDDERSEN-PETERSEN (2004): (F), drawing on the example of *''Defensive-threat''* from ZIMEN (1971)

Facial Expression	**Signals**
Muzzle form	long, pulled-back (Z) (F), poss. suddenly opening the mouth (Z) (F), at a sharp angle (F)
Corner of the mouth	
Lips shape	the lips being extremely drawn up or down (F), baring the teeth (Z) (F)(S)
Nose bridge	wrinkled (Z)
Eyes/ Gaze direction	
Forehead	
Head posture	lowered or lifted up against the opponent (Z)
Ears position	directed to forward (Z), the ear's root being pulled back or up (Z), lied back on the head (F), openings being plied together (F)
Teeth	bared all the way to the molars (F), gingiva is visible (F)
Body Posture	**Signals**
Limbs/Joints	crooked (Z) (F)
Tail position	tail drawn in (Z), With extreme body posture: tail pulled unto the belly (F)
Tail activity	stiff
Hair	piloerected on the back (Z) (F)
Muscles	
Body posture	hunch (Z), crouched (Z), slightly crouched (F)
Other behavioral elements	(Defensive-) snapping (S), uncompleted pouncing (S), pushing forward and biting (F), bite-clapping (S) (F), making oneself look small (F)
Vocalizations	silent (Z), hissing (Z), barking-growling (Z), growling-hissing (Z), growling (Z) (F), atonale barking (F-O) (F), squalling (F)

2.2.4.3 Categorization of Aggressive Behavior

FEDDERSEN-PETERSEN and OHL (1995) emphasized that the appearance of a behavior pattern depends on two factors, which are *internal* (internal dispositions and drives) and *external* (effective stimuli) *factors* and this rule is also applied to *aggressive behavior.* Considering this constant rule, many different authors classified aggressive behavior in a different manner as shown in table 2.7.

In this section, however, only ''fear induced-, pain/shock induced- and redirected-aggression'' will be discussed since these types of aggression are subjects of our interest for this study.

a. Pain - or Shock Induced Aggression

ULRICH and AZRIN (1962) demonstrated that aggressive attacks can be elicited in rats upon aversive - painful - stimuli. According to the ''*damage-avoidance''* principle introduced by TSCHANZ (1993), every handling that causes pain or discomfort can induce an aggressive reaction (LANDSBERG et al. 2003).

TORTORA (1983) developed a theory about aggressive attacks in dogs and used the term *''avoidance-motivated aggression''* in order to explain how previous experiences influence aggressive reactions against aversive stimulus. This study based on the experiment conducted by AZRIN *et al.,* (1967), which showed that the animals can learn to avoid the aversive stimuli by performing aggressive display. Considering both studies, it can be suggested that the aggressive behavior can evoke as a response to previously experienced painful stimuli. In other words, the pain- or shock-induced aggression can progress to fear-induced aggression (OVERALL 1997).

b. Fear Induced Aggression

As previously mentioned, defensive attack may be evoked by fearful stimulation, especially in situations where the dog has no chance to withdraw or escape (LINDSAY 2001, KING et al., 2003). However, offensive aggression, which is the result of learning process in this context, can also be observed in dogs exposed to an aversive situation.

The more often a dog experiences that aggressive behavior leads to success at the threatening situation, the more often, intense and faster aggressive behavior is exhibited in order to cope with the aversive stimuli (LINDSAY 2000, LANDSBERG et al.2003, APPLEBY 2004).

It was reported that fear biting is the second most common behavioral problem in dogs (BEAVER 1983, BORCHELT 1983, BLACKSHAW 1987). BEAVER (1994) described the body posture in case of exhibiting *fear induced aggression* as follows: ''Body postures may indicate distance-increasing signs, which warn of an attack, or they may be ambivalent, indicating the conflict of fear, submission and aggression''. The mix body posture involves staring to the threat while lowering its head and body. The other signals can be described as the piloerection of the hair, tucking of the tail, lowered ears, wrinkled muzzles, horizontal and then vertical lip retraction and growling. In case that the threatening stimulus continues, snapping, biting attempt, biting, urination, defecation and anal sac expression can also occur.

c. Redirected Aggression

Redirected aggression is the form of aggression which elicits in response to a correction or thwarting of a desire (OVERALL 1997). In case that the dog is prevented from directing its aggression toward the emotionally arousing stimuli, its aggression might be redirected toward a nearby individual (BEAVER 1999). OVERALL (1997) pointed out that these dogs can be non-aggressive if its reaction against the stimuli is not interrupted.

Table 2.7 Categorization of aggressive behavior developed from BRUNS (2003), drawing on the example of many different authors

VOITH and BORCHELT (1996)	**OVERALL (1997)**	**BEAVER (1999)**	**SCHÖNING (2000b, 2001)**	**JONES-BAADE (2001a, 2002)**
Fear induced aggression	Fear induced aggression	Fear induced aggression	Fear induced aggression	Fear induced aggression
Dominance aggression	Dominance aggression	Dominance aggression	Rank related aggression	Status related aggression
Protective aggression	Territorial and protective aggression	Territorial-material Protective aggression	Territorial related aggression	Territorial aggression
	Play aggression	Play aggression	Play aggression	Aggression in Play
Possessive aggression	Possessive aggression	Material aggression		Aggression for defending the possession of individual object
Redirected aggression	Redirected aggression	Redirected aggression		Redirected aggression
Pain induced aggression	Pain induced aggression	Pain induced aggression	Pain or shock induced aggression	Aggression due to the organic diseases
	Food related aggression	Food protective aggression		
Maternal aggression	Maternal aggression	Maternal aggression	Hormonally induced aggression of the female dogs in post partum, *i.e.,* lactatio falsa	Maternal aggression
	Idiopathic aggression	Idiopathic aggression		Idiopathic aggression
Intermale/ Interfemale aggression	Interdog aggression	-intrasexual aggression (intermale/-female) -Dominanance aggression against dogs.	Hormonally induced aggression of -the female dogs (in heat) -in male dogs	Hormonally induced aggression: -intermale -interfemale
Punishment induced aggression				

2.2.5 Play Behavior

Play behavior is another behavioral form used in friendly communications by dogs, which contains many different components of different behavioral forms such as fighting, mating and predatory behaviors which are exhibited in incomplete sequences (BEAVER 1999, BEKOFF 2001).

FEDDERSEN-PETERSEN and OHL (1995) characterized the play behavior into five different categories:

1. Play movements or play signals with highly demandive character: jumping, jumping up, pushing the partner with forepaws, jumping up on one's hind legs, jumping while turning, lifting head up (TEMBROCK 1958), sudden starting to run, head-tossing (TEMBROCK 1958)
2. Initial play: play-bow (holding the front-body part low), running as an invitation to play (TEMBROCK 1958), approaching the partner with play intention, attacking the partner with play intention, biting at the partner's back with play intention, scooping, pawing, muzzle pushing, making a move with play intention, hitting the deck with play intention, digging of the floor
3. Contact play: biting with play intention, placing the front-paws on the partner, bouncing up, cuddling (TEMBROCK 1958), pushing the partner down with play intention (TEMBROCK 1958), climbing up the partner, farrying on one's back, pushing the partner with play intention, turning one's back,

   ''King of the castle'' (DARLING 1937), pushing the partner, biting at the muzzle with play intention
4. Running games: Running fast and jumping like a rabbit, following the partner while running, cross-running, jumping over the partner (TEMBROCK 1958)
5. Characteristic Dog Play Signals (FEDDERSEN-PETERSEN 1992): barking with play intention, stamping

2.3 Learning Theory

The term *''learning''* has been defined in many different ways by different psychologists. A simple definition given by GRAY (1991), explained learning as ''any process through which experience at one time can alter an individual's behavior at a future time''. According to this definition, *''experience''* refers to the environmental effects mediated by the individual's sensory system. LIEBERMAN (2000), on the other hand, gave a more specific definition for the learning and defined it as ''a change in the individual's capacity for behavior, as a result of particular kinds of experience''. In this definition, he characterized *''experience''* as the storage of information in the brain, which changes individual's capacity to respond. Combining these two definitions together, the definition of the learning captures the influence of the experience on the subsequent behavior.

In this section, the forms of learning, the learning theories, and their applications in the dog training will be explained.

2.3.1 The Forms of Learning

In order to explain the forms of learning, the meaning of ''reflex'' should initially be characterized. Descartes was the first who proposed the reflex concept in the terms of connection between mechanistic and the nervous system of the human being. According to the Descartes' illustration of the reflex arc is, ''our senses and muscles are connected by a complex network of nerves, and the flow of ''animal spirits'' through these nerves makes the instinctive reactions necessary for survival possible.

If a person steps accidentally into a fire, for example, the nerves in the foot are stimulated and transmit the excitation to the brain. The brain then releases animal spirits into the nerve, which flow back to calf muscle and cause it to swell, resulting in the foot's withdrawal from the flame'' (LIEBERMAN 2000). Thus, Descartes' initial discovery about *reflex* showed the simple mechanism of the complex body movements, namely the stimulus-response relationship.

Today the reflex is accepted as a basic for the learning theory and explained as ''a simple, relatively automatic, stimulus-specific response sequence mediated by the nervous system'' (GRAY 1991). Consistent with this definition, the response must be mediated by the nervous system and, also, be elicited always the same response to be considered as a reflex.

2.3.1.1 Non-Associative Learning

Under some conditions, reflexes can be modified by experience. For instance, when the stimulus repeats several times, the strength of the reflexive response can decline. This decrease in the magnitude of the reflex respond is called ''*habituation*'', which is considered as the simple form of learning.

THOMPSON and SPENCER (1966) stated that the any repeated stimulus is able to evoke the *habituation* as a respond. All repeated stimuli, however, do not always result in *habituation*.

2.3.1.2 Associative Learning

Associative learning is the form of learning where the individual learns by forming associations or relationships between two events. Within the frame of associative learning, classical conditioning and operant conditioning which also involves the concepts of *reinforcement* and *punishment* will be discussed in this part of the study.

a. Classical Conditioning

''In contrast the habituation which does not elicit the new stimulus-reflex sequence but only weakens an already existing one, classical conditioning is a form of reflex learning that does produce a new stimulus-response sequence'' (GRAY 1991).

A well known classical conditioning theory was discovered by Ivan Petrovich PAVLOV (1849-1936) who was the scientist whose primarily interest was the physiology of digestion, particularly, the digestive reflexes in dogs. In order to measure the salivary and gastric secretions in dogs, he redirected one of the dog's salivary ducts to a glass tube by a surgical operation.

Using this implanted tubes, PAVLOV found that the dog salivated whenever food contacted to the mucous membrane of the mouth and, moreover, the dog salivated differently depending on the sort of the food. Thus, he showed that salivation was an autonomic-reflexive response. After several test sessions, PAVLOV noticed that the dogs that had been given food previously would salivate not only when food was placed in their mouths but also before receiving food, together with the sight of the food or the sound associated with its delivery.

Although he first treated this event as an experimental error and called it ''physic secretion'', he thought later on that this psychic secretion might be considered as a reflex just as the reflexive salivary response to the mouth in the food. Thus, he started to study on conditioned reflexes (GRAY 1991, LIEBERMAN 2000).

One of the famous studies of PAVLOV is the experiment in which the bell sound had been instructed just before the food was placed into the dog's mouth. After several trials, in which the bell was paired with the food, the dog would salivate in response to the bell sound alone. PAVLOV referred to this salivation reflex as a ''conditioned reflex'' and the bell sound as a ''conditioned stimulus''. The salivation elicited by the food, however, was called ''unconditioned reflex'' and the food was an ''unconditioned stimulus''. As a result, he figured out that a neutral stimulus which previously did not elicit a response evokes the response after it was paired several times with an unconditioned stimulus (GRAY 1991, LIEBERMAN 2000).

b. Phenomena Associated with Classical Conditioning

Many scientists including PAVLOV proposed different phenomena concerning with classical conditioning.

- **Extinction:** *''Extinction''* is a phenomenon which was introduced by PAVLOV and his research group. According to this phenomenon, the conditioned response gradually disappears when the conditioned stimulus is presented a number of times without the unconditioned stimulus. They also revealed that the animal does not fully return to the unconditioned state after ''extinction process'' completed and, furthermore, that the conditioned reflex is not truly lost during this process.

- If the conditioned stimulus is instructed again after an interval of time, the conditioned response can reappear. This phenomenon is now known as *''spontaneous recovery''* (GRAY 1991, LIEBERMAN 2000).

- **Counter conditioning:** *''Classical counter conditioning* is an extremely powerful agent for behavior change'' (REID 2007). The main principle of the counter conditioning is to eliminate the conditioned response and to reveal a new response by pairing the conditioned stimulus which elicited it with an unconditioned stimulus which elicited a different response.

The basic counter conditioning study was conducted by EROFEEVA (1916, 1921, cited in DICKINSON and DEARING, 1979) who belonged to PAVLOV's research group. EROFEEVA (1916, 1921, cited in DICKINSON and DEARING, 1979) found that the strong salivary response elicited by the food could be conditioned to an electric shock as a conditioned stimulus in dogs. According to the experiment, the painful electric stimulus was instructed as a sign of the food delivery to the hungry dogs. At the end of the study, it was observed that the dogs' defensive reactions were suppressed so that the dogs showed alimentary responses to the aversive stimulus and, furthermore, the electric shock lost its noxious character. The aim of this study was to counter condition an aversive unconditioned stimulus, rather than conditioned stimulus. Later studies on counter conditioning, however, were mostly performed on counter conditioning a conditioned stimulus (DICKINSON and PEARCE, 1977).

- **Generalization and Discrimination:** One of the other phenomena found by PAVLOV (1927) is called *''generalization''*.

According to this phenomenon, after conditioning process is completed, any stimulus which is similar to the conditioned stimuli elicits the conditioned response, even though they never paired with the unconditioned stimulus before. However, if the response to one stimuli is reinforced, whereas to the other is extinguished, generalization between them can be abolished. This process is known as *''discrimination''* (GRAY, 1991).

- **Conditioned Emotional Responses:** *''Conditioned emotional response''* refers to conditioning the emotional responses through Pavlovian procedures. John B. WATSON (1920), the founder of *behaviorism*, was one of the first psychologists attempting to demonstrate the conditioning of fear in human infants (LIEBERMAN 2000). Thus, together with Rosalie RAYNOR, WATSON conditioned an eleven-month-old-baby named Albert B. to fear laboratory rats.

During the experiment, a white rat was initially introduced to Albert and it was reported that Albert showed no signals of fear-'' *at no time did this infant ever show fear in any situation'' (WATSON and RAYNOR, 1920).* In order to condition the fear, the bar was struck with a hammer to produce a loud sound just as Albert touched the animal. In this case, however, Albert showed signs of fear. After the second trial, Albert started to show fear response each time he saw the rat, even though the loud sound was not instructed: *''The instant the rat was shown the baby began to cry. Almost instantly he turned sharply to the left, fell over on left side, raised himself on all fours and began to crawl away so rapidly that he was caught with difficulty before reaching the edge of the table'' (WATSON and RAYNOR, 1920).* As a result, WATSON and RAYNOR (1920) showed the possibility of conditioning emotional responses.

c. Operant conditioning/ Instrumental Conditioning

Operant conditioning or *instrumental conditioning* can be defined as ''an activity that occurs because it is effective in producing a particular consequence or reinforcer'' (DOMJAN, 1998).

Some of the initial research with *operant conditioning* were conducted by Edward Lee THORNDIKE (1911), who coined the *''law of effect''* principle. In his experiments, he used an apparatus called *''puzzle box''* which was a cage that could be opened from inside by a specific act such as pressing a lever or pulling down on a loop. For instance, in one experiment, he placed a hungry cat into the cage and put the food just outside it, but visible through its slats. After placing inside the cage, the cat engaged many unsuccessful attempts to escape from there till finding the correct way to open the door.

When this procedure was repeated, it was observed that with each successful trial the number of the useless movements before opening the cage decreased, whereas the escape from the cage became quicker. Moreover, most cats would open the cage as soon as they were locked in, after about 20-30 trials.

Thus, THORNDIKE (1911) came to the view that the animal has to be treated as an active object which produces a number of responses and one has to wait patiently till the animal produces the correct one. In contrast to PAVLOV, he was interested in ''consequence'' of the response, rather than the precursor to it.

The puzzle box experiments were also basis of the *''THORNDIKE's law of effect''*, which can be stated as follows: ''*Of several responses made to the same situation, those which are accompanied or closely followed by satisfaction to the animal will, other things being equal, be more firmly connected with the situation, so that, when it recurs, they will be more likely to recur; those which are accompanied or closely followed by discomfort to the animal will, other things being equal, have their connections with that situation weakened, so that, when it recurs, they will be less likely to occur. The greater the satisfaction or discomfort is, the greater the strengthening or weakening of the bond* '' *(THORNDIKE 1911).*

Although THORNDIKE's studies drew a considerable interest, the use of terms such as *''satisfaction''* and *''reward''* in *''law of effect''* aroused considerable controversy since these terms refer to mental state (GREY 1991, LIEBERMAN 2000).

Burrhus Fredric SKINNER (1938), an American psychologist, was the one who proposed the term ''*reinforcer",* as replacement for *''satisfaction''* and *''reward''*. SKINNER (1938) also developed a device called *''Skinner box''* which was the modificated model of *''THORNDIKE's puzzle-Box''*. In contrast to *''THORNDIKE's puzzle-Box''*, SKINNER designed a mechanical system in the box to deliver the food or water whenever the animal made the correct movement. Thus, the animal could be kept in the same box during the whole experiment. The goal of designing this mechanical system is to keep the environmental stimuli as constant as possible.

Another advantage of keeping the animal in the box after experiencing the success is that the animal is free to respond repeatedly to get the same effect.

d. Phenomena Associated with Operant Conditioning

- **Shaping:** *''Shaping''* refers to the technique to reinforce the slightly closer instances of the desired response, in case that the subject did not show the desired response or did show the response so infrequently (SKINNER 1951, GREY 1991, LIEBERMAN 2000). Once the animal exhibits the initial respond, it is reinforced systematically to show the variation in the respond. This procedure is continued till the animal responds in the desired way (REID 2007).

- **Extinction and Schedules of Partial Reinforcement:** Analogue to the *''extinction''* phenomenon of classical conditioning, *''extinction''* as a phenomenon of the operant conditioning refers to gradually disappearing of the operationally conditioned response, so that it no longer results in the reinforcer. As in the classical conditioning *''spontaneous recovery''* can be observed when the response is reinforced again after an interval of time (GREY 1991).

Throughout his experiment, SKINNER (1938) found some difficulties under laboratory circumstances about *continuous reinforcement* in which the response must every single time be reinforced. Moreover, he had the idea that in the real world not all of the actions were reinforced. In other words, *partial reinforcement* principle was valid in the real life.
Considering this principle, SKINNER (1938) developed a new phenomenon called'' *partial reinforcement* '' and tried several different schedules of it, in order to achieve the most effective response. As a result, SKINNER (1938) and other researchers developed four main schedules:
Fixed ratio: the response is rewarded after a fixed number of responses,
Variable ratio: the response is rewarded after an unpredictable number of responses,
Fixed interval: the first response is rewarded after passage of a specified amount of time and,
Variable interval: the response is rewarded after the passage of an unpredictable time.

The main advantage of applying partial reinforcement is that the response is more resistant to extinction than that in continuous reinforcement and also that the method is more economical since the reinforcement must not be administered each time the response occurs (GREY 1991, LIEBERMAN 2000).

- **Negative Reinforcement:** *''Negative reinforcer''* can be defined as the "termination of an aversive stimulus upon the performance of a response". In other words, in the concept of negative reinforcement, in case that the desired behavior is exhibited, negative consequence is removed. For instance, if there is an experiment in which if a rat presses a lever it receives a shock, negative reinforcement would be the situation in which the rat presses the lever but receives no shock at all (HINTZMAN, 1978).

- **Punishment:** *''Punishment''* is often described as following: ''Application of an aversive stimulus during or immediately following the occurrence of an undesired behavior, in order to suppress the reoccurrence of that particular behavior'' (LANDSBERG et al. 2003). This description, however, only comprises the *''positive punishment'',* which is the presentation of an aversive stimulus as a consequence of an undesired behavior.

On the other hand, *''negative punishment''*, another type of punishment, is the prevention or withholding of the delivery of an appetitive stimulus in case that the undesired behavior occurs (REID 2007).

Though the concept of *''positive punishment*'' and *''negative reinforcement''* are often confused, these two phenomena have two main differences. First, in the concept of *''positive punishment''* an undesired response is followed by an aversive stimulus. Negative reinforcement, on the other hand, involves removing of an aversive stimulus when a desired behavior is performed.
Second, the goal of reinforcement is *''increases probability of desired behavior''*, whereas the goal of punishment is *''decreases probability of undesired behavior''* (GLEITMAN *et al.* 2004, GEORGE and JONES 2008).

The other two concepts which are often confused are *''negative punishment''* and *''extinction''*. REID (2007) stated that although these two phenomena are confused in many cases, they are distinctly different from each other. As previously mentioned, *''extinction''* is the phenomenon in which ''a previously reinforced behavior no longer produces reinforcement'', whilst in *''negative punishment''*, previously reinforced behavior is not a requirement. REID (2007) also emphasized that *''negative punishment''* is also named as *''time out''* in most of its applications.

In the study written by UHL and SHERMAN (cited in REID 2007), it was suggested that considering the suppression of undesired behavior, *''negative punishment''* is a more effective training technique than *''extinction''*. Moreover, reducing of the frequency of undesired behavior takes more time in *''negative punishment''* than in *''positive punishment''* and nevertheless complete suppression rarely occurs in *''negative punishment''*.

2.4 Electronic Training Collars in Perspective

Using of the electronic training collar is a subject causing considerable debates among authorities for years. Therefore, in this section, currently available scientific studies concerning the use of electronic training collars are compiled.

2.4.1 Application of Electronic Training Collars in Dog Training

SCHWIZGEBEL (1996a) indicated that there are three possible ways to train dogs using electronic training collars:

1) *Punishment Training:* in which the chosen target behavior will be punished. TORTORA (1982) described the rules of punishment training as following:
    - *Punishment should be immediate:* In order to achieve the most effective result, punishment should be administered as soon as the behavior starts.
    - *Punishment should be an effective dose the first time it is administered:* Gradually increasing level of electrical stimulus as a punishment strategy can result in *''habituation''*. Therefore, it is suggested to start with a punishment aversive enough for the dog (AZRIN and HOLZ 1966, ANGERMEIER 1976, TORTORA 1982).
    - *Punishment should be natural:* TORTORA (1982) stated that animals experience natural environment punishment all the time and, thus, they associate the punishment with the crime. According to him, it is possible to simulate natural-like punishments with an electronic training collar because the experiencing electrical stimulus has the same learning effect as other natural punishments causing discomfort on animals.

- *Punishment should be administered by nature:* According to TORTORA (1982), it is important that the dog learns not to do target behavior which was determined by the owner; otherwise it will be punished by the environment. Therefore, electronic training collars are significant training aids since they can be administered at a distance so that the dogs do not associate receiving the shock with the owner.
- *Punishment should be associated with the misbehavior only:* This rule also has the same principle as the previous one, that the dog should not associate the punishment with the presence of its owner. It should learn that whenever it performs the undesirable behavior, it will be punished and the application of this rule is easy with electronic training collars.
- *Punishment should be used as infrequently as possible:* TORTORA (1982) suggested that since the electronic training collars eliminate the misbehavior after a few implications, they met also this rule.
- *Punishment should be counterbalanced with a reward:* According to TORTORA (1982), it is essential that the dog associates the owner presence with a reward and electronic collars allows owner to reward his dog after the punishment with praise, attention, play etc. so that the dog feels safe near the owner. This application should, however, never immediately follow the punishment in order that the dog does not associate the punishment with the reward.
- *The Avoidance Training and/or Relaxation Training should be administered in case of eliminating very powerful instinctive behavior before using the punishment:* The principle of avoidance training with electronic training collar will be explained as a second training way in the following.

2) *Avoidance and Safety Training:* In comparison with *punishment* training, *avoidance training* has a different goal. The goal of avoidance training is to *motivate* determined behavior, whereas the goal of punishment training is to *eliminate* misbehavior (TORTORA 1982, POLSKY 1994, SCHWIZGEBEL 1996a).

In avoidance training, the dogs learn that they can terminate the aversive stimuli such as electric shock and thus avoid the uncomfortable experience by obeying a recently trained command.

In safety training, an aversive stimulus follows a warning stimulus such as buzz tone (SCHWIZGEBEL 1996a). It is important that the dog receives the warning of discomfort ‘’ right after the command but before he has a chance to respond’’ (TORTORA 1982).

According to TORTORA (1982), there are some important points to be watched in this kind of training. For instance, training of the command before the application of the method and, also, good timing as if in the punishment training is significant in the training. Furthermore, terminating time of the electrical stimuli should be bewared since wrong timing results in incorrect and undesirable response to the command. In case of termination of the aversive stimulus at the wrong moment, dog will associate the particularly performed behavior with turning off the electrical stimulus.

3) *Activation Training:* The principle of this training is to reinforce a determined behavior through electrical stimulus in dogs. The basis of activation training involves the following observation: ‘’When a dog, which has an expectation of play with its owner in the determined situation, is stimulated with an electrical stimulus immediately after instruction of a command, it performs the desired behavior without exhibiting submissive signals. In this situation, intensity of the electrical stimulus, namely the optimal intensity, depends on the liveliness of the dog concerning with the play. ‘’

Practical application of this observation includes three phases,

1. *Play training:* in which the dog is rewarded with the play whenever it performs the desired behavior after the instruction of the command.
2. *Training with mechanical stimulation:* in which the pulling of a leash on a normal collar after the instruction of the command leads performing of the desired behavior. This step also includes playing with the dog after the desired behavior is exhibited.
3. *Training with mechanical and electrical stimulation:* in which the dog receives an electrical stimulus at the same time with pulling of the leash after the instruction of the command. In this situation, the mechanical stimulation is stronger than electrical stimulation and playing with the dog is the reward as in the previous phases. The principle of applying the mechanical and electrical stimulation is that an additional pulling effect is elicited as a consequence (SCHWIZGEBEL 1996a).

2.4.2 Effects of Electrical Stimuli

Many studies were conducted to examine the physiological, physical and behavioral effects of electric shock in animals and, also, in humans.

2.4.2.1 Physiological and Physical Effects of Electrical Stimuli

In a study conducted by BEERDA (1997), the dogs were exposed to different types of stimuli such as *sound blasts, electric shock, opening of an umbrella, restraintment* and *falling bag* and subsequently their behavioral, saliva cortisol and heart rate responses were measured. The result of that study demonstrated that the unanticipated stimuli, *i.e. electric shock, loud noise and falling back,* induced increased cortisol responses, whereas the stimuli which were administered by the visible experimenter did not change the cortisol values in dogs.

In that study, heart rates were not measured when the effects of electrical stimuli were tested. However, another research which examined the effects of human contact on the dog showed that increased heart rate was also observed in dogs when a tone was followed by electrical stimuli (LYNCH and McCARTHY 1969).

Already in 1983 DESS *et al.* demonstrated that an electric shock induced the elevation of adrenal cortisol and, also, that the uncontrollable shocks caused significantly higher cortisol response than the controllable shocks. In contrast to BEERDA's (1997) findings, DESS *et al.* (1983) stated that *''predictability''* had no significant effect on cortisol responses.
A recent study conducted by SCHALKE et al. (2006), however, showed the important role of '' *predictability''* in aversive dog training, such as electronic dog training. For this study, three experimental groups of dogs were used, each of which received the shock in a different manner. *Group A (Aversion)* received the shock when the dog touched the prey, *Group H (Here)* received the shock when the dog did not obey previously trained ''here'' command and *Group R (Random)* received the shock randomly-out of context.
As a result, elevation of saliva cortisol level was significantly higher in *group H* and in *group R* when comparing with *group A*. Considering those results, SCHALKE et al. (2006) concluded that: ''animals, which were able to clearly associate the electric shock with their action - touching the prey - and consequently predict and control the stressor, did not show consistent and persistent stress indicators''.

They also emphasized that there is a high risk that dogs will show persistent and severe stress symptoms in case of poor timing in application of high electric pulses. Overall, this study also pointed out the significance of *predictability* and *controllability* of the electric shock in dog training and further of good timing, namely of experienced trainers in administration of electronic training collars.

In a research performed on rats, it was found that during the acquisition and expression of the conditioned aversive stimulus - sound accompanied by electric shock-, modification of the synaptic projections from the auditory cortex of the brain to the lateral amygdala revealed (TSVETKOV *et al.* 2002). Thus, the changes in the brain during fear conditioned learning were emphasized.

POLSKY (1994) stated that inappropriate use of electronic training collars -extreme tight or long application - may cause lesions on the dog's neck. He further emphasized that the lesions caused by mechanical abrasion result from the electrodes rubbing the skin rather than from the electric shock.

LINDSAY (2005) pointed out that the electric stimulus used in dog training causes no physical damage, neither to the skin nor to the underlying tissue. The introduction of electric stimulus, however, causes an illusion of startling stimulus by activating mechanic receptors along Aβ and Aδ fibers. As a result, transmitting of Aδ fibers cause 'tingling', 'tapping' and 'fluttering' sensations, whereas the transmitting of Aβ fibers cause sensation 'pricking'. High levels of electric stimulus, on the other hand, may activate C-fiber which produces sensation of 'burning' (SANG et al. 2003). In other words, although no physical damage occurred, sensation of burning was perceived upon the administration of the high level of electrical stimulus.

2.4.2.2 Behavioral Effects of Electrical Stimuli

In the above mentioned experiment conducted by BEERDA (1997), it was also found that unanticipated stimuli such as electric shock elicited a very low posture correspondent to the increased saliva levels in dogs. The findings from the study carried on by SCHILDER and van der BORG (2004) also indicated the low body posture as a reaction to the electric shock.

In this study, direct reaction of dogs to electrical stimuli, as well as the comparison of the dogs trained with and without electronic training collars was investigated. As a result, it was found that the dogs showed the following reactions to the electrical stimuli: *lowered body posture, high pitched yelping, barking, squealing, avoidance, redirected aggression and tongue flicking*. Furthermore, the dogs trained with the electronic training collars exhibited lowered ear positions than the dogs trained without electronic training collar - but still in a harsher way.

All in all, SCHILDER and van der BORG (2004) concluded that receiving electric shock is painful for dogs and further that the dogs associate the owner's presence with the receiving of the shock. Thus, they suggested banning these instruments from the dogs sports completely.
However, in a scientific review written by JACQUES and MYERS (2007), it was pointed out that since in the study conducted by SCHILDER and van der BORG (2004), no information was provided about the experience of the handlers and dogs and also about the level of shock, ''the study has come under considerable fire''.

CHRISTIANSEN *et al.* (2001a) explained the reactions of the dogs to the electric shock as following: *''displaying grades of jumping, head shaking, vocalizations, and the speed of withdrawal from the sheep''*. They further pointed out that these reactions differed between individuals. Additionally, in this study, the significance of timing in electronic dog training was indicated and it was also suggested ''to avoid this method for other purposes than training dogs to avoid chasing sheep.''

CHRISTIANSEN *et al.* (2001b) presented a subsequent study examining learning effects of the electronic dog collar in the following year. Considering their findings in that study, they cited that the use of electronic training collars is an efficient way to prevent the undesirable hunting behavior in dogs. They also indicated that no adverse effect of this method was observed.

In a study conducted by POLSKY (2000), it was found that unconditioned aggression can be evoked as a result of a dog having received electric shock. REISNER (2003) also cited that human directed aggression might be observed upon the administration of aversive methods such as electric stimulation, prong or training (choke) collars as a result of increase anxiety.

2.5 Mechanical Training Aids

LANDSBERG et al. (2003) described mechanical devices such as choke, pinch and prong collars as training aids which help training in a manner that causes increasingly discomfort on dogs by pulling on them. They also explained the principle of these collars as follows: ‘’the more forceful the owner’s pull, the more discomfort for the pet.’’ TORTORA (1982), on the other hand, described these devices as ‘’attached training aids’’ and the correction applied by these collars as ‘’leash correction’’.

He further emphasized that the efficiency of these collars are dependent on the experience, strength and motivation of the user. In case of harsh administration of these collars, the dog could be physically damaged.

LINDSAY (2005) also suggested that with respect to produce physical damage to the skin and / or the body, electronic training collars are relatively safe in comparison to mechanical training aids. He further explained: ‘’...since mechanical techniques work by forcefully stimulating mechanoceptors and nociceptors, such tools may cause local irritation or muscle strain. Unlike the aversive effect of electrical stimulus; which rapidly dissipates after being discontinued, forceful stimulation of skin and muscle tissue can result in chain of biochemical events that may cause sustained throbbing, local irritation and bruising.’’

3. Materials and Methods

3.1 Subjects

42 adult police dogs of both genders (33 males and 9 females) and varying ages (3-10 years old) of the breed Belgian Malinois served as subjects for this study. The decision to use only Belgian Malinois was employed in an attempt to avoid the variability, due to breed characteristics. All dogs in the study were previously trained for the official police service dog certification.

During the study, dogs participated the sessions with its own handler. 22 dogs which were tested in Muenster were recruited from different Police Departments in Nordrheinwestfalen. All of these dogs, however, have been trained by the same trainer. Another 20 dogs, which attended the study, belonged to Hannover Police Department.

Since the dogs tested in Hannover and in Muenster had different training histories and were trained by different trainers, they were considered as two different groups. At the end of the study, not only the individual results but also the group results could be compared with each other. The sizes of two main groups were close to each other; therefore it was significant to make this comparison.

3.2 Questionnaire

A questionnaire with three different sections, namely, *general information, training aids and general assessment*, was addressed to the canine officers who participated in this research as handlers.

The aim of using this questionnaire as a part of this study was to gain information about dogs' characteristics, past experience, health situation etc., and thus, to avoid incorrect assessment of the test results. Furthermore, through this information, correlations between these parameters and the body language of the dogs and/or direct reactions to the test methods were possible to be evaluated.

The first section of the questionnaire (*general information*) was designed to gather information regarding the dogs' demographic data and past experience. This part included following questions:

1) Name of the owner
2) Name of the dog
3) Age of the dog
4) Number of ex-owner
5) Service period as a police dog
6) Gender of the dog
7) Housing conditions
8) Number of training sessions per a day and per a week
9) The order of exercises during training
10) Number of real criminal contact of the dog
11) Participation at dog sports

In the second part of the questionnaire (*training aids*), questions related to dogs' past experience with the training aids and former and/or current behavioral problems of the dogs were asked.

The last part named as *general assessment* contained the questions about individual characteristics of the dogs such as self-confidence, arousal level and motivation type.

3.3 Test Persons

Two doctorate students of Institute of Animal Welfare and Behavior of the Veterinary University of Veterinary Medicine Hannover attended the whole experiment as test instructors. The main responsibility of test instructors was the observation and control of the test sessions. Besides, one of the test instructors gave the starting and ending instructions of test sessions and filled out the learning effect and time tables while the second instructor was filming the experiment.

Additionally, two experienced canine officers who were also dog trainers in Muenster Police Department took part in the study as helpers.

The helpers were responsible for provoking the dogs during the test sessions to urge the dog to make a certain mistake, which was determined mutually by test instructors and dog handlers. With the implementation of this method in the study, behavioral and learning effects of the training methods could be tested. Another responsibility of the helpers during this study was the administration of the electronic training collar. During the sessions in which the electronic training collar was tested, they held the receiver of the collar and gave the electric impulse whenever the dog made the mistake. Each of the helpers provoked one group during the whole experiment, either in Muenster or in Hannover. The aim of using the same person as helper for all dogs in the same group was to minimize the variability arising from the provocation style and, also, to the helper himself.

3.4 Test Area

All tests in Hannover were carried out on the same training ground which belonged to Misburg Police Dog Society. The tests in Muenster, however, were conducted on two different training grounds, one of which was in Nottuln/ Muenster and the other belonged to *''General German Rottweiler Club''* in Muenster. Each dog was tested on the same place during the entire experiment, where it initially started to be tested.

All test areas were already used as training grounds for the police dog training. Thus, all of the dogs were familiar to the area where they were tested.

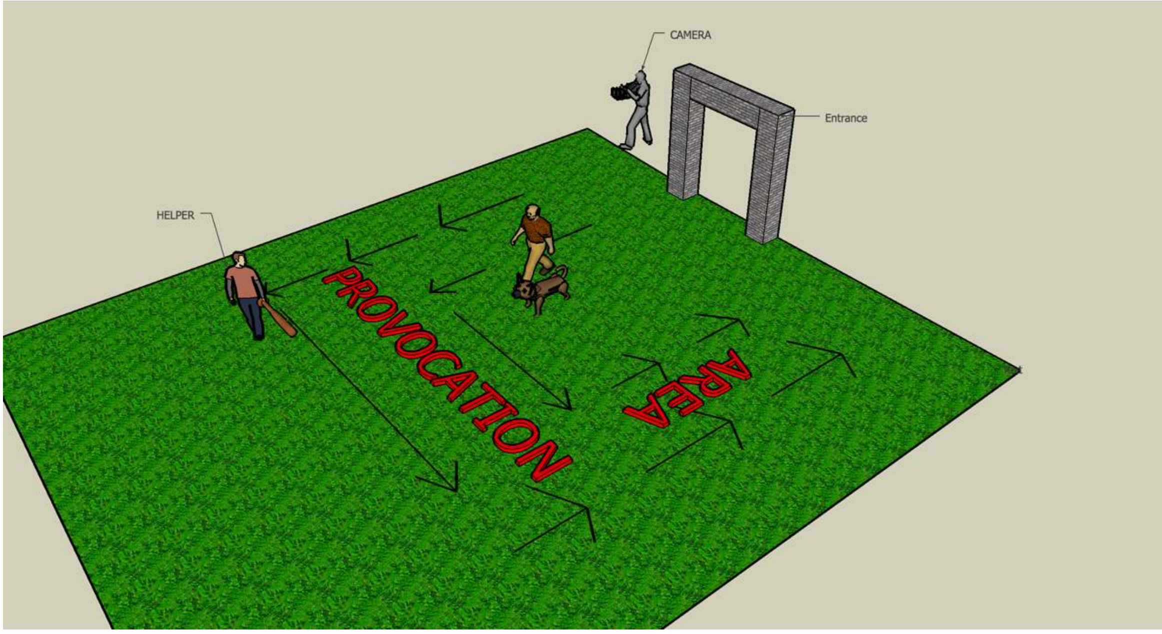

Figure 3.1: Test area in Hannover

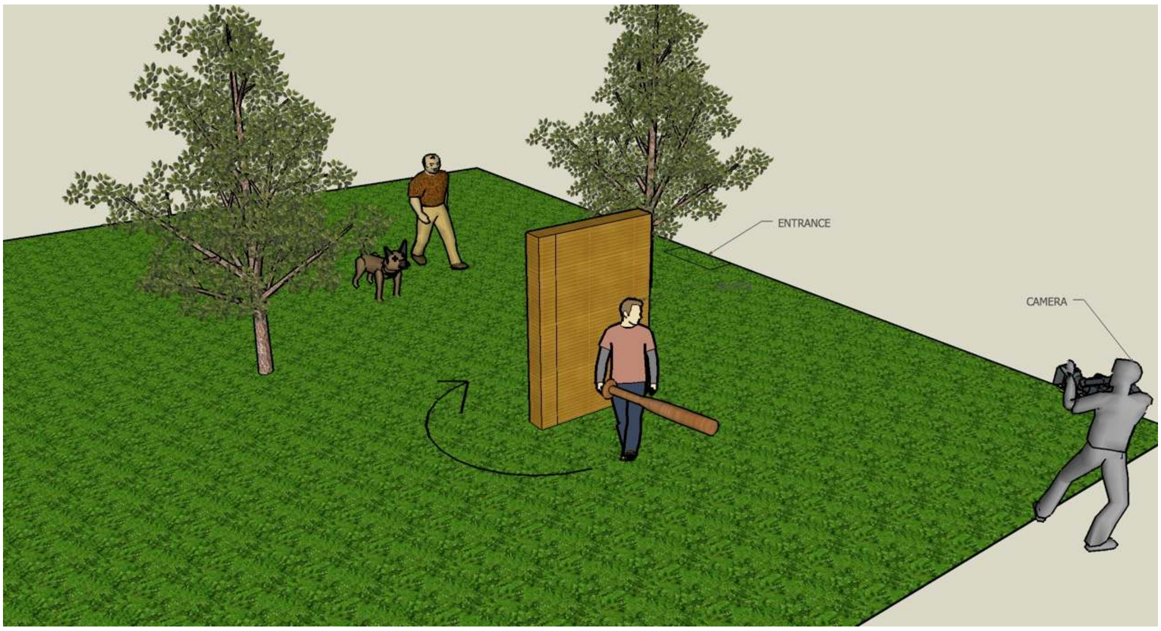

Figure 3.2: Alternative test area in Hannover

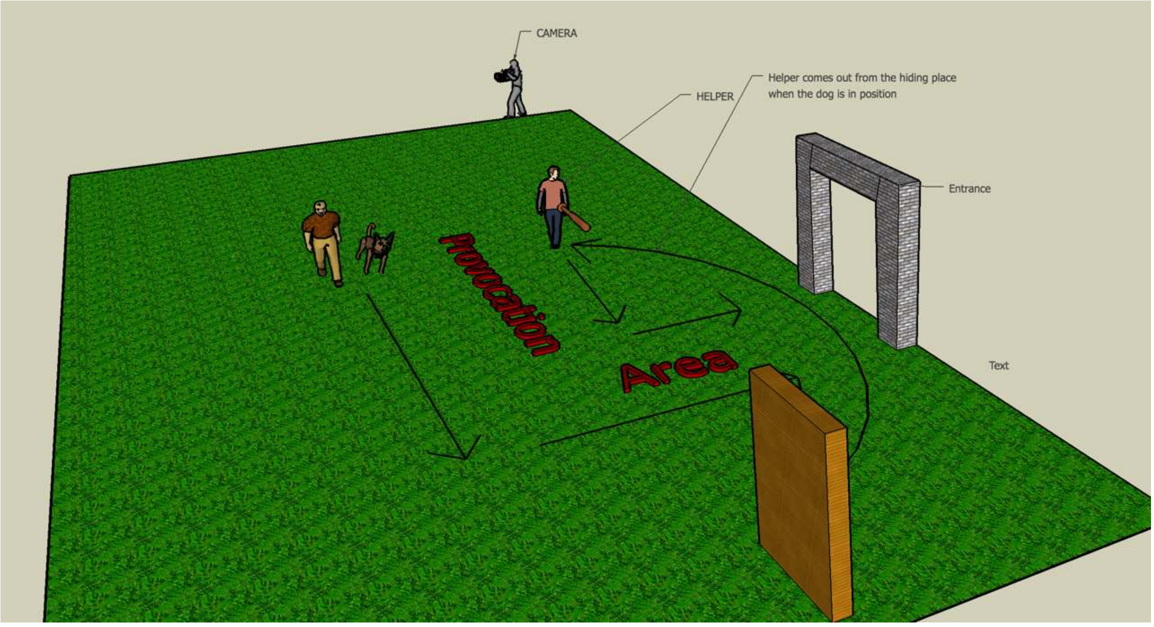

Figure 3.3: Test area in Nottuln/Muenster

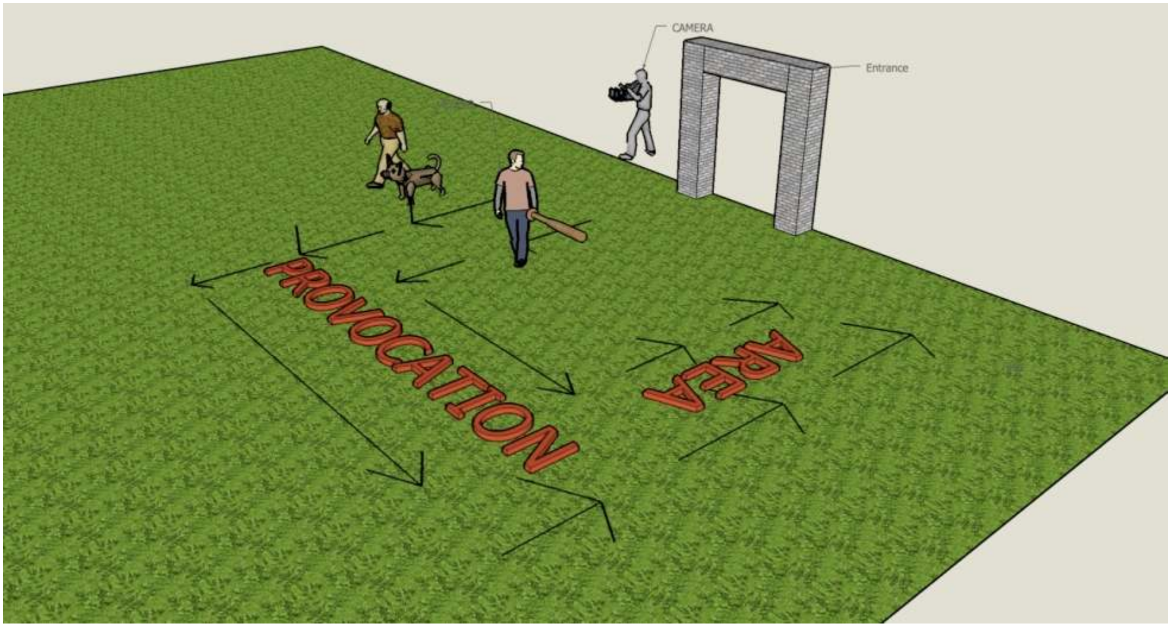

Figure 3.4: Test area in Muenster (Training area of *''General German Rottweiler Club''*)

3.5 Training Aids

Each training method used in this research required a proper training aid. Dogtra 600 NCP/2 electronic training collar, Klickstachelhalsung pinch collar, the standard normal collar and the 5 m long leash were used as training aids[1]. As the use of electronic training collar required a special process, the device and the adaptation procedure to the electronic collar will be explained in the following section.

3.5.1 Electronic Training Collar

''Dogtra 600 NCP/2 Electronic Training Collar'' was used for this research. The complete device consists of a transmitter with an antenna and a collar with two receivers. The company reported that both the collar, receiver and transmitter are water-proof and the device has a maximum range of 800 m depending on the weather and the area conditions.

Each receiver has two brass electrodes inside, one of which has single and the other has tripod ending. Both receivers have to be in close contact with the dog's skin via these electrodes. The transmitter has two buttons, *i.e.,* single impulse and constant impulse, which transmit the adjusted impulse. The impulse level of the transmitter can progressively be adjusted between the minimum and maximum levels (0-100). As an additional function, the device has a vibration pager which is an impulse free vibration mechanism.

Adaptation to electronic training collar: Since 7 of the dogs in Hannover had never been trained with the electronic training collar before, the adaptation phase, which lasted six weeks, was conducted for them. For the adaptation phase, the dogs carried the electronic training collars during the normal daily training routine. No electric impulse was given to the dogs during the training.

For the other 35 dogs, however, the same procedure was applied for a week since they were already familiar to the electronic training collar. This procedure was conducted in order to achieve accustomization of the dogs to the device again since the electronic training collars are forbidden in Germany since 2006.

[1] The training aids used in the study are manufactured by Fa. Schweikert Hundesportartikel (Zum Muehlgraben 10, 68642 Buerstadt).

Before the main experiment was started, the impulse level which would be used had to be determined and documented for each dog.

3.6 Experimental Design

VINCENT and MICHELL (1996) and Van der BERG *et al.* (2003) cited that inter individual differences and individual variations affecting stress proneness influence the statistical results of group comparisons in a negative way. LINDSAY (2005) also suggested that in order to amplify the statistical results in the studies in which the electronic training collar is tested, within subject design must be applied since individual variables can cause incorrect data. Therefore "w*ithin subject design"* was used as an experimental design for the present study. In order to implement this design method in our research, each training method was tested on each dog on different days. The administration order of these methods, however, was related to the groups the dog belonged to. Therefore, six subgroups, *A, B, C, D, E, F*, were established according to the administration order of the training methods by using *randomized cross-over design*. The dogs from Hanover Group (H) and from Muenster Group (M) were divided into these subgroups randomly. The experimental design of the study is shown in figure 3.5.

SUBGROUPS	1st day	2nd day	3rd day
A	Q	E	P
B	Q	P	E
C	E	Q	P
D	E	P	Q
E	P	Q	E
F	P	E	Q

Figure 3.5: The cross-over design of the study
(Q: Quitting signal, P: Pinch Collar, E: Electronic Training Collar)

3.6.1 Distribution of the Dogs into Groups and Subgroups

3.6.1.1 Muenster Group (Group-M): consisted of 4 female and 18 male dogs, ages of which varied between 3-9 years.

3.6.1.1.1 Subgroups of Muenster Group

Subgroup A: consisted of 4 male dogs, ages of which varied between 3-6 years.
Subgroup B: consisted of 2 male and 2 female dogs, ages of which varied between 3-5 years.
Subgroup C: consisted of 3 male dogs, ages of which varied between 4-9 years.
Subgroup D: consisted of 3 male dogs, ages of which varied between 3-7 years.
Subgroup E: consisted of 2 male and 2 female dogs, ages of which varied between 3-7 years.
Subgroup F: consisted of 3 male dogs, ages of which varied between 4-9 years.

3.6.1.2 Hannover group (Group-H): consisted of 5 female and 15 male dogs, ages of which varied between 3-10 years.

3.6.1.2.1 Subgroups of Hannover group

Subgroup A: consisted of 4 male dogs, ages of which varied between 4-7 years.
Subgroup B: consisted of 2 male and 1 female dogs, ages of which varied between 3-8 years.
Subgroup C: consisted of 1 male and 1 female dog, ages of which varied between 5-7 years.
Subgroup D: consisted of 3 male and 1 female dogs, ages of which varied between 5-7 years.
Subgroup E: consisted of 1 male and 2 female dogs, ages of which varied between 4-5 years.
Subgroup F: consisted of 4 male dogs, ages of which varied between 3-10 years.

3.7 Procedures

The research project has been conducted in two phases, *training* and *main experiment phases,* from January 2008 to June 2008.

3.7.1 Training Phase

During the training phase, which lasted four months, dogs learned to abandon an unwanted behavior after a determined signal, *quitting signal,* was given. The main principle of the quitting signal is to condition a feeling of frustration, and thus, to abandon of a distinctive behavior towards a specific signal. This method is the application of *''negative punishment''*.

Although two dog handlers from Hanover reported that their dogs had already trained with the quitting signal, the normal training procedure was carried out for them, as well.
Both of them, also, notified that they had never used the signal during the police dog training. The other forty dogs, however, had not been familiar to the signal before the training procedure was conducted.

The training steps were performed in a different manner depending on the characteristic of the each individual.
A sample procedure is given below:

1st step:

The first aim of the quitting signal training was to condition the feeling of frustration with any vocable which was previously insignificant to the dog. To this end, the following program was carried out:

1) The handler with many treats in his/her one hand made fists with his both hands. He held his/her hands in a certain position so that the dog was able to see both of them.
2) He took the treats one by one from his full hand to his other hand and fed the dog till the association has been developed and the dog expected to have the food with the above mentioned hand movement. During this feeding session, no orders were given to the dog.

3) The handler took the food piece by applying the same hand movement but this time instructed the signal, *i.e.,* the previously chosen vocal, with the normal tone of voice immediately before the hand movement had completed and subsequently retained the food in his/her hand. The dog was startled by the sudden absence of the food which it got used to having without exhibiting any performance and, therefore, got frustrated.
4) As soon as the dog quitted demanding the food from the hand and exhibited any alternative behavior, the other hand was opened and the handler gave the food piece to the dog. Thus, exhibiting the alternative behavior after getting the signal was the only solution for the dog to terminate the feeling of a frustration.

2nd step:

1) In this step, the same feeding procedure as the one in the first step was performed by a foreign person.
2) Together with the signal instructed by the owner, the foreigner retained the food in his/her hand.
3) As soon as the dog showed the alternative behavior, the owner rewarded the dog by serving the food.

Different sorts of treats such as dry food, sausage, cheese or mixture of two or three of them etc. were used for the training. If food mixture was used, the dog's favorite one was served as a reward.

3rd step:

1) For this obligatory step, the dog was in a long leash (approx. 3 m) and the owner had two toys.
2) The owner played with the dog by throwing a toy till that the dog had the feeling of free access to the toy.
3) The handler threw the toy so far that the dog could not reach it and instructed simultaneously the signal.
4) As soon as the dog exhibited the alternative behavior, the owner plays with the dog by using the other toy as a reward.

For this step, different sort of toys such as balls, tug toys etc. were used. If two different toys were used, the dog's favorite one was served as a reward.

This last step was the obligatory step for the study. In order to participate in the experiment, the dog should withdraw itself from the toy after the quitting signal was instructed. Before the main experiment started, quitting signal training procedure was completed and the signal was tested on each dog.

3.7.2 Main experiment

The main experiment took place on three test days for each dog. The time interval between test days was one week. On each training day, a different training method among the quitting signal, the electronic training collar and the pinch collar was administered on dogs in accordance with the groups to which they belonged. Regardless of which method was tested, each dog should carry the three collars around its neck, which were standard, pinch and electronic training collars, during the whole experiment in order to ensure the standardization among the training methods.

3.7.2.1 Determination of the Mistake

Before the main test was performed, the *mistake* for each dog was determined by its own handler. The handler chose either the ''loosing of *Blick* contact'' or ''leaving the *Fuss* position'' as the mistake for the dog, which would be corrected during the test session. Upon the mentioned training methods were only administered, when the dog made the determined mistake.

3.7.2.2 Main testing process

Prior to the testing of related training methods two different sessions were conducted with each dog; obedience and play sessions.

Obedience session: Main test started with the *obedience session* in which the dog did some obedience exercises for eighty seconds. During this session the leash was on the standard collar and the owner was not allowed to correct the dog when the dog made a mistake.

Play session: After the *obedience session*, a *play session*, in which the handler played freely with his/her dog, was carried on. This session, which lasted for forty seconds, was the relaxation session for the dogs. The goal of conducting the *play session* between the *obedience*- and *test-sessions* was to avoid misevaluation of extra-stress which sources from the test session following the unrewarded obedience exercises.

***Test session*:** At the end of the two minutes, the dog and its handler came to the determined point at which they should take up the basic position. The basic position was the position in which the dog sat straight and attentive next to its handler standing tall with his/her hands at his sides.

Depending on the training method which would be tested, the handler put the correct leash on the correct collar at the determined point before taking up the basic position. In other words, if the training method that would be tested was pinch collar, the handler put the leash on the pinch collar. If the quitting signal would be tested, the handler changed the standard leash with the 5 m long leash. The reason of using 5 m long leash for the quitting signal is to allow reaction time for the dog handler and, also, for the dog and, thus, to be able to evaluate clearly whether the dog stopped due to the influence of the collar or to the signal. These preparations were only necessary for the test sessions in which the pinch collar or the quitting signal was tested.

After the dog and its owner took up the basic position with their backs turned to the entry of the test area, the helper with a *protection sleeve* and a *whip* in his hand entered the test area. He took his position up at a distance of approximately 3 m from them and gave the ‘’*ready*’’ signal to the dog handler.

After getting this signal, the owner gave the ‘’*Fuss*’’ command to his/her dog and started to walk by the provocateur. From that moment on, the helper tried to provoke the dog in order that it made the mistake. As soon as the dog made the mistake, the training method which would be tested was administered. If the dog abandoned the undesired behavior reliably after the correction, the same test procedure was repeated after an hour in order to see whether the method had a learning effect. During the repetition of the test, the same procedure as in the first test was carried out. The helper did exactly the same provocation against the dog. If the dog did *not* repeat the same mistake, the test session was terminated and it was noted that the method *had a learning effect.*

In case that the dog showed a reaction against the provocateur again, the test was repeated after an hour for the last time. Thus, maximal three test sessions were conducted for each dog per a day.

If the dog did not abandon the undesired behavior reliably after the correction, the handler and the dog left the test area and no repetition session was conducted.

As mentioned before, during the test sessions learning effect table (shown in figure 3.6) was filled out for each dog.

			1st test session		**2nd test session**				**3rd test session**			
Name of the Handler	**Name of the Dog**	**Method**	1st correction		Control of the learning effect		2nd correction		Control of the learning effect		3rd correction	
			reliably quitting		unwanted behavior		reliably quitting		unwanted behavior		reliably quitting	
			yes	no	yes	no	yes	no	yes	no	yes	no

Figure 3.6: Sample of learning effect table

Alternative test session: In most cases, the provocation level that was performed against the dog increased between the test days because of the learning effect of the training methods. Five dogs from Hannover, however, did not make any mistake on the second / third test day even though the highest possible level of provocation was performed by the helper. Therefore, an alternative test session, which was carried out on the different part of the same test area, was designed.

The following procedure was conducted for the alternative test session:

The handler was instructed to give *''Fuss''* command when he/she and the dog entered the test area. The helper was already hidden behind a wall on the test area at the entrance of them. When the handler and the dog came to test ground the hidden helper appeared at the ground and started to threat the dog with his whip from a distance of approximately 5 m. The handler and the dog approached the helper and walked by him while he was continuing to provoke the dog. As soon as the dog made the mistake, the relevant training method was administered. Afterwards, the handler and the dog left the test area.
Regardless of which test session was conducted, the number of corrections that had been administered was checked with the helper immediately after the test.

3.8 Behavioral Observations

The behavior of each dog during the test was filmed on DVDs using a SONY DCR-DVD110E camera with 2000 x digital and 40 x optical zoom. The recorded DVDs were reviewed later in order to analyze the body language of the dogs during the obedience session and, also, the direct behavioral reactions of the dogs after the administration of the training methods.

3.8.1 Assessment of the Obedience Session

Considering the relevant literature (ALTMANN 1974, SIMPSON and SIMPSON 1977, SUEN and DONALD 1984, MARTIN and BATESON 1993), *focal animal sampling*, *i.e.,* observation of a single individual in a certain amount of time, was used as sampling method and *instantaneous sampling* was used as recording method in order to evaluate the body posture of the dog during the obedience session.

In instantaneous sampling (ALTMANN, 1974), observation session is divided into time intervals. The particular behavior which occurs at the last instant of the interval is recorded as *'one'*, whereas non-occurrence of the behavior is recorded as *'zero'*.

After the pre-analysis phase of DVDs, in which the time between instruction of commands and turns which cause the postural differences were evaluated, it was decided to divide obedience session into 10 sample intervals each of which lasted 8 seconds. At the end of each sample interval the video was paused and the movements of separate body parts have been analyzed by using an extensive ethogram.

The *obedience ethogram* contained mainly five different parts which were *facial expression, head position, ear position, tail position and body position/joints.*
The ethogram was designed following the studies of FEDDERSEN-PETERSEN and OHL (1995), BEERDA (1997),and SCHILDER and van der BORG (2004).

Definitions of bodily expressions and scoring of the body parts are shown in table 3.1 and table 3.2 respectively:

Table 3.1: Descriptions of bodily expressions (developed from BEERDA (1997), SCHILDER and van der BORG (2004))

BODY PARTS	DESCRIPTIONS
Facial Expression	
Corner of the mouth relax	
Corner of the mouth back	Lips drawn back
Corner of the mouth forward	Lips are forming ‘’C’’, short and round shape
Submissive grin	Lips drawn back to expose teeth
Head position	
Neutral	Head held in a normal and a relaxed position
Elevated	Head lifted up to form a wide angle with the neck
Trained eye contact	Keeping eye contact with the owner
Slightly lowered	The head is held in low position to a small extent
Lowered	The head is held in a low position
Turned away	The head is turned away from the owner
Ears position	
Neutral	The pinnae are held partly sidewards and completely upwards; opening is completely visible from the side
Maximally backwards	The pinnae are flat on the head
Backwards	The pinnae are backwards for more than half, are upright of buckled, they are in one line with the stop of the nose and are not flat on the head
Laterally turned	The pinnae are turned sidewards; opening is not visible from the side
High	The openings point forward while ears held in an aroused position
Directed to the stimuli/owner	Each pinnae are directed to source of the stimuli by establishing different combinations of ear positions
Forward	The pinnae are directed forward to form an acute angle with the head
Tail position	
Neutral	The breed specific tail position under neutral conditions
Half low	Tail lower than neutral
Low	Upper side of tail against back, tail forms a ‘’S’’
Curled between legs	Tail held stabile between the legs
Straight out	Tail follows line of lower back of dog
High	Tail higher than neutral
Body posture/ Joints	
High posture	The breed specific posture as shown by dogs under neutral conditions, but in addition the tail is positioned higher or the

	position of the head is elevated and the ears are pointed forwards
Neutral posture	The breed posture shown by dogs under neutral conditions
Half low posture	From three features: a lowered position of the tail (compared to the neutral posture), a backward position of the ears and bent legs, two are exhibited
Low posture	The position of the tail is lowered, the ears are positioned backwards and the legs are bent
Very low posture	Low posture, but now the tail is curled forward between the hind legs
The back is arched	Curving position of the back
Extremely ness	The back is arched maximum together with lowering of the head
Lowering back	Flexed hind legs
Crouching	Flexed fore- and hind legs

Table 3.2: Scoring system of obedience session

Method:		**Sample Points**									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Corner of the Mouth: 0: relax 1: back 2: forward 3: submissive grin	**1st administration**										
	2nd administration										
	3rd administration										
Head: 0: neutral 1: elevated 2: trained eye contact 3: slightly lowered 4: lowered 5: turned away	**1st administration**										
	2nd administration										
	3rd administration										
Ear: 0: neutral 1: maximally backwards 2: backwards 3: laterally turned 4: high 5: directed to the stimuli 6: forward	**1st administration**										
	2nd administration										
	3rd administration										
Body posture/Joints: 0: the back is arched 1: extremely ness 2: crouching 3: lowering back 4: straight 5: aroused stiff legs	**1st administration**										
	2nd administration										
	3rd administration										

3.8.2 Evaluation of the direct behavioral reactions

One-zero sampling method was used in order to assess the direct behavioral reaction of the dog upon the administration of the above mentioned methods. The behavioral elements given in table 3.3 were evaluated for this aim:

Table 3.3: Direct behavioral reactions (developed from BEERDA 1997, SCHILDER and van der BORG 2004).

Behavioral Reactions	**Definitions**
Lips drawn ways back	Corner of the mouth is back
Lips shaped ‘’C’’	Corner of the mouth is forward
Snout licking	Part of the tongue is shown and moved along the upper lip
Tongue out	The tip of tongue is briefly extended
Teeth clapping	Making short loud noise by hitting teeth together
Yawning	Mouth open to apparent fullest extend while eyes are closed
Drooling	Profusely salivating
Eyes averted	Looking away
Eyes directed to the owner	Gazing at the owner
Eyes directed to the helper	Gazing at the helper
Lowering the ears	Positions of the pinnae are backwards for more than half, are upright of buckled, they are in one line with the stop of the nose and are not flat on the head, after receiving the stimulus
Maximum flattening of the ear	The ears lied on the head after receiving the stimulus
Ears directed to the stimuli	Each pinnae are directed to source of the stimuli by establishing different combinations of ear positions after receiving the stimulus
Aroused ears	The openings are pointed forward while ears held in an aroused position after receiving the stimulus
Ears directed to forward	The pinnae are directed forward to form an acute angle with the head after receiving the stimulus
Lifting the head up	The head is lifted up after receiving the stimulus
Lowering of the head	The head is lowered after receiving the stimulus
Turning the head away	The head is turned away from helper after receiving the stimulus
Lowering the tail	The tail is held in a low position while upper side of it against back after receiving the stimulus
Lifting the tail	The tail is held in a high position after receiving the stimulus
Tail curled between legs	The tail is held between the legs after receiving the stimulus
Tail wagging	Repetitive wagging movements of the tail in high frequency after receiving the stimulus

Tail moving sidewards	Wagging of the tail in low frequency
Tail swinging	Back and forth movement of the tail
Avoiding	Moving away from helper with high speed
Jumping against the owner	
Bouncing	Bouncing at point or backwards
Snapping	Snapping at owner
Biting the owner	
Biting the leash	
Body shaking	Rapid back and forth movement of the head and/or body
Head shaking	Rapid shaking movement of the head
Trembling	A clear shivering of the body
Sniffing	Sudden short sniffing of ground
Circling	Turning 180-360 degree around the owner or at point
Play bow	Lowering the front part of the body to the ground with the fore legs somewhat extended
Freezing	Becoming motionless/immobile
Urinating	Urinating in sitting or standing position
Vocalizing	
Barking	Loud, rough noise
Yelping	Sudden, short, high sound
Whining	Long, high sound
Squealing	High-pitch sound
Growling	Low- rough sound
Hissing	Hissing sound

3.9 Statistical Analysis

As a result of the above mentioned research design, different data sheets were produced. Characteristics and past experience of the dogs were gathered through the questionnaire. The age of the dogs ranged between 3 and 10 years, while the mean age was 5 years. The mean duty period of the subjects was 3 years.
A summary table containing the description of the sample is provided in table 4.16.

The second data sheet that was analyzed was the learning effect table, which has been filled out during the training sessions.

The last data sheet was the ethogram, which was produced during the behavioral-video analysis. As the data, mentioned above, were gathered by different methods, different statistical analyses were employed for the evaluation and comparison of the results.

Kruskal-Wallis tests were used for the comparison of the learning effect of the training methods between groups and subgroups as well as for the comparison of group differences in body positions during the obedience sessions. The reason for using Kruskal Wallis test for comparing the groups and subgroups was the non-linear distribution of data and the variable number ($n>2$). Learning effects between the training methods were analyzed by paired-sample t-tests.

In order to determine the general body position of the dogs during the obedience session, frequency analyses were performed. Frequency analyses have also been used for the detection of direct behavioral effects of training methods.
Data analysis was performed with SPSS 16.0 Inc. computer program. Two significancy levels were set at the levels 95% ($p<0.05$**) and 99% ($p<0.01$*).

4. Results

The first part of this chapter includes the results from the statistical analyses of the learning effect of each training method, as well as the comparison of the learning effects of the training methods. Group and subgroup differences concerning learning effect are also analyzed in this part.

In the second part, the scores for the separate body parts during the obedience session, *i.e.,* corner of the mouth, head, ear, tail and joints, are analyzed. Furthermore, the dogs with submissive body posture are detected considering the data sets for the separate body parts.

In the third part, direct behavioral effects of training methods are compared with each other. Moreover, group and subgroup differences considering direct behavioral reactions to the training methods are analyzed.

4.1 Learning Effect

4.1.1 Learning Effect of the Training Methods

The learning effect of each training method was calculated, in order to compare the effectiveness of the training methods. The research resulted in high learning effect for pinch collar and electronic training collar, on the other hand quitting signal showed a low learning effect. The reasons and implications of this result will be discussed in chapter 5.

The result of the calculation of the learning effect of each method showed that the electronic training collar had learning effect on the majority of the dogs (N=39/42). However, one dog in Hannover was not able to be tested for learning effect of the electronic training collar since it did not reliably quit the behavior after the administration of the method.

4 dogs were able to be tested for the learning effect of the quitting signal since the other 38 dogs did not reliably quit the behavior after the instruction of the signal. All in all, the signal had learning effect on only 3 dogs out of 42 subjects.

Similar to the electronic training collar, the pinch collar had learning effect on 32 of 42 dogs, which also includes the majority of the dogs.

Comparing the learning effects of the training methods with one another rendered the following results:

4.1.1.1 Electronic Training Collar vs. Pinch Collar: Compared with the electronic training collar, pinch collar appeared to have lower learning effect on the dogs. However, this difference was not found to be significant (paired sample t-test, $p = 0.16$).

4.1.1.2 Electronic Training Collar vs. Quitting Signal: The learning effect of the electronic training collar was significantly higher than the learning effect of the quitting signal (paired sample t-test, $p < 0.01$*).

4.1.1.3 Pinch Collar vs. Quitting Signal: A significant difference for learning effect between the pinch collar and the quitting signal was found (t-test, $p < 0.01$*).

Table 4.1: Learning effects of training methods on dogs

	Yes (frequency of the dogs)	**No (frequency of the dogs)**	**not evaluated (frequency of the dogs)**
Electronic training collar	92,9%	4,8%	2,4%
Pinch collar	76,2%	23,8%	0%
Quitting signal	7,1%	2,4%	90,5%

4.1.2 Comparison of the groups

Group differences were observed in learning effect of the pinch collar, as well as, of the quitting signal.

4.1.2.1 Electronic Training Collar: No significant difference was found in comparison of learning effect of the electronic training collar between Hannover and Muenster. 19 of 20 subjects reliably abandoned the behavior after getting the correction in Hannover and therefore 19 dogs were able to be tested for the learning effect of the method. In Muenster, however, all dogs could be tested for the learning effect since all of them reliably quitted the behavior after getting the correction. As a result, electronic training collar had learning effect on 18 dogs out of 20 subjects in Hannover, while the same method showed learning effect in all dogs from Muenster.

Table 4.2: Comparison of the learning effect of the electronic training collar between groups

	Yes (frequency of the dogs)	**No (frequency of the dogs)**	**not evaluated (frequency of the dogs)**
Muenster	100%	0%	0%
Hannover	90%	5%	5%

4.1.2.2 Pinch Collar: The method showed learning effect in 13 of 20 subjects in Hannover. In Muenster, however, the learning effect of the pinch collar was higher than the one in Hannover, which involved 19 of 22 subjects. As a result, comparison of the groups showed a tendency towards significance for the pinch collar (Kruskal-Wallis, p=0.109).

Table 4.3: Comparison of the learning effect of the pinch collar between groups

	Yes (frequency of the dogs)	No (frequency of the dogs)	not evaluated (frequency of the dogs)
Muenster	86%	14%	0%
Hannover	65%	35%	0%

4.1.2.3 Quitting Signal: Considering the learning effect of quitting signal, significant difference was found between cities (Kruskal-Wallis, $p < 0.05$**).

None of the dogs in Muenster could be tested for the learning effect of the quitting signal since none of them reliably abandoned the behavior after the signal had been instructed.

In Hannover, however, 4 out of 20 dogs reliably quitted the behavior after getting the signal and thus, could be tested for the learning effect of the method. As a result, the method showed a learning effect in 3 out of 4 dogs in Hannover.

Table 4.4: Comparison of the learning effect of the quitting signal between groups

	Yes (frequency of the dogs)	No (frequency of the dogs)	not evaluated (frequency of the dogs)
Muenster	0%	0%	100%
Hannover	15%	5%	80%

4.1.3 Comparison of the subgroups

Considering learning effect of the training methods, no significant difference was found between subgroups[2].

4.1.3.1 Electronic Training Collar:

Subgroup A: The method showed *no* learning effect in 1 of 8 dogs, which belonged to Hannover group.

Subgroup B: The method showed *no* learning effect in 1 of 7 dogs, which belonged to Hannover group.

Subgroup C: The method showed learning effect in all dogs (N=5).

Subgroup D: The method showed learning effect in all dogs (N=7).

Subgroup E: The method showed learning effect in all dogs (N=8).

Subgroup F: The method showed learning effect in all dogs (N=7).

4.1.3.2 Pinch Collar:

Subgroup A: The method showed *no* learning effect in 1 of 8 dogs, which belonged to Muenster group.

Subgroup B: The method showed learning effect in 4 of 7 dogs. The 2 of 4 dogs, in which the method had *no* learning effect belonged to H-group, while the other 1 dog was from Muenster group.

Subgroup C: The method showed *no* learning effect in 1 of 5 dogs, which belonged to Muenster group.

Subgroup D: The method showed *no* learning effect in 1 of 7 dogs, which belonged to Hannover group.

Subgroup E: The method showed *no* learning effect in 2 of 8 dogs, which belonged to Hannover group.

Subgroup F: The method showed *no* learning effect in 3 of 7 dogs, which belonged to Hannover group.

[2] Comparison of the subgroups: Electronic training collar (Kruskal-Wallis test, p=0,18); Pinch collar (Kruskal-Wallis test, p=0,650); Quitting signal (Kruskal-Wallis test, p=0,792) .

4.1.3.3 Quitting Signal

Only 4 dogs belonged to Hannover group (from the subgroups A, B, C and E) could be tested for learning effect of the quitting signal since only these 4 dogs abandoned the behavior after the signal had been instructed. As a result the method showed learning effect in 3 out of 4 dogs, which belonged to groups A, C and E.

4.2. Body Posture during the Obedience Session

Considering the body posture during the first obedience session of the experiment, the dogs exhibiting *submissive body posture* were detected. In order to assess the *submissive body posture*, separate ear (low ear), head (low head), tail positions (low tail) and, also, the behavioral elements such as flexing of the joints, arching of the back and extreme ness of body posture were scored. All in all, when the dog exhibited at least two submissive behavioral elements during the first obedience session, body posture of the dogs was scored as *submissive body posture*. A summary of each dog's body posture during the first obedience session is presented below:

Dogs	Descriptions
1	The dog exhibited submissive behavioral elements during the obedience sessions, such as *''low tail''* and *''backward ear''* positions (the 1st&the 3rd days). Moreover, it was observed that the dog flexed the fore- and hind legs together with the commands, as well as with the turns during the obedience session. As a result, the body posture of the dog was evaluated as *''submissive posture''.*
2[3]	The head position of the dog was scored as either *''trained eye contact''* or *''neutral head position''* and the ear position was scored as *''directed to the stimuli''* during all obedience sessions. All these positions were considered as *'' neutral positions''.* The tail was held in a high position during the entire experiment. The first obedience session was not be filmed due to the technical problems. Therefore, the 2nd obedience session was considered as the one at which the body posture of the dog was evaluated.
3	The head and ear positions of the dog were scored as *''neutral positions''* during all obedience sessions. The tail was held in a *''high''* position during the entire experiment. It was, also, noted that the dog held its tail closed to its owner at some sessions (the 2nd session of the 1st day& the 2nd session of the 3rd day).

[3] The first obedience session was not be filmed due to the technical problems. Therefore, the 2nd obedience session was considered as the one at which the body posture of the dog was evaluated.

4	The head and ear positions were scored as *''neutral positions''* during all obedience sessions. The dog had, however, *''low tail position''* which is one the elements of *''submissive posture''* during the entire experiment.
5	The dog showed either *''slightly lowered head position''* or *''trained eye contact''*, which was considered as a neutral position, during the experiment. *''Slightly lowered head position''* was, however, observed more often than the *''trained eye contact''*. The dog had *''backward ear positions''* at some sessions, which (the 1st session of the 1st day& the 1st session of the 2nd day) is one of the elements of the *''submissive posture''*. The tail was held in a low position, which was also considered as the *''submissive element''*, during all obedience sessions. All in all, the body posture of the dog was evaluated as *''submissive posture''.*
6	The dog showed *''backward ear positions''* at some sessions (the 1st sessions of the 1st and the 3rd days). It was, however, the only submissive behavioral element that the dog exhibited during the entire experiment.
7	The dog showed *''submissive ear (maximum backward) and tail (held between the legs or tight to one body side in a low position) positions''* during all obedience sessions. As a result, the body posture of the dog was evaluated as *''submissive posture''.*
8	The dog exhibited submissive behavioral elements during the experiment, such as *''low head position''* (the 1 session of the 1st day), *''backward ear position''* (the 1st sessions of the all test days) and *''low tail position''* (all obedience sessions, except the 2nd session of the 1st day). *''Shaking of the head''* was, also, observed together with the commands, as well as with the turns in the dog. Consequently, the body posture of the dog was evaluated as *''submissive posture''.*
9	The head position was scored as *''neutral positions''* during all obedience sessions. *''Backward ear position''*, which is one of the submissive elements, was detected at some sessions (1st & the 2nd sessions of the 3rd day). The other submissive behavioral element, that the dog showed during some obedience sessions (the 2nd and the 3rd sessions of the 2nd day & the 2nd session of the 3rd day), was the *''low tail positions''* As a result, the body posture of the dog was evaluated as *''submissive posture''.*

10	The head and ear positions of the dog were scored as *''neutral positions''* during all obedience sessions. The only submissive behavioral element that the dog exhibited was the *''low position of the tail''* at one obedience session (1st session of the 2nd day).
11	The dog showed submissive behavioral elements, such as *'’low position of the head''* (all sessions, except the 1st session of the 2nd day), *''backward position of the ears''* (the 2nd session of the 1st day, the 1st and the 3rd sessions of the 2nd day & the 1st session of the third day) and the *''low position of the tail''* (the 2nd session of the 3rd day). The posture of the dog was, however, not evaluated as the *''submissive body posture''* since the combination of the two submissive elements were not be observed at the first obedience session of the first test day.
12	The dog exhibited submissive behavioral elements during the experiment, which were *''low posture of the head''* (all sessions), *''backward position of the ears''* (3rd session of the 3rd day) and the *''low tail position''* (2nd session of the 1st day & the 1st session of the 2nd day).
13	The head position was scored as *''neutral positions''* during all obedience sessions*.' Backward ear position''*, which is one of the submissive elements, was detected at some sessions (the 2nd & the 3rd test days). Additionally, the position of the tail was scored as *'' high''* during the entire experiment. It was noted that the dog whined during the obedience sessions and, also, occasionally barked after getting the command and together with the turns.
14	The dog exhibited some behavioral elements, such as *''backward ear''* (1st session of the 2nd day &the 1st and the 2nd sessions of the 3rd day) and *''low tail''* positions during the experiment. As a result, the body posture of the dog was evaluated as *''submissive posture''.*
15	The head position of the dog was scored as *''neutral position''* during all obedience sessions. The dog showed, however, submissive ear positions, which were *''backward''* (the 1st session of the 1st and the 2nd days) and *''maximum backward''* (the 1st session of the 3rd day) positions during some sessions. The tail position was scored as *''high position''* during the experiment.
16	The head position of the dog was scored as *''neutral position''* during all obedience sessions. On the other hand, *''backward ear''* (the 1st session of the 1st day & the 1st and the 2nd sessions of the 3rd day) and *''low tail''* (2nd session of the 3rd day) positions were detected in some sessions, which are the elements of the submissive posture.

17	The dog exhibited submissive behavioral elements during the experiment, which were *''backward position of the ears''* (3rd session of the 1st day & the 1st session of the 2nd day) and the *''low tail position''* (the 1st and the 3rd sessions of the 1st day & the 1st and the 2nd sessions of the 2nd day).
18	The head position of the dog was scored as *''neutral position''* during all obedience sessions. *''Backward ear position''*, which is one of the submissive elements, was detected at some sessions (the 2nd session of the 1st day & the 1st and the 2nd session of the 2nd day& the 1 session of the 3rd day). Additionally, *''the low position of the tail''* was observed (the 2nd session of the 2nd day) at the experiment.
19	The head and ear positions of the dog were scored as *''neutral positions''* during all obedience sessions. The tail was held in a *''high''* position during the whole experiment.
20	The head and ear positions of the dog were scored as *''neutral positions''* during all obedience sessions. The tail was, also, held in a *''high''* position during the entire experiment.
21	The head position of the dog was scored as *''neutral position''* and the tail was scored as ''high *position''* during the entire experiment. On the other hand, submissive ear positions, *i.e., ''backward''* and *''maximum backward''* positions were observed during the all obedience sessions, except the 1session of the 2nd test day.
22	The head position of the dog was scored as *''neutral position''* and the tail was scored as *''high position''* during the entire experiment. *''The backward positions of the ears''* were, however, observed on the third day, which was the only behavioral element that the dog exhibited.
23	The head and ear positions of the dog were scored as ''neutral positions'' during all obedience sessions. *''The low position of the tail''* was, however, detected at some sessions (the 1st and the 2nd sessions of the 1st day & the1st session of the 2nd day & the 1st session of the 3rd day).
24	The head position was scored as *''neutral position''* and the tail position was scored as *''high position''* during the all obedience sessions. The only submissive behavioral element, which was the *''backward position of the ear''* was detected at the first session of the first test day.
25	The dog exhibited submissive behavioral elements during the experiment, which were *''backward position of the ears''* (the 2nd and the 3rd session of the 1st day & the 1st session of the 2nd day & the 1st session of the third day) and the *''low tail position''* (the 2nd session of the 1st day & the 1st session of the 2nd day & the 1session of the 3rd day).

26	The dog exhibited *''neutral''* ear and head positions and, also the *''high''* tail position during the entire experiment.
27	The dog exhibited submissive behavioral elements during the experiment, which were *''low posture of the head''* (the 2nd session of the 3rd day), *''backward position of the ears''* (the 2nd and the 3rd sessions of the 2nd day& the 2nd session of the 3rd day) and the *''low tail position''* (1st session of the 1st day & the 1st and the 2nd sessions of the 3rd day).
28	The dog showed submissive behavioral elements during the experiment, such as *''low head''* (all obedience sessions, except the 1st session of the 3rd day), *''backward ear''* (the 1st sessions of the 1st and the 3rd days & the 2nd session of the 2nd day) and *''low tail''* (the 2nd session of the 2nd day & the 1st and the 2nd sessions of the 3rd day). As a result, the body posture of the dog was evaluated as *''submissive posture''.*
29	No obedience sessions were conducted at the 2nd and the 3rd sessions of the third day, since the alternative test was performed for the dog. The head and ear positions of the dog were scored as *''neutral positions''* during all obedience sessions. *''The low position of the tail''* was, however, detected at some sessions (all sessions of the 1st day) during the experiment.
30	The dog exhibited *''neutral''* ear and head positions and, also the *''high''* tail position during the entire experiment.
31	No obedience sessions were conducted at the 2nd and the 3rd sessions of the 2nd day and, also, at none of the sessions of the 3rd day, since the alternative test was performed for the dog. The head and ear positions of the dog were scored as ''neutral positions'' during all obedience sessions. *''The low position of the tail''* was, however, detected at some sessions (the 1st and the 2nd sessions of the 1st day).
32	No obedience sessions were conducted at the 2nd and the 3rd sessions of the 2nd day and, also, at none of the sessions of the 3rd day, since the alternative test was performed for the dog. The dog exhibited submissive behavioral elements during the obedience sessions, such as *''low head''* (the 1st and the 2nd sessions of the 1st day), *''backward ear''* and *''low tail''* positions (the 1st session of the 2nd day). As a result, the body posture of the dog was evaluated as *''submissive posture''.*

33	The head and ear positions of the dog were scored as *''neutral positions''* during all obedience sessions. *''The low position of the tail''* was, however, detected at all obedience sessions.
34[4]	The head position of the dog was scored as *''neutral position''* during all obedience sessions. On the other hand, *''backward ear''* (the 2nd session of the 2nd day & the 1st and the 2nd sessions of the 3rd day) and *''low tail''* (2nd session of the 3rd day) positions were detected, which are the elements of the submissive posture. The first obedience session was not be filmed due to the technical problems. Therefore, the 2nd obedience session was considered as the one at which the body posture of the dog was evaluated.
35	The dog showed submissive behavioral elements during the experiment, which were *''low posture of the head''* (the 2nd session of the 3rd day), *''backward position of the ears''* and the *''low position of the tail''*. All in all, the body posture of the dog was evaluated as the *''submissive posture''*.
36	The dog showed submissive behavioral elements during the experiment, such as *''low posture of the head''* (the 3rd session of the 1st day) and *''backward position of the ears''* (all sessions, except the 2nd session of the 2nd day). The tail position was scored as *''high''* during the entire experiment.
37	No obedience sessions were conducted at the 2nd and the 3rd sessions of the 2nd day and, also, at none of the sessions of the 3rd day, since the alternative test was performed for the dog. The dog exhibited submissive behavioral elements during the obedience sessions, such as *''low head''*, *''backward ear''* (1st session of the 2nd day) and *''low tail''* positions. As a result, the body posture of the dog was evaluated as *''submissive posture''.*
38	The head position of the dog was scored as *''neutral position''* during all obedience sessions. *''Backward ear position''*, which is one of the submissive elements, was detected at some sessions (the 2nd session of the 1st day & the 1st and the 2nd session of the 3rd day). Additionally, *''the low position of the tail''* was observed during the entire experiment.

[4] The first obedience session was not be filmed due to the technical problems. Therefore, the 2nd obedience session was considered as the one at which the body posture of the dog was evaluated.

39	The head and ear positions of the dog were scored as *''neutral positions''* during all obedience sessions. *''The low position of the tail''* was detected at only one obedience session (the 1st session of the 1st day).
40	The dog exhibited submissive behavioral elements during the experiment, which were *''low posture of the head''* (the 1st session of the 2nd day & the 2nd session of the 3rd day), *''backward position of the ears''* (the 1st session of the 1st day & 1st and the 3rd sessions of the 2nd day& the 1st session of the 3rd day) and the *''low tail position''*. All in all, the body posture of the dog was evaluated as *''submissive posture''.*
41	The dog showed submissive head (low), ear (maximum backward and/or backward) and tail (low = the 1st and the 2 sessions of the 2nd and the 3rd days) positions during the experiment. As a result, the body posture of the dog was evaluated as *''submissive posture''.*
42	The dog showed submissive behavioral elements during the experiment, such as the *''low position of the head''* (the 1st session of the 1st day), the *''backward positions of the ears''* (all sessions, except the 2nd session of the 1st day) and the *''low position of the tail''*.

All in all, 8 out of 20 dogs from Hannover and 3 out of 22 dogs from Muenster group were evaluated as the dogs which showed *''submissive posture''* during the obedience sessions. Table 4.1 shows the distribution of these dogs according to the cities and sub-groups.

Moreover, when comparing the differences in the positions of the separate body parts of the dogs on the first and the last day of the experiment, changes only at ear and tail positions were detected as shown in table 4.2. Interestingly, the postural differences of the ears were evaluated as *''passing to the submissive position''*, whilst the tail differences were scored as *''passing to the high position''* between the first and the last experiment days.

Table 4.5: The number of the dogs exhibited ''submissive body posture'' during the obedience session.

	HANNOVER	MUENSTER
Subgroup A	2	0
Subgroup B	1	1
Subgroup C	2	0
Subgroup D	3	0
Subgroup E	0	2
Subgroup F	0	0

Table 4.6: Comparison of the bodily differences between the first and the last days of the Experiment (Subgroups: A, B, C, D, E, and F)

		HANNOVER Number of the dogs			MUENSTER Number of the dogs			
		Up	Down	Fixed	Up	Down	Fixed	Total
A	HEAD	0	1	3	0	0	4	Fixed
	EAR	1	2	1	1	1	2	Down=Fixed
	TAIL	2	0	1	1	0	3	Fixed
B	HEAD	0	2	1	0	0	4	Fixed
	EAR	1	1	1	0	2	2	Down=Fixed
	TAIL	1	0	1	2	1	1	Up
C	HEAD	0	1	1	0	0	3	Fixed
	EAR	0	2	0	0	1	2	Down
	TAIL	1	0	1	1	0	2	Fixed
D	HEAD	0	1	3	0	0	3	Fixed
	EAR	0	1	3	0	0	3	Fixed
	TAIL	1	1	2	2	0	1	Up= Fixed
E	HEAD	0	0	3	0	0	3	Fixed
	EAR	0	0	3	1	2	2	Fixed
	TAIL	0	1	2	0	0	5	Fixed
F	HEAD	0	0	4	0	0	3	Fixed
	EAR	0	2	2	0	0	3	Fixed
	TAIL	0	1	3	1	0	2	Fixed

4.3 Direct Reactions of the Dogs to the Training Methods

In order to determine the direct effects of the training methods, the reactions of the separate ear, tail and joint parts as well as the vocalizations of the dogs are considered. However the comparison between groups considering the eye/gaze direction and head reactions with pinch collar has not been performed. The reason for this decision was the correction technique of pinch collar. The correction of the pinch collar involves the pulling of the leash. As a result, eyes/gaze directions and head reactions can be affected and this situation causes misinterpretation.

4.3.1 Eyes/gaze direction

4.3.1.1. Electronic training collar: Considering eyes/gaze direction upon the administration of the electronic training collar rendered the following results:

At the *first test session*, 41 out of 42 dogs could be evaluated. 38 dogs of these 41 dogs averted the eyes from the helper, whilst 3 dogs directed the eyes to the helper.

At the *second test session*, 8 of 9 dogs, on which the method was applied, averted the eyes from the helper. The reaction of 1 dog was, however, staring the helper after getting the correction.

At the *third test session*, it was observed that both of 2 dogs, which were subjected to the correction, averted the eyes from the helper.

4.3.1.2 Pinch collar: Concerning eyes/gaze direction upon the administration of the pinch collar, the following results were found:
At the *first test session*, 12 out of 42 dogs could be evaluated. As a result, 9 dogs averted the eyes from the helper, while 2 dogs directed the eyes to the helper. One dog reacted, however, by staring at the owner.

At the *second test session*, 5 out of 18 dogs, which were subjected to correction, could be evaluated. The reaction of all dogs was averting of eyes from the helper.

At the *third test session*, 6 out of 10 dogs which were subjected to the correction averted the eyes from the helper. The reactions of the other 4 dogs could be tested.

4.3.1.3 Quitting Signal: Concerning eyes/gaze direction upon the administration of the quitting signal, the following results were found:

As mentioned before, only 4 dogs out of 42 subjects abandoned the behavior after having been given the quitting signal during *the first session*. Therefore, only the reactions of these 4 dogs were tested. Consequently, 3 out of 4 dogs averted the eyes from the helper, whilst 1 dog reacted by staring at the helper.

At the second test session, both 2 dogs which were subjected to correction averted the eyes from the helper.

The reaction of the dog, which was the only dog tested for quitting signal at the *third test session*, averting of eyes from the helper.

4.3.2 Head Reaction:

4.3.2.1 Electronic training collar: Concerning the head reaction upon the administration of the electronic training collar, the following was found:

At the *first test session*, 20 of 42 dogs turned their heads away, while 13 dogs not only lowered but also turned their heads away. The reaction of 1 of 3 dogs, which showed low head position after the administration of the method, was assessed as *''slightly lowered''*.

At the *second test session*, 9 dogs were subjected to the correction. 6 dogs showed low head position, whilst 2 dog both lowered and turned their heads away. On the other hand, 1 dog took the *''trained eye contact''* position after the method was applied.

At the *third test session,* both 2 dogs, which were subjected to the correction, turned their heads away.

4.3.2.2 Pinch collar: Considering the head reaction upon the administration of the pinch collar rendered the following results:

At the *first test session*, 19 of 42 dogs could be evaluated. 18 dogs showed the ‘’*low head position’’* after getting the correction. The head positions of 5 out of these 18 dogs were, however, assessed as *‘’slightly lowered’’*. On the other hand, 4 dogs turned their head away from the helper. Only 1 dog exhibited combined reaction which was both lowering and turning of head.

At the *second test session*, 12 of 18 dogs, which were subjected to the method, could be evaluated. 3 of these 12 dogs turned their heads away from the helper, while the other 9 dogs lowered their heads. 3 of 9 dogs, which lowered their heads, were assessed as *‘’slightly lowered head position’’*.

At the *third test session*, 7 out of 10 dogs, which were subjected to the correction, were able to be evaluated. As a result, 1 of 7 dog reacted by turning the head away, whilst the other 6 dogs lowered their heads. The head position of 3 out of 6 dogs, which lowered their heads, assessed as *‘’slightly lowered’’*.

4.3.2.3 Quitting Signal: Concerning the head reaction upon the administration of the quitting signal, the following results were found:

As mentioned before, only 4 out of 42 dogs abandoned the behavior after having been given the quitting signal during the first session. Therefore, only the reactions of these 4 dogs were tested. The head position of all 4 dogs were assessed as *‘’low head position’’*. The head reactions of 2 out of these 4 dogs were, however, evaluated as *‘’slightly lowered’’*.

At the *second test session***,** 1 out of 2 dogs which were corrected by quitting signal showed ‘’*neutral head position’’*. The head of the other dog was, on the other hand, slightly lowered.

At the *third test session*, only 1 dog was subjected to the signal at the third session. The head position of the dog assessed as *‘’neutral position’’* after the instruction of the signal.

4.3.3 Ear Reaction

In case that the dogs exhibited mixed ear positions as a reaction to the methods, the position of the lowest ear position was considered as the ear reaction.

4.3.3.1 Electronic training collar: Considering ear reaction upon the administration of the electronic training collar rendered the following results:

At the *first test session*, all 42 dogs exhibited low ear position. The ears positions of 26 dogs were, however, assessed as *''backward position''*, whilst the 16 dogs had *''maximum backward ear position''*.

At the *second test session,* 8 out of 9 dogs, which were subjected to the method, had low ear position. The ear position was ''*maximally backward''* in 5 dogs, whilst 3 dogs had *''backward ear position''*. The ear position of one dog was assessed as *''directed to the stimuli''* after getting the correction.

At the *third test session*, 2 dogs were subjected to the method during this session. One of them exhibited ''*maximum backward ear position''*, while the ear reaction of the other dog was assessed as *''backward ear position''*.

4.3.3.2 Pinch Collar

Considering the ear reaction upon the administration of the pinch collar rendered the following results:

At the *first test session*, 27 out of 42 dogs had ''*maximum backward ear position''*, whilst 14 dogs showed *''backward ear position''*. The ear reaction of one dog was, on the other hand, not able to be evaluated.

At the *second test session*, 12 out of 18 dogs, which were corrected by the pinch collar, had *''backward ear position''*, while the ear positions of 6 dogs were evaluated as *''maximally backward''*.

At the *third test session*, all of 10 dogs, which were exposed to the correction at this session, exhibited ‘’*low ear position*’’. The ear positions of 8 dogs were assessed as *‘’backward’’*. The ear of other the 2 dogs were, on the other hand, *‘’maximally backward’’*.

4.3.3.3 Quitting Signal

Concerning the ear reaction upon the administration of the quitting signal, the following results were found:

As mentioned before, only 4 out of 42 dogs abandoned the behavior after having been given the quitting signal during the *first session*. Therefore, only the reactions of these 4 dogs were tested. Consequently, it was observed that 2 of these 4 dogs lowered their ears after the instruction of the signal. Thus, the ear positions of these 2 dogs were evaluated as *‘’backward’’*. The *‘’high’’* ear position was observed in one dog, whilst the ear position of the other dog was *‘’directed to the stimuli’’*.

At the *second test session,* 1 of 2 dogs, which were subjected to the method, exhibited *‘’backward’’* ear position. The ear position of this 1 dog was, however, evaluated as *‘’directed to the stimuli’’*.

The signal was used on only one dog in the *third test session*. As a result, the ear reaction of the dog was evaluated as *‘’directed to the stimuli’’*.

4.3.3.4 Comparison of the ear reactions to the pinch- and the electronic training collar

Comparing the first ear reactions of the dogs to the pinch- and the electronic training collar, it was found that the correction applied by the pinch collar caused lower ear position than the one applied by the electronic training collar.

Table 4.7: Comparison of the first ear reactions to the electronic training collar and the pinch collar

	Maximum backwards (frequency of the dogs)	Backwards (frequency of the dogs)	Not evaluated (frequency of the dogs)
Electronic training collar	38,1%	61,9%	0%
Pinch collar	64,3%	33,3%	2,4%

4.3.3.5 Comparison of the groups for ear reactions to the methods: A tendency towards significance was seen in comparison of the groups for the first ear reactions to the methods [5].

4.3.3.6 Comparison of the subgroups for ear reactions to the methods: Comparing the first ear reactions to the methods, no significant difference was found between subgroups for reaction to the electronic training collar[6]. The first ear reaction to the pinch collar, however, showed no significant difference between subgroups (Kruskal-Wallis, $p<0.1$) as shown in table 4.8.

[5] Comparison of the groups for ear reactions to the methods: Electronic training collar (Kruskal-Wallis test, p=0,309); Pinch collar (Kruskal-Wallis test, p=0,298); Quitting signal (Kruskal-Wallis test, p=0,067).

[6] Comparison of the subgroups for ear reactions to the electronic training collar (Kruskal-Wallis test, p=0,633).

Table 4.8: Comparison of the subgroups (A, B, C, D, E, F) for the first ear reactions to the pinch collar

	Maximum backwards (frequency of the dogs)	**Backwards (frequency of the dogs)**	**Not evaluated (frequency of the dogs)**
A	87,5%	12,5%	0%
B	85,7%	14,3%	0%
C	80%	20%	0%
D	28,6%	71,4%	0%
E	37,2%	50%	12,5%
F	71,4%	28,6%	0%

4.3.4 Tail Reaction

4.3.4.1 Electronic training collar: Considering tail reaction upon the administration of the electronic training collar rendered the following results:

At the *first test session*, the tail positions of 40 out of 42 dogs could be evaluated as the reaction to the electronic training collar. As a result, 23 of these 40 dogs exhibited *''low''* tail positions, while the other 17 dogs had *''high''* tail positions. Moreover, 2 out of 23 dogs, which had the low tail positions, curled their tails between the legs, which was considered as *''extreme low position''*.

At the *second test session*, 7 out of 9 dogs, which were subjected to the method, had '*'high tail positions*'', whilst the other 2 dogs showed low tail positions.

At the *third test session*, both 2 dogs, which were subjected to the method during this session, showed the ‘’*high’’* tail positions.

4.3.4.2 Pinch Collar: Considering the tail reaction upon the administration of the pinch collar rendered the following results:

At the *first test session*, 40 out of 42 dogs could be evaluated. As a result, 21 of these 40 dogs showed ‘’*high’’* tail positions. On the other hand, the tail reaction of the other 19 dogs were assessed as *‘’lowering of the tail’’*. Moreover, 5 dogs curled their tails between the legs, which was considered as an *‘’extreme low position’’*.

At the *second test session*, 17 dogs out of 18 subjects, which were corrected by the pinch collar, could be evaluated. Consequently, 8 of these 17 dogs had ‘’*low’’* tail positions, the tail positions of 5 out of which were assessed as *‘’extreme low position’’*. The other 9 dogs, however, exhibited ‘’*high’’* tail positions.

At the *third test session*, 5 of 10 dogs, which were exposed to the correction, exhibited ‘’*low’’* tail position, while the tail positions of the other half were scored as *‘’high’’* position.

4.3.4.3 Quitting Signal: Concerning the tail reaction upon the administration of the quitting signal, the following results were found:

As mentioned before, only 4 out of 42 dogs abandoned the behavior after having been given the quitting signal during the first session. Therefore, only the reactions of these 4 dogs were tested. The tail positions of 3 of these 4 dogs were assessed as *‘’high’’*. The other one dog, however, lowered its tail after the instruction of the signal.

At the *second test session*, 1 of 2 dogs, which were subjected to the method, exhibited low tail position. The tail position of the other dog was, however, evaluated as *‘’high’’*.

The signal was used on only one dog at the *third test session*. As a result, the tail reaction of the dog was evaluated as *‘’lowering of the tail’’*.

4.3.4.4 Comparison of the first tail reactions to the pinch- and the electronic training collar:

No statistically significant difference was found in comparison for the tail reactions between the electronic training collar and the pinch collar[7]. However, it has been observed that the dogs lowered their tails more often as a reaction to the electronic training collar than to the pinch collar.

Table 4.9: Comparison of the first tail reactions to the electronic training collar and the pinch collar

	High (frequency of the dogs)	**Low (frequency of the dogs)**	**Not evaluated (frequency of the dogs)**
Electronic training collar	40,5%	54,8%	4,8%
Pinch collar	50%	45,2%	4,8%

4.3.4.5 Comparison of the groups for tail reactions to the methods:

Comparing the first tail reactions to the methods, no significant difference was found between the H- and M-groups for reaction to the electronic training collar[8].
The first tail reaction to the pinch collar, however, showed significant differences between Hannover and Muenster (Kruskal-Wallis, $p < 0.05^{**}$) as shown in table 4.10.

[7] Comparison of the first tail reactions to the pinch- and the electronic training collar: (t-test, p=0,165).

[8] Comparison of the groups for tail reactions to the methods: electronic training collar (Kruskal-Wallis, p=0,489).

Table 4.10: Comparison of the groups for the first tail reactions to the pinch collar

	Extreme low (frequency of the dogs)	Low (frequency of the dogs)	High (frequency of the dogs)	Not evaluated (frequency of the dogs)
Muenster	9,1%	50%	36,3%	4,5%
Hannover	15%	15%	65%	5%

4.3.4.6 Comparison of the subgroups for tail reactions to the methods:

Considering the first tail reactions to the methods, no significant difference was found between subgroups[9].

4.3.5 Body Posture: Regarding body posture, flexing of the fore and/or hind legs, sitting, arching of the back and extreme ness posture of the body were scored.

4.3.5.1 Electronic training collar: Considering the joints and body reactions upon the administration of the electronic training collar rendered the following results:

At the *first test session,* 34 out of 42 dogs exhibited joint reactions. These reactions were scored as *''lowering of the back''* in 18 dogs, as *''crouching''* in 14 dogs an as *''sitting''* in 2 dogs. Moreover, 2 of 14 dogs which crouched as a reaction to the method also arched their backs.

At the *second test session,* 6 out of 9 dogs, which were subjected to the method, showed joint reactions. These reactions were scored as *''crouching''* in 4 dogs and *''lowering of the back''* in the other 2 dogs. *''Arching of the back''* was also observed in one dog which crouched as a reaction to the method.

Both 2 dogs, which were subjected to the method, crouched as a reaction to the electronic training collar at the *third test session*.

[9] Comparison of the subgroups for tail reactions to the methods: pinch collar (Kruskal-Wallis, p=0,316); electronic training collar (Kruskal-Wallis, p=0,282).

4.3.5.2 Pinch Collar: Concerning the joints and body reactions upon the administration of the electronic training the following results were found:

At the *first test session,* 40 dogs out of 42 subjects could be evaluated for the joint reactions. As a result, 37 of these 40 dogs showed postural differences after having been corrected by the pinch collar. These differences were scored as *''crouching''* in 22 of the 37 dogs crouched and '*'lowering of the back''* in 13 dogs. Furthermore, *''extreme ness of body posture''* was observed in 2 dogs which crouched after getting the correction. The other 2 dogs sat down as a reaction to the correction.

At the *second test session,* 14 dogs out of 18 subjects, which were corrected by the pinch collar, could be evaluated. As a result, 12 of these 14 dogs showed joint reactions after having been corrected by the pinch collar. These reactions were scored as *''flexing of fore- and hind-legs''* in 7 dogs and *''flexing of hind-legs''* in 4 dogs. The other 2 dogs sat down after having been corrected by the collar.

At the *third test session*, 6 of 10 dogs, which were exposed to the correction, exhibited joint reactions. As a result, 2 of these 6 dogs crouched as a reaction to the pinch collar, one of which also arched its back together with this reaction. The other 4 dogs, on the other hand, just lowered their backs after getting the correction.

4.3.5.3 Quitting Signal: Concerning the joint and body reactions upon the administration of the quitting signal, the following results were found:

As mentioned before, only 4 out of 42 dogs abandoned the behavior after having been given the quitting signal during the first session. Therefore, only the reactions of these 4 dogs were tested. Consequently, 1 of these 4 dogs showed *''extreme ness of body posture''* together with the *''crouching''* after getting the correction. The other 3 dogs, however, did not exhibit any joint reactions.

At the *second test session*, 1 of 2 dogs, which were subjected to the method, exhibited joint reaction, which was *''flexing of the fore- and hind-legs''*.

The signal was used on only one dog at the *third test session*. As a result, no joint reaction was observed in this dog.

4.3.5.4 Comparison of the first joint reactions to the pinch- and the electronic training collar

Comparing the first joint reactions of the dogs to the pinch- and the electronic training-collar, it was found that the correction applied by the pinch collar caused lower body posture than the one applied by the electronic training collar. Moreover, 2 dogs exhibited *''extreme ness of body posture''* as a reaction to the pinch collar, whilst this reaction was observed in none of the dogs against the electronic training collar.

Table 4.11: Comparison of the first joint reactions to the electronic training collar and the pinch collar

	Lowering of back (frequency of the dogs)	**Crouching (frequency of the dogs)**	**Extreme ness (frequency of the dogs)**	**Sitting (frequency of the dogs)**
Electronic training collar	42,9%	33,3%	0%	4,8%
Pinch collar	31%	47,6%	4,8%	9,5%

4.3.5.5. Comparison of the groups for joint reactions to the methods: Considering the first joint reactions to the methods, no significant difference was found between Hannover and Muenster[10].

4.3.5.6 Comparison of the subgroups for joint reactions to the methods: Comparing the first joint reactions to the methods, no significant difference was found between subgroups for reaction to the electronic training collar, as well as to the pinch collar[11].

[10] Comparison of the groups for joint reactions to the methods: pinch collar (Kruskal-Wallis, p=0,349); electronic training collar (Kruskal-Wallis, p=0,155).

[11] Comparison of the subgroups for joint reactions to the methods: pinch collar (Kruskal-Wallis, p=0,349); electronic training collar (Kruskal-Wallis, p=0,155).

4.3.6 Vocalizations: In some cases, the dog was exposed to the correction many times during the obedience session. Therefore, it was possible that the dog elicited different vocalizations after each correction. In these cases, only the first vocalization against the method was considered as a *''vocal reaction''*.

4.3.6.1 Electronic training collar: Considering the vocal reactions upon the administration of the electronic training collar rendered the following results:

At the *first test session*, 25 out of 42 dogs elicited vocal reactions. These reactions were scored as *''barking''* in 8 dogs, ''yelping'' in 8 dogs, *''whining''* in 6 dogs and as ''squealing'' in 3 dogs.

At the *second test session*, 6 out of 9 dogs, which were subjected to the method, elicited vocalization. These vocal reactions were *''barking''* in 3 dogs, *''yelping''* in 1 dog, *''whining''* in 1 dog and *''squealing''* in 1 dog.

Both 2 dogs, which were subjected to the method, elicited vocalizations, which were *''barking''* and *''squealing''* at the *third test session'*.

4.3.6.2 Pinch Collar: Concerning the vocal reactions upon the administration of the pinch collar the following results were found:

At the *first test session*, 10 out of 42 dogs elicited vocalizations after having been corrected by the pinch collar. These reactions were recorded as *''barking''* in 4 dogs, *''whining''* in 3 dogs, *''yelping''* in 2 dogs, and as *''squealing''* in 1 dog.

The vocal reactions, which were *''barking''* and *''whining''* were recorded in 2 out of 18 dogs, which were corrected by the pinch collar at the *second test session*.

At the *third test session*, 2 of 10 dogs, which were exposed to the correction at this session, emitted vocalizations as a reaction to the pinch collar. The vocal reactions of both dogs were recorded as *''barking''*.

4.3.6.3 Quitting Signal: Considering the vocal reactions upon the administration of the quitting signal, the following was found:

As mentioned before, only 4 out of 42 dogs abandoned the behavior after the quitting signal had been given during the first session. Therefore, only the reactions of these 4 dogs were tested at the *first test session*. None of these dogs, however, emitted vocal reactions after the instruction of the signal.

None of 2 dogs, which were subjected to the method, elicited vocalizations as a reaction to the signal at the *second test session*.

The signal was used only in 1 dog at the *third test session*. No vocal reaction was, however, recorded in this session.

4.3.6.4 Comparison of the first vocal reactions to the pinch- and the electronic training collar: Comparing the first vocal reactions to the electronic training collar and to the pinch collar, a statistically significant difference was found (t-test, p <0.01*).

Table 4.12: Vocal reactions to the electronic training collar and the pinch collar

	Vocal reaction (frequency of the dogs)	**No vocal reaction (frequency of the dogs)**
Electronic training collar	59,5%	40,5%
Pinch collar	23,8%	76,2%

4.3.6.5 Comparison of the groups for vocal reactions to the methods: Considering the first vocal reactions to the methods, no significant difference was found between the Hannover and Muenster[12].

[12] Comparison of the groups for vocal reactions to the methods: pinch collar (Kruskal-Wallis, p=0,277); electronic training collar (Kruskal-Wallis, p=0,193).

4.3.6.6 Comparison of the subgroups for vocal reactions to the methods: Comparing the first vocal reactions to the methods, no significant difference was found between subgroups[13].

4.3.7 Other Behavioral Reactions: The other reactions performed by the dogs upon the administration of the training methods were shown in table 4.13, table 4.14 and in table 4.15 respectively.

Table 4.13: Direct reactions to the electronic training collar
First application of the electronic training collar: ETC1
Second application of the electronic training collar: ETC2
Third application of the electronic training collar: ETC3

Number of the dogs

	Lifting front paw	**Snout licking**	**Fast open and close**	**Avoiding**	**Jumping against owner**	**Biting the owner**	**Circling**
ETC1 ***N*=42**	5	19	2	7	3	1	2
ETC2 ***N*=9**	0	4	0	3	0	0	1
ETC3 ***N*=2**	0	1	0	0	0	0	0

[13] Comparison of the subgroups for vocal reactions to the methods: pinch collar (Kruskal-Wallis, p=0,243); electronic training collar (Kruskal-Wallis, p=0,493).

Table 4.14: Direct reactions to the pinch collar

First application of the pinch collar: PC1

Second application of the pinch collar: PC2

Third application of the pinch collar: PC3

Number of the dogs

	Lifting front paw	**Snout licking**	**Fast open and close**	**Avoiding**	**Jumping against owner**	**Biting the owner**	**Circling**
PC1 ***N*=42**	6	13	0	3	2	0	0
PC2 ***N*=18**	1	6	0	0	0	0	0
PC3 ***N*=10**	1	4	0	0	0	0	0

Table 4.15: Direct reactions to the quitting signal

First application of the quitting signal: QS1

Second application of the electronic training collar: QS2

Third application of the electronic training collar: QS3

Number of the dogs

	Lifting front paw	**Snout licking**	**Fast open and close**	**Avoiding**	**Jumping against owner**	**Biting the owner**	**Circling**
QS1 ***N*=42**	0	5	0	0	0	0	0
QS2 ***N*=3**	0	1	0	0	0	0	0
QS3 ***N*=1**	0	1	0	0	0	0	0

4.4 General Information:

As mentioned previously, characteristics and past experience of the dogs were gathered through the questionnaire. Considering the answers given by the dog handlers to this questionnaire, a summary table containing following descriptions was established:

- *General information: gender, age, availability of ex-owner, service period as a police dog, housing conditions, the order of exercises during training, availability of real criminal contact of the dog, participation at dog sports*
- *Training aids: currently available behavioral problems*
- *General assessment: self-confidence, arousal level and motivation type*

The description of the sample is provided in table 4.16.

Table 4.16: Summary table of characteristics

Characteristics	**%** (frequency of the dogs)	***Characteristics***	**%** (frequency of the dogs)
Gender		**Currently available behavioral problem**	
Male	78,6	Yes	42,8
Female	31,4	no	57,2
Age		**Behavioral problem**	
Under 2 years old	0	Barking	55,1
2-5 years old	66,7	Unwanted hunting behavior	13,8
Over 5 years old	33,3	Displacement activities	10,3
Service period		Stereotype	10,3
Under 2 years	22	Others	10,3
2-5 years	68,2	**Motivation type**	
Over 5 years	9,8	Conflict-motivated	35,7
Past owner		Prey-motivated	54,8
Yes	75	Both	9,5
No	25	**Level of arousal**	
Housing		High in training	76,2
House	31,7	Always high	19
Kennel	36,6	Always relax	4,8
Both	31,7	**Self-confidency**	
Real criminal contact		Self-confident against human	85,7
yes	74,3	Self-confident against environment	92,9
no	25,7	**Participation at dog sports**	
Order of exercises during training		yes	0
1. Obedience exercises 2. Protection work	35	no	100
Parallel	65		

5. Discussion

This study aimed to assess the effectiveness of three training methods, namely electronic training collar, pinch collar and quitting signal, considering two parameters: stress and learning effects. In order to achieve this, direct behavioral reactions of 42 police dogs of the breed Belgian Malinois were examined upon the administration of the above mentioned methods. In addition to this, body language of each dog during obedience exercises was filmed and analyzed so that correlations between *body posture and experience*, *body posture and characteristics*, as well as between *body posture and direct reactions of the dogs to the above mentioned training methods* were detected.

In a study, conducted parallel to the study presented here, saliva cortisol levels of the dogs after the application of these methods were evaluated as a physiological stress indicator.

The present study based on two publications: the research conducted by SCHILDER and van der BORG (2003) examining the 'short and long term behavioral effects of electronic training collars on police dogs' and the research conducted by SCHALKE et al. (2006) investigating the 'stress effects of electronic training collars on dogs *(Canis familiaris)* in everyday life situations considering physiological parameters'.

In the study conducted by SCHILDER and van der BORG (2003) direct behavioral reactions of 15 dogs from different breeds (Malinois crosses, pure breed Malinois, German Shepherds and Rottweiler) to the electric shock were investigated. Additionally, the behavior of 16 dogs (all German Shepherds) which had received electric shocks in the recent past, was compared with the behavior of 15 control dogs (all German Shepherds), which had received similar training but never had received shocks.
SCHALKE et al. (2006), on the other hand, examined stress reactions of 14 laboratory-bred Beagle to the electronic training collars considering two physiological parameters: saliva cortisol and heart rate measurement. The dogs were divided into three study groups each of them received a different application procedure of electric shock and the results obtained from these study groups were compared with each other.

Following questions were proposed as research questions that guided the design of the presented study:

1. *Stress* caused by the use of specific conditioned signal, *quitting signal*, pinch collar and electric training collar,

2. *Learning effects* of the above mentioned training methods, i.e. electronic training collar, pinch collar and quitting signal,

3. *Compatibility of effectiveness* of application of *negative punishment* with the *positive punishment* methods in a training with high level of arousal and motivation.

In the following sections the critics about material and methods that were used during this study will be presented and the implication of the statistical findings to the theory will be discussed.

5.1 Materials and Methods

5.1.1 Subjects

The 42 dogs, which were chosen as subjects of this study, were official police serving dogs. There were two main reasons for choosing police dogs for this experiment: The first reason of using police dogs was to be able to test as many dogs as possible. The second reason was since police dogs are kept and trained in a similar way, it was possible to minimize the variability arising from housing and training conditions.

Another important reason why police dogs were preferred to laboratory dogs was the level of arousal in testing of all training methods. The testing of the three methods was performed in a situation requiring high level of arousal and motivation. This procedure is an actual dog training situation, thus a daily situation for police dogs. The laboratory dogs, however, would have to be trained in a certain way for a long time in order to be able to test them in such situation.

In addition to that, only the police dogs from a certain breed, Belgian Malinois, were tested in order to avoid the variability due to the breed characteristics. Since these breed of dogs are more frequently used as police dogs than other breeds, police dogs of other breed were excluded from the experiment.

As previously mentioned, 22 dogs which were tested in Muenster had the same trainer, although they were recruited from different Police Departments in Nordrhein-Westfalen. The other 20 dogs attending the study belonged to Hannover Police Department. Since the dogs tested in Hannover and in Muenster had different training histories and were trained by different trainers, they were considered as two different groups. At the end of the experiment, not only the individual result but also the group results were compared with each other. Thus, the factors causing different group results were analyzed.

Additionally, a questionnaire was addressed to the handlers in order to reveal the underlying factors, which influence the dogs' behavior and reaction to the methods.

5.1.2 Test Persons

Several studies underlined the significance of *controllability* and *predictability* and thus, the essential value of good timing in case of administration of electric shock to the animal (TORTORA 1982, DESS et al.1983, POLSKY 1994, BEERDA 1998, STICHNOTH 2002). In a study published by SCHALKE et al. (2006)\ it was emphasized that the electronic training devices should be used by professional dog trainers only who proved his/her theoretical and practical proficiency since the *timing* is a very important factor for the application of these devices. In the review by JACQUES and MYERS (2007), it was particularly pointed out that the electronic training devices should be used only by skilled and experienced handlers. Considering all these publications, it can be concluded that the administration of electronic training devices only by experienced and proficient handlers, should be the main criteria to be met.

Considering this, two experienced and proficient dog trainers both of them having absolutely the same training approach participated in the present study as the helpers responsible for provoking the dogs and, also, of the administration of the electronic stimulus. Each of the helper was responsible for only one group during the entire experiment, either in Muenster or in Hannover.
The reason of using the same helpers for the same group was to minimize the variability, arising from the provocation style and also, the helper himself. In this way a certain standardization was obtained.

5.1.3 Training aids

As previously mentioned, the use of electronic training collars is a highly controversial subject. Many authors cite that using these devices in a training is more effective and cause less physical damage to the animal than the mechanical instruments, such as pinch and choke collars (TORTORA 1982, LINDSAY 2005), whereas the opponents firmly emphasize the necessity of banning these instruments completely from dog sports (SCHILDER and van der BORG 2003).

The British Small Animal Veterinary Association (BSAVA) (2003) claims that even highly motivated behaviors such as chasing prey can be elicited without using electronic training collars. According to BSAVA (2003) the use of electronic training instrument is only suggested in case that the only alternative is euthanasia.

OVERALL (2007), however, rejects the use of these collars in any cases even in case of euthanasia: *'' the use of shock does not bring dogs back from the brink of euthanasia; instead it may send them there''*.

Some authorities, on the other hand, suggest the use of electronic training collars only by sophisticated users and only in strictly specified situations (CHRISTIANSEN et al. 2001a, SCHALKE et al. 2006).

Though there are many studies examining *stress* (BEERDA 1998, CHRISTIANSEN et al. 2001a, STICHNOTH 2002, SCHILDER and van der BORG 2003,) and *learning* (CHRISTIANSEN et al. 2001b) effects by electronic training collars, a scientific study comparing other training methods with electronic training collars considering these parameters is non-existent to our knowledge.

Therefore, the pinch collar, the electronic training collar and the quitting signal were chosen as training methods for comparison in the present study.

Reason of choosing ‘’pinch collar’’ is first because it is a standard working dog training equipment and used as an alternative method to the ‘’electronic training collar’’ in daily police dog training and second, since it is a sort of mechanical training aid, it was able to make the comparison between the electronic training- and the mechanical-device. Though both electronic training- and pinch-collar are the application of ‘’positive punishment’’, quitting signal is the application of ‘’negative punishment’’. Thus, effectiveness of ‘’negative punishment’’ in dog training was able to be tested.

5.1.4 Experimental parameter

There are different examples in the literature studying behavioral indicators for the assessment of acute stress in animals.

LAY et al. (1992) cited that the behavioral responses are the essential parameters to identify stress and, furthermore, suggested to use physiological parameters together with behavioral observations. Similar to the findings of LAY et al. (1992), the study conducted by BEERDA (1997) revealed that behavioral responses are useful indicators for acute stress and saliva cortisol and heart-rate measures support the interpretation of the behavioral data. BLACKSHAW et al. (1990) further stated that the behavioral signs are the effective indicators to assess stress in dogs. The study carried out by HICKS et al. (1998) also emphasized that behavioral signs are the most reliable and consistent stress indicators. In this study, however, it was indicated that physiological, endocrine and immune traits are not consistently changed in case of exposing to different acute stressors; whilst in every treatment behavioral changes can clearly be identified. In two different studies, it was also pointed out that behavioral responses are not always concomitant to physiological parameters in case of exposing to stress (VINCENT and MICHELL 1992, CRONIN et al. 2003).

Moreover, SCHILDER and van der BORG (2004) claimed that in a study involving highly exciting training sessions such as police dog training, the use of physiological measures, *i.e.,* cortisol levels and heart-rate frequency, as stress parameters is useless and the behavioral data is sufficient for evaluating stress.

As previously mentioned, in a study conducted parallel to this study, cortisol levels of the dogs were measured in order to be able to compare the behavioral and physiological data to evaluate stress. The results of the parallel study were, nevertheless, not yet available during the writing period of this study. Thus, for the present study, only the behavioral observations were evaluated as stress parameter. Considering above-mentioned studies, however, it can be assumed that since the behavioral responses are defined as the most obvious, consistent and essential stress parameters, it is sufficient to evaluate the behavioral observations to identify stress effects of the above mentioned training methods (EWBANK 1985, BROOM and JOHNSON 1993, HICKS et al. 1998).

A disadvantage of using only behavioral data for assessing stress, on the other hand, is that the behavioral observation is a subjective evaluation; as a result it is difficult to present the precise results. In order to eliminate this disadvantage, an extensive ethogram including reactions of separate body parts, vocalizations and number of behaviors was developed. All these reactions and behaviors in this ethogram were clearly described so that no misinterpretation was possible. Although one appraiser conducted the evaluation of direct behavioral effects of training methods, a second appraiser was consulted in case of difficulties and ambiguities.

Additionally, as already mentioned the entire test was filmed on DVDs using a video camera. The recorded DVDs were reviewed later in order to analyze the body language of the dogs during the obedience session and, also, the direct reactions of the dogs after the administration of the training methods. A major advantage with video analysis is that it allows the analyst to capture sudden reactions of the dogs, even small details, during the complex and/or quick behavioral sequences via *''slow motion''* and *''repeating''* functions. Thus, it is possible to make a detailed behavioral assessment.

Furthermore, these recordings are ''useful back-up to live observation, ensuring that nothing is lost'' as stated by MARTIN and BATESON (1993).

5.1.5 Test area

The main test was carried on three different places, two of which were in Muenster and the other one in Hannover. To obtain the standardization in respect to the test area, each dog was tested on the same place where it started to be tested during the entire experiment.
Another essential point to obtain standardization was that all dogs were familiar to the area where they were tested since all test areas were already used as training grounds for the police dog training.

5.1.6 Experimental design

In a review of the current literature on electronic training devices, it was cited that the response of each dog to aversive stimuli would be different from each other. In other words, perceiving aversive stimuli for dogs can be entirely different, depending on the characteristics of the individual (JACQUES and MYERS 2007). SHEPPARD and MILLS (2002) emphasized that there are differences in response to aversive stimulus between individuals since perception of environment depends on the underlying biology of the individual. VINCENT and MICHELL (1996) and Van der BERG et al. (2003) also pointed out that inter-individual differences and individual variations affecting stress proneness influence the statistical results of group comparisons in a negative way.

LINDSAY (2005) additionally suggested that in order to amplify the statistical results in studies in which the electronic training collar was tested, "within subject design'' must be applied since individual variables can cause incorrect data. Therefore, in the present study *''within subject design''* was applied as experimental design for comparison of behavioral and learning effects of the different training methods**.** Thus, each training method was tested on each dog on different days so that each dog represented its own control.
In order to eliminate the effects of the administration orders of the training methods on the results, six subgroups, *A, B, C, D, E, F*, were established, to each of them a different administration order of the training methods was applied (*randomized cross-over design).*

The dogs from Hannover (Group H) and from Muenster (Group M) were divided into these subgroups randomly. Accordingly, the results obtained from the subgroups could be compared with each other at the end of the study.

5.1.7 Test procedure

Prior to the main experiment, the "*mistake"* for each dog was determined by its own handler. The different training methods were only administered, when the dog made the determined mistake. Thus, we were able to evaluate the ''learning effect'' of the methods considering the repetition of the certain mistake.

The main experiment was conducted on three test days for each dog. The time interval between test days was a week. On each training day a different training method, i.e. either the quitting signal or the electronic training collar or the pinch collar, was applied on dogs in accordance with the groups they belonged to. Regardless of which method was tested, each dog should carry the three collars around its neck, which were standard, pinch and electronic training collars, during the entire experiment in order to ensure the standardization among the training methods.

Before conducting the main test, two different sessions were performed with each dog; obedience and play sessions. In the obedience session, the dog and the handler performed some standard obedience exercises, while the leash was on the standard collar. During this session the owner was not allowed to correct the dog, if the dog made any mistake. Thus, the general body posture of the dog, as well as the reaction of the dog to the commands given by its handler during obedience training could be observed and analyzed. Additionally, this session brings the dog to a certain level of arousal, so that the optimal results could be achieved at the main test.

After the obedience session, a play session, in which the handler played freely with his/her dog, was conducted. The goal of performing the play session between the obedience- and test sessions was to avoid misevaluation of extra-stress arising from the test session following the unrewarded obedience exercises.

At the end of the play session, the dog and its handler was instructed to come to a determined point, at which they should take up the basic position and thus the main test started.

During the main test, following instructions were strictly heeded:

- The helper always carried the same accessories, a *protection sleeve* and a *whip*, at each test session during the entire experiment. Using these accessories, however, was depending on the dog.

In case of using any provocation accessory in one session, the same accessory was used in the repetition sessions while performing exactly the same provocation.

- During testing the quitting signal, the handler used a 5 m long leash. The reason of using 5 m long leash for the quitting signal was to allow reaction time for the dog handler and also for the dog and, thus, to be able to evaluate clearly whether the dog stopped due to the influence of the collar or to the signal. Accordingly, ‘’timing’’ of the handler while instructing the signal could be assessed.
- As previously mentioned, in a study conducted parallel to this study the saliva cortisol level of the dogs was evaluated. It is known that cortisol levels normalize within 60 minutes following the administration of a stressor (BEERDA 1997). Therefore the time between the main test sessions was determined as 60 minutes and repetition sessions were applied definitely 60 minutes after the termination of the test session.
- In the study conducted by SCHALKE et al. (2006) it was stated, that the main test was terminated after the third application of the electric shock. Therefore, maximal three main test sessions were conducted for each method and each dog per day and learning effect of training methods were evaluated considering these three sessions.
- Since the test was performed as an open-field test, the controllability of external factors would be a disadvantage. In order to minimize this disadvantage, only the test instructors were allowed to be near the test area. The dog cages were placed in a way that no confrontation between test dogs was possible. Furthermore in case of occurrence of any independent factors which cause stress in dogs, the main test was immediately terminated and the same session was repeated after 60 minutes.

5.2 Discussion of the Results

Police dog training is a strict and a rigid training. Many things should be accomplished in a relatively short amount of time, an effective handler and dog partnership must be built and dogs must unconditionally pay attention to its handler and obey the commands of its handler (BRYSON 2002). Therefore an effective training method, which brings success in a short time, is crucial for the training of police dogs. It should be specifically mentioned that the police dog training is a kind of training that requires high level of arousal and motivation. Additionally, dogs used as police dogs come from specific breeding lines, which are ranked high in personality traits such as *''aggressiveness''* and *''playfulness''* (SCHILDER and van der BORG 2003, SVARTBERG 2005).

All in all, police dog training compels training methods leading to maximal success in highly exciting training situations without causing physical and/or psychological damage on animal. In this section of the study, learning and direct behavioral effects of different training methods in police dog training will be discussed.

5.2.1 Learning effects of the training methods

In the present study the effectiveness of electronic training collar and pinch collar as an application of *''positive punishment''* was compared with the conditioned signal, "*quitting signal''*, as an application of *''negative punishment''* in police dog training.

The results in this study indicate the highest learning effect in electronic training collar when comparing with the other methods, while the quitting signal had the lowest learning effect. In other words, negative punishment was not found to be effective in the training situations requiring high level of arousal and motivation when comparing with positive punishment.
These results can be attributed to many factors. In this section, these factors will be discussed within the frame work of the "*criteria of punishment training''*, which were determined by TORTORA (1982) as follows:

- *Punishment should be immediate*
- *Punishment should be associated with the misbehavior only*
- *Punishment should be administered by the nature*

The *''trainer''* and the *''timing''* should be considered as the main factors causing different results while evaluating the learning effect of training methods. As previously emphasized, various authors underline the essential value of *''good timing''* in training since only accurate timing makes it possible for the dog to associate the misbehavior with the punishment (TORTORA 1982, POLSKY 1994, BEERDA 1998, SCHALKE et al., 2006).

In a study published by SCHALKE et al. (2006) and, also, in a literature review by JACQUES and MYERS (2007) it was particularly emphasized, that the electronic training devices should only be used by skilled and experienced handlers in order to justify this precursor, i.e. "*timing"*. This precursor is also valid for the application of the mechanical training aids such as pinch collars and also in instruction of the conditioned signal, such as quitting signal.

In the present study, experienced and proficient dog trainers having absolutely the same training approach were responsible of the administration of the electronic training collar stimuli. By this way, a standardization of the *''administrator''* and the *''timing''* for the application of the electronic training collars were obtained.
The other two training methods, *i.e.* the pinch collar and the quitting signal, were, however, applied by the dog handlers themselves. Therefore, for sure the *''timing''* of the application of electronic training collar was better than for the other methods during the experiment. This hypothesis was also supported by the video analyses which showed that most of the handlers had timing problems, in particular for giving the quitting signal; whereas the handlers of the dogs, using the methods that had a learning effect, corrected their dogs at the right time. Thus group differences were observed for the learning effect of the pinch collar, as well as, of the quitting signal, while no significant group differences were found for the learning effect of electronic training collar. These results also indicate the significance of the *''trainer''* and, accordingly, *''good timing''* factors.

According to TORTORA (1982) electronic training collars are significant training aids since they can be administered at a distance so that the dogs do not associate receiving the shock with the owner. Thus, it can be said that for the application of the electronic training collar, the only association is made with the collar, not with the owner. The application of mechanical training aids is, however, directly associated with the handler since the correction made by the owner is visible by the dog.

By this way, the visibility of the punishment can cause that the dog reacts in different ways according to the cues given by the handler subconsciously, such as facial expression, body language, holding style of the leash etc..

All in all, even though perfect timing is applied, reaction of the dog and thus the effectiveness of the mechanical training aids depends on the willingness of the handler, as well as his/her proficiency. In addition to that, the factors such as strength and motivation of the handler are also essential for the effectiveness of the mechanical training devices (TORTORA 1982, LANDSBERG et al. 2003, LINDSAY 2005).

Beside the *''bad timing''* during the instruction of the quitting signal, a possible explanation for the low learning effect may be the unsuccessful training procedure, namely an incomplete conditioning of the signal.

SCHILDER and van der BORG (2003) stated that the police dog training is relatively short, considering the expectations from the dog and since the severe punishment brings success in such a short time, the willingness to change the training type is not promoted. Parallel to this argument, SCHALKE (personal communication) also pointed out that since the police dog handlers get used to achieve quick results in a short time by using positive punishment in the training, they are not familiar with any training method requiring structured effort, such as quitting signal training. Therefore, most of them do not consider the quitting signal, namely the negative punishment, as an effective method in police dog training. As a result their disbeliefs in a given signal could also be a factor influencing the achievement of the maximal success in the training.

She also emphasized on the personality traits of the Belgian Malinois, that they should necessarily be considered in evaluating the learning effect of the quitting signal and further explained it as follows: ''The Belgian Malinois could, in general, deal with positive punishment better than negative punishment since it is not a kind of breed which easily copes with frustrate situations'' .

Since the quitting signal training was mainly conducted by the handlers, it is possible that some mistakes during the training procedure could be overlooked. Though the training in Hannover was regularly supervised because it took place in the same city as the University of Veterinary Medicine Hannover, only two supervisions could be made during the quitting signal training in Muenster. Accordingly, the quitting signal showed higher learning effect in Hannover than in Muenster. Nonetheless, it should particularly be mentioned that all subjects had been tested for the quitting signal prior to the main test in order to make sure that all dogs completed the training procedure.

5.2.2 Body posture during the obedience

Considering the body posture during the first obedience session of the experiment, 8 out of 20 dogs in Hannover and 3 out of 22 dogs in Muenster were assessed as dogs showing *submissive body posture*.

In order to detect the *submissive body posture* in dogs, separate ear (low ear), head (low head), tail positions (low tail) and, also, the behavioral elements such as flexing of the joints, arching of the back and extreme ness of body posture of each dog were scored. In case that the dog exhibited at least two submissive behavioral elements during the first obedience session, body posture of the dogs was evaluated as *''submissive body posture''*.

Our main interest was here to determine the factors causing the different body postures in dogs. Therefore, correlations were sought between *''the age and the submissive body posture''*, between *''the gender and the submissive body posture''*, as well as *''between the real criminal contact and the submissive body posture''*. However, no statistically significant correlations were found between these parameters.

With respect to these findings, it can be suggested that the body language of the dog mainly indicates the relationship between the owner and the dog, as well as the personality trait of the dog as mentioned in the study of LEFEBVRE et al. (2006). However, within the frame of the present study no detailed investigation on this subject was conducted.

5.2.3 Direct behavioral reactions

One of the goals of the present study was to compare the direct behavioral reactions of the dogs to three different training methods: the electronic training collar, the pinch collar and the quitting signal. To this end, the reactions of the separate ear, tail and joint parts as well as the vocalizations of the dogs in addition to a number of behaviors were evaluated by using an extensive ethogram, which was developed in accordance with studies of BEERDA (1997) and SCHILDER and van der BORG (2003).

During the evaluation of the ethogram the specific nature of pinch collar has been considered. The correction of the pinch collar involves the pulling the leash. As a result eyes/gaze directions and head reactions can be affected and therefore could cause misinterpretation.
Thus, the comparison between the cities, *i.e. Hannover* and *Muenster*, considering the eye/gaze direction and head reactions with pinch collar will not be discussed.

Several researchers reported a number of different behavioral indicators of acute stress in dogs, which comprise lowering and arching of the body (SCHWIZGEBEL 1982, FEDDERSEN-PETERSEN and OHL 1995, BEERDA 1997, LINDSAY 2005), lowering head (SCHWIZGEBEL 1982, BEERDA 1997, FEDDERSEN-PETERSEN and OHL 1995, LINDSAY 2005), averting eye contact (SCHWIZGEBEL 1982, FEDDERSEN- PETERSEN and OHL 1995, BEERDA 1997, LINDSAY 2005), flattening ears (SCHWIZGEBEL 1982, FEDDERSEN-PETERSEN and OHL 1995, BEERDA 1997, LINDSAY 2005), lowering the tail and/or holding the tail tightly between the legs (SCHWIZGEBEL 1982, BEERDA 1997, LINDSAY 2005), thigmotactic reactions involving efforts to lean on the owner or against some other object (including floor) (LINDSAY 2005) when the dogs are confronted with the aversive situation.

In a study conducted by SCHWIZGEBEL (1982), yelping, snout licking, paw-lifting, lowered standing and crouched sitting postures have been defined as stress indicators in response to acoustic and physical punishment in dogs.

To sum up, it can easily be said that lowering of the body posture, lowering of the tail, as well as of the ears are definite behavioral indicators of acute stress in dogs since these behavioral elements are reported as behaviors connected to pain, fear and submission in several publications (SCHWIZGEBEL 1982, FEDDERSEN-PETERSEN and OHL 1995, BEERDA 1997, LINDSAY 2005).

In the present study, lowering of the body posture and maximum backward position of the ears are more frequently exhibited as reactions to the pinch collars than to the electronic training collars. Moreover, 2 dogs exhibited *''extreme ness of body posture''* as a reaction to the pinch collar, whilst the same reaction was observed in none of the dogs in response to the electronic training collar.

The last finding is particularly important since BEERDA (1997) emphasized, that the lowered posture of dogs may indicate a relatively severe state of stress, namely the *distress*. Here, *''distress''* refers to the possibly adaptive, harmful and unpleasant level which is outwardly expressed by behavior (EWBANK 1985). Overall, considering the body posture and ear positions, pinch collars seem to induce more *''distress''* in dogs than electronic training collars.

However, it has also been observed that lowering of the tail – another indicator of acute stress - occurred more often as a reaction to the electronic training collar than to the pinch collar. This contradiction in bodily reactions can probably explained by the main function of the tail – *balance.* ABRANTES (1999) described the *''tail''* as follows: ''The tail is an extension of the spinal column and acts as a stabilizer when the dog moves, especially when it runs and needs to execute tight turns. This stabilizing influence is very important in maintaining the animal's *balance*''. Considering this definition, the tail reaction of dogs to the pinch collar can be evaluated as a reaction for maintaining the balance of the body position rather than a stress-induced reaction since the correction with the pinch collar involves strong pulling of the dog's neck, which causes a sudden change in the balance of the dog.

All in all, in accordance with the above mentioned authors, it can be said that the pinch collars induce more stress (for this special case in the form of *distress*) in dogs than the electronic training collars, considering these behavioral elements.

These results are also in accordance with the theory of LINDSAY (2005), which supports the idea that the electric stimulus used in dog training causes no physical damage, neither to the skin nor to the underlying tissue, whereas mechanical techniques such as pinch collars may cause sustained throbbing, local irritation and bruising. On the other hand, the quitting signal caused the fewest stress effect on the dogs when comparing with the pinch and the electronic training collar.

Although the pinch collar caused more behavioral reactions, in the form of *distress*, than the electronic training collar, the electronic training collar elicits more vocal reactions in dogs than the pinch collars.

Since the evaluation of stress, as well as of distress, should be discussed considering the entire picture, namely the postural and vocal reactions, this contradiction between the bodily and vocal reactions raises an important question:

How would it be possible that the dogs exhibiting less stress related behavioral reactions vocalize more intensely than the animals showing severe stress related behaviors?

The only explanation for this could be that these vocal reactions are elicited as *''startle reactions''* (BROOM and JOHNSON 1993) rather than *''pain-induced vocalizations''*. As a matter of fact, the feeling of the leash on the pinch collar could be a signal for the dog as forthcoming punishment while testing the pinch collar, whereas no signal could be perceived by the dog while testing the electronic training collar. Thus, receiving electric shock is unexpected for the dog, in particular, at its first application.

Similar to vocal reactions, interesting results were obtained in assessment of the *''avoidance reaction''* against the pinch- and the electronic-training collar. According to these results, more dogs exhibited *''avoidance''* as a reaction to the electronic training collar than to the pinch collar. These avoiding reactions were however evaluated as *''approaching the owner''* in all of the dogs out of 8 dogs avoided from the electronic training collar, while the same reactions were evaluated as *''circling''* in one dog and as *''distance increasing''* in the other dog out of 3 dogs avoided from the pinch collar. Furthermore it was observed, that the same dog approached the owner after the application of the electrical shock, while it attempted to flight as a reaction to the pinch collar.

The reasonable interpretation of these results is that since the dog does not link the handler with receiving the electrical shock, it considers its handler as a ‘’safety point’’ near which it can protect itself from the aversive situation. In other words, the dog perceives the punishment by the electronic training collar as the punishment by the environment as a result of not paying attention to the handler’s warning and, thus, to obey the handler is the only solution to avoid the aversive situation (TORTORA 1982, LINDSAY 2005).

The application of the pinch collar is on the other hand directly linked to the handler since the correction made by the owner is visible to the dog. Therefore, the only solution for the dog is to avoid from the owner in order to avoid from the aversive situation.

5.3 Conclusion

The results of the present study indicate that the electronic training collar induces less *distress* and shows stronger "*learning effect"* in dogs in comparison to the pinch collar. The quitting signal is on the other hand not found effective in police dog training although it causes the "*least distress"* reactions in dogs when comparing with the electronic training- and pinch-collar. Altogether, concerning the "*bodily reactions"*, the pinch collar was evaluated as the most distressful method and considering the "*learning effect"*, the electronic training collar was found to be the most effective method.

These results can probably be explained by that electronic training collar complies completely with the punishment criteria, which were defined by TORTORA (1982), in case of proof of the proficient and experienced user. On the other hand when applying the pinch collar, these criteria can not be met even though perfect timing is applied since reactions of the dog and effectiveness of the method depends on several different factors such as the willingness, strength and motivation of the handler, as well as his/her proficiency. In addition to that, the visibility of the administrator and, thus, of the punishment is another important factor influencing the efficiency of the pinch collar because the dog directly links the punishment with its owner. Therefore this method does not satisfy the *''punishment criteria''* at all. The quitting signal on the other hand requires criteria, such as good timing and structured training procedure, on account of complete conditioning in order to achieve effective results. Even if these criteria are met, the personality trait of the dog is another factor, which influences the efficiency of the signal.

It should particularly be mentioned, that the quitting signal training was implied only on adult dogs within the frame of this study. Therefore, the results should not be interpreted as that the quitting signal can not be a suitable method in police dog training. As previously stated training of the quitting signal requires a hard and a structured procedure. Thus, if the training, namely the conditioning, begins at the puppy hood, the quitting signal can also be an effective method in police dog training.

Overall, the results of this study show that an efficient training which complies with the animal welfare principles should ensure the following punishment criteria: *good timing, association with the misbehavior only* and *application of correct strength and/or dose*. Therefore, the debates about training methods can only be reasonable in case that they comprise not only the training aids, but also all inputs which affect the training, such as the trainer, the training conditions etc.

6. Summary

In the present study stress and learning affect of three training methods, i.e. electronic training collar, pinch collar and quitting signal are investigated. Additionally a questionnaire was addressed to the canine officers, who participated in this research as handlers, in order to gain information about dogs' characteristics, past experience, health situation etc., and thus, to avoid incorrect assessment of the test results. Furthermore, body language of each dog during obedience exercises was filmed and analyzed, so that correlations between *body posture and experience*, *body posture and characteristics*, as well as between *body posture and direct reactions of the dogs to the training methods* could be detected.

The tests were performed on 42 adult police dogs of both genders (33 males and 9 females) and varying ages (3-10 years old) of the breed Belgian Malinois. 22 dogs, which were tested in Muenster, were recruited from different Police Departments in Nordrheinwestfalen, whereas another 20 dogs which participated the study belonged to Hannover Police Department. The dogs tested in Hannover and in Muenster were considered as two different groups. The main experiment took place on three test days for each dog. The time interval between test days was one week. *''Within subject design''* was used as experimental design for the study. Therefore, on each training day a different training method among the quitting signal, the electronic training collar and the pinch collar was administered to dogs in accordance with the subgroups to which they belonged. The subgroups were established according to the administration order of the training methods by using a *randomized cross-over design*.

There was a high learning effect for the electronic training collar and the pinch collar and a low learning effect for the quitting signal. Compared with the electronic training collar, pinch collar appeared to have a lower learning effect in dogs. However, this difference was not found to be significant (paired sample t-test, p =0.16).

No significant difference was found comparing the learning effect of the electronic training collar between Hannover and Muenster, whereas a tendency towards significance was seen between the cities in comparison of learning effect of the pinch collar (Kruskal-Wallis, p= 0.109***), as well as of quitting signal. (Kruskal-Wallis, p <0.05**).

A high learning effect of electronic training collar may be due to that this is the only method in police dog training, which satisfies the punishment criteria completely only if it is administered by a proficient and experienced user.

An important part of this study was the detection of stress related behavioral reactions to the above mentioned training methods. In order to achieve this, direct behavioral reactions of the dogs were examined. Comparing the first *ear* and *joint* reactions of the dogs to the pinch- and the electronic training collar it was found, that the correction applied by the pinch collar caused *lower ear* and *lower body* position than the one in reaction to the electronic training collar. Moreover, 2 dogs exhibited *''extreme ness of body posture''* as a reaction to the pinch collar, whilst in none of the dogs this reaction was observed against the electronic training collar. No statistically significant difference was found when comparing the tail reactions between the electronic training collar and the pinch collar. However, it has been observed, that the dogs lowered their tails more often in reaction to the electronic training collar than to the pinch collar. The results of this study also indicate, that electronic training collar elicits statistically significant (t-test, $p < 0.01^*$) more vocal reactions in dogs than pinch collar.

Only 4 out of 42 dogs abandoned the behavior after having been given the quitting signal during the first session. Therefore, only the reactions of these 4 dogs to the quitting signal could be tested. Consequently, it was observed that 2 dogs showed low *ear positions*, while only one dog exhibited *low body posture* together with *low tail position* following the signal. The joint reaction of this dog was, however, scored as *"extreme ness of body posture"* and "*crouching"*. None of these dogs on the other hand emitted vocal reactions reaction to the instruction of the signal.

All in all, considering the bodily reactions, pinch collar was found to be more distressful for dogs when comparing with the other methods. In accordance with the literature it seems possible to draw conclusions from bodily reactions to level of stress in dogs.

7. Zusammenfassung

In dieser Studie wurden Stress und Lerneffekt unter Anwendung von drei unterschiedlichen Methoden, im Einzelnen mit Stromimpulsgeraten, Stachelhalsband und Abbruchsignal untersucht. Zusaetzlich hierzu wurden Fragebogen an die Hundeführer verteilt, die an dieser Studie teilgenommen haben, um mittels der Fragen Informationen über die charakterlichen Eigenschaften des Hundes, bereits erlangte Erfahrungen, Gesundheitszustand usw. zu erlangen und mit Hilfe dessen fehlerhafte Auswertungen der Testergebnisse zu vermeiden. Darüber hinaus wurde die Körperhaltung jedes einzelnen Hundes waehrend der Gehorsamkeitsübungen aufgezeichnet und analysiert, so dass die Korrelation zwischen Körperhaltung und Erfahrung, Körperhaltung und Wesen sowie Körperhaltung und der direkten Reaktion der Hunde auf die einzelnen Ausbildungsmethoden festgestellt werden konnte.

Die Tests wurden mit 42 ausgewachsenen Polizeihunden der Belgian Malinois Rasse beiden Geschlechts (33 maennliche und 9 weibliche Hunde) und unterschiedlichen Alters (3-10 Jahre alt) durchgeführt. 22 Hunde, zusammengeführt aus verschiedenen Polizeistellen in Nordrheinwestfahlen, wurden in Münster getestet. Bei den restlichen an der Studie beteiligten 20 Hunden handelte es sich um Polizeihunde der Polizeidienststelle Hannover, wobei die Hunde in Hannover und Münster als zwei unterschiedliche Gruppen erachtet wurden. Die eigentliche Testdauer erstreckte sich über jeweils drei Tagen pro Hund mit einer jeweligen Unterbrechung von einer Woche zwischen den einzelnen Testphasen. ***"Within subject design"*** wurde als experimentale Ausrichtung der Studie eingesetzt. Aus diesem Grunde wurde an jedem Trainingstag und abhaengig von der Untergruppe zu der der Hund zugeordnet war, eine der drei unterschiedlichen Lernmethoden d.h. entweder das Abbruchsignal, das Stromimpulsgeraet oder das Stachelhalsband angewandt. Die Untergruppen wurden unter Anwendung des *"randomized cross-over design"* und unter Berücksichtigung der Reihenfolge der Lernmethodik zusammengestellt.

Die Untersuchung ergab einen hohen Lerneffekt beim Einsatz von Stromimpulsgeraeten und Stachelhalsband bzw. einen geringen Lerneffekt beim Abbruchsignal. Die Ergebnisse weisen zudem beim Stachelhalsband einen geringeren Lerneffekt auf als mit Stromimpulsgeraeten, allerdings ohne signifikanten Unterschied (paired sample t-test, p=0.16).

Auch hinsichtlich des Lerneffektes mit Stromimpulsgeraten waren keine wesentlichen Unterschiede zwischen den Hunden in Hannover und Münster festzustellen. Wohl aber hinsichtlich des Lerneffektes mit Stachelhalsband (Kruskal-Wallis, p=0.109***) wie auch unter Einsatz des Abbruchsignals (Kruskal-Wallis, p<0.05). Dass mit Stromimpulsgeraeten ein hoher Lerneffekt erzielt wurde, dürfte darauf zurückzuführen sein, dass es die einzige Lernmethode im Training von Polizeihunden ist, der die Kriterien zur Bestrafung komplett erfüllt, wenn er von einem professionellen und erfahrenen Anwender eingesetzt wird.

Ein bedeutender Teil dieser Studie galt der Erforschung des stressbedingten Verhaltens in Verbindung mit den oben erwaehnten Lernmethoden. Hierzu wurden direkte Verhaltensreaktionen der Hunde untersucht. Verglichen mit der Anfangsposition (ersten Position) der Ohren und der Gesamtkörperhaltung wurde beim Einsatz von Stachelhalsband und Stromimpulsgeraeten festgestellt, dass die mit Stachelhalsband erreichte Korrektur ein staerkeres zurücklegen der Ohren und tiefere Körperhaltung verursachte als es bei der Anwendung von Stromimpulssignalen der Fall war. Darüber hinaus reagierten zwei der Hunde mit "extrem ness of body posture" auf den Einsatz des Stachelhalsbandes. Wogegen bei keinem der Hunde eine derartige Reaktion bei der Anwendung des Stromimpulsgeraetes festzustellen war. Beim Vergleich der Hüftpositionen als Reaktion auf den Einsatz von Stromimpulsgeraeten und Stachelhalsband wurden keine statistisch bedeutsamen Unterschiede erkannt. Demgegenüber war zu beobachten, dass die Hunde beim Einsatz von Stromimpulsgeraeten haeufiger eine Hinterkörper-Tiefstellung einnahmen als bei der Anwendung des Stachelhalsbandes. Die Ergebnisse dieser Studie belegen zudem, dass Stromimpulsgeraete im Vergleich zum Stachelhalsband eine statischtisch signifikante staerkere vokale Reaktion bei den Hunden hervorrufen (t-test, p<0.01)

Lediglich bei 4 der 42 Hunde war eine erfolgreiche Verhaltensveraenderung infolge des Abbruchsignals zu beobachten, so dass nur bei diesen 4 Hunden die Reaktion auf das Abbruchsignal getestet werden konnte. Hierbei wurden bei zwei dieser 4 Hunde eine herabhaengende Ohrstellung und lediglich bei einem Hund eine eingeknickte Körperhaltung mit niedriger Schwanzposition im Anschluss an das Abruchsignal beobachtet. Die gesamte Körperhaltung dieses Hundes wurde insofern als "extreme ness of body posture" und "Hockerstellung" eingestuft. Zu erwaehnen ist zudem, dass keiner dieser Hunde mit vokaler Reaktion auf die Instruktion dieses Signals reagierte.

Insgesamt gesehen ergab die Untersuchung unter Berücksichtigung der körperlichen Reaktionen, dass das Stachelhalsband im Vergleich zu den anderen angewandten Methoden bei den Hunden einen grössen Stress auslöste. Im Einklang zur Literatur sind Rückschlüsse auf den Stresslevel des Hundes aufgrund der jeweiligen Reaktion des Körpers möglich.

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9. Appendix

Table 1: Frequency table for learning effect of pinch collar

learning_effect_PC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	32	76,2	76,2	76,2
	no	10	23,8	23,8	100,0
	Total	42	100,0	100,0	

Table 2: Frequency table for learning effect of electronic training collar

learning_effect_ETC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not evaluated	1	2,4	2,4	2,4
	yes	39	92,9	92,9	95,2
	no	2	4,8	4,8	100,0
	Total	42	100,0	100,0	

Table 3: Frequency table for learning effect of quitting signal

learning_effect_QS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not evaluated	38	90,5	90,5	90,5
	yes	3	7,1	7,1	97,6
	no	1	2,4	2,4	100,0
	Total	42	100,0	100,0	

Table 4: Frequency table for reliably quitting of the behavior after the administration of pinch collar

reliably_quitting_CC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	42	100,0	100,0	100,0

Table 5: Frequency table for reliably quitting of the behavior after the administration of electronic training collar

reliably_quitting_ETC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	41	97,6	97,6	97,6
	no	1	2,4	2,4	100,0
	Total	42	100,0	100,0	

Table 6: Frequency table for reliably quitting of the behavior after the administration of quitting signal

reliably_quitting_QS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	4	9,5	9,5	9,5
	no	38	90,5	90,5	100,0
	Total	42	100,0	100,0	

Table 7: T-test for learning effect

Paired Samples Test

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	learning_effect_PC - learning_effect_ETC	,143	,647	,100	-,059	,344	1,432	41	,160
Pair 2	learning_effect_ETC - learning_effect_QS	1,000	,494	,076	,846	1,154	13,122	41	,000
Pair 3	learning_effect_QS - reliably_quitting_PC	-,881	,395	,061	-1,004	-,758	-14,445	41	,000

Table 8: Kruskal-wallis test for learning effect

Ranks

	vcity	N	Mean Rank
learning_effect_PC	Hannover	20	23,85
	Muenster	22	19,36
	Total	42	
learning_effect_ETC	Hannover	20	22,05
	Muenster	22	21,00
	Total	42	
learning_effect_QS	Hannover	20	23,70
	Muenster	22	19,50
	Total	42	

Test Statistics a-b

	learning_effect_PC	learning_effect_ETC	learning_effect_QS
Chi-Square	2,573	,385	4,738
df	1	1	1
Asymp. Sig.	,109	,535	,029

a. Kruskal Wallis Test

b. Grouping Variable: vcity

Table 9: T-test for direct behavioral reactions

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Vocal_P1 - Vocal_E1	,73810	,96423	,14878	,43762	1,03857	4,961	41	,000
Pair 2	Vocal_E1 - Vocal_Q1	-,57143	1,34605	,20770	-,99089	-,15197	-2,751	41	,009
Pair 3	Vocal_P1 - Vocal_Q1	,16667	1,03398	,15955	-,15554	,48888	1,045	41	,302
Pair 4	EarP1 - EarE1	-,14286	,95180	,14687	-,43946	,15374	-,973	41	,336
Pair 5	Ear E1 - EarQ1	-2,71429	1,23537	,19062	-3,09925	-2,32932	-14,239	41	,000
Pair 6	EarQ1 - EarP1	2,85714	1,47452	,22752	2,39765	3,31664	12,558	41	,000
Pair 7	JointP1 - JointE1	,07143	3,11090	,48002	-,89800	1,04085	,149	41	,882
Pair 8	TailP1 - TailE1	,524	2,402	,371	-,225	1,272	1,414	41	,165
Pair 9	TailE1 - TailQ1	-2,381	2,888	,446	-3,281	-1,481	-5,343	41	,000
Pair 10	TailP1 - TailQ1	-1,857	2,656	,410	-2,685	-1,030	-4,532	41	,000

Table 10: Frequency table for first tail reaction to pinch collar

Tail P1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	low	10	23,8	23,8	23,8
	half low	4	9,5	9,5	33,3
	curled/held between legs	5	11,9	11,9	45,2
	half high	12	28,6	28,6	73,8
	high	9	21,4	21,4	95,2
	not evaluated	2	4,8	4,8	100,0
	Total	42	100,0	100,0	

Table 11: Frequency table for first tail reaction to electronic training collar

Tail E1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	low	15	35,7	35,7	35,7
	half low	6	14,3	14,3	50,0
	curled/held between legs	2	4,8	4,8	54,8
	half high	6	14,3	14,3	69,0
	high	11	26,2	26,2	95,2
	not evaluated	2	4,8	4,8	100,0
	Total	42	100,0	100,0	

Table 12: Frequency table for first tail reaction to quitting signal

Tail Q1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	low	2	4,8	4,8	4,8
	half low	2	4,8	4,8	9,5
	curled/held between legs	2	4,8	4,8	14,3
	half high	8	19,0	19,0	33,3
	high	22	52,4	52,4	85,7
	not evaluated	6	14,3	14,3	100,0
	Total	42	100,0	100,0	

Table 13: Frequency table for first vocal reaction to pinch collar

Vocal P1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	10	23,8	23,8	23,8
	no	31	73,8	73,8	97,6
	Not evaluated	1	2,4	2,4	100,0
	Total	42	100,0	100,0	

Table 14: Frequency table for first vocal reaction to electronic training collar

Vocal E1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	25	59,5	59,5	59,5
	no	17	40,5	40,5	100,0
	Total	42	100,0	100,0	

Table 15: Frequency table for first ear reaction against to pinch collar

Ear P1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	maximum backward	27	64,3	64,3	64,3
	backward	14	33,3	33,3	97,6
	not evaluated	1	2,4	2,4	100,0
	Total	42	100,0	100,0	

Table 16: Frequency table for first ear reaction to electronic training collar

Ear E1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	maximum backward	16	38,1	38,1	38,1
	backward	26	61,9	61,9	100,0
	Total	42	100,0	100,0	

Table 17: Frequency Table for first joint reaction to pinch collar

		Frequency	Percent	Valid Percent
Valid	Lowering back	13	31,0	31,0
	Crouching	22	52,3	52,3
	Extreme ness	2	4,8	4,8
	Sitting	2	4,8	4,8
	Not evaluated	2	4,8	9,5
	Total	42	100,0	100,0

Table 18: Frequency Table for first joint reaction to electronic training collar

		Frequency	Percent	Valid Percent
Valid	Lowering back	18	42,9	42,9
	Crouching	14	33,3	33,3
	Sitting	2	4,8	4,8
	Arching back	2	4,8	4,8
	Total	42	100,0	100,0

Table 19: Questionnaire

Lieber Teilnehmer,
wir bitten Sie, diesen Fragebogen auszufüllen.

Bitte versuchen Sie, möglichst alle Fragen zu beantworten.

Vielen Dank für Ihre Mitarbeit!

ALLGEMEINE INFORMATIONEN:

1. Name des Diensthundeführers:

____

(Name, Vorname)

2. Name des Diensthundes:

____

3. Alter des Hundes: _____,___ Jahre

4. Anzahl der Vorbesitzer: ________

5. Seit wann wird Ihr Hund (von Ihnen u./od. anderen) als Diensthund geführt? _____ Jahre

6. Geschlecht des Hundes:

- ☐ männlich
- ☐ männlich kastriert
- ☐ weiblich
- ☐ weiblich kastriert
- ☐ Kontrazeptiva (Läufigkeitsverhinderung)

7. Wie wird der Hund bei Ihnen gehalten?

- ☐ im Zwinger
- ☐ im Haus
- ☐ sowohl als auch
- ☐ sonstiges: ______________________

8. Wie viele Trainingseinheiten absolvieren Sie mit dem Hund?

__________ pro Woche und ________ pro Tag

9. Wie haben Sie mit Ihrem Hund bisher gearbeitet?

- ☐ Zunächst Unterordnung (Hund beherrschte alle Hörzeichen); dann Schutzdienst
- ☐ Unterordnung und Schutzdienst gleich parallel gearbeitet

10. Hatte ihr Hund bereits realen Täterkontakt?

☐ ja ☐ nein

Wenn ja, wie oft? ______________

<u>nur Hundeführer aus Niedersachsen:</u>

11. Wird Ihr Hund auch sportlich im Schutzdienst geführt?

☐ ja ☐ nein

ERZIEHUNGSHILFSMITTEL

Tabelle 1: **Training**

A: Gehorsamsübungen

B: Stellen und verbellen von passiven Personen

C: Einstellen der Kampfhandlung

D: Nasenarbeit

E: Sonstiges: ________________

Erziehungshilfsmittel	**Anwendung im Training**	**Übungen**				
		A	**B**	**C**	**D**	**E**
Stachelhalsband	bei mir: □ ja □nein	□	□	□	□	□
	bei Vorbesitzer/n: □ ja □nein □weiß nicht	□	□	□	□	□
Stromimpulsgerät	bei mir: □ ja □nein	□	□	□	□	□
	bei Vorbesitzer/n: □ ja □nein □weiß nicht	□	□	□	□	□
Sonstiges: ____________________	bei mir: □ ja □nein	□	□	□	□	□
	bei Vorbesitzer/n: □ ja □nein □weiß nicht	□	□	□	□	□

Tabelle 2: **Verhaltensprobleme**

Problemverhalten:

A: Übersprungshandlungen (z.B. Verbeißen in der Leine, Beißen des Hundeführers, 'Schreien')

B: Bellen

☐ im Dienstfahrzeug ☐ in der Zwingeranlage ☐ generell

C: Unerwünschtes Jagdverhalten

D: Stereotypie

E: Sonstiges (bitte beschreiben Sie das Problem kurz)

____

Erziehungshilfsmittel	**Anwendung bei Verhaltensproblemen**	**A**	**B**	**C**	**D**	**E**
Stachelhalsband	bei mir: ☐ ja ☐nein	☐	☐	☐	☐	☐
	bei Vorbesitzer/n: ☐ ja ☐nein ☐weiß nicht	☐	☐	☐	☐	☐
Stromimpulsgerät	bei mir: ☐ ja ☐nein	☐	☐	☐	☐	☐
	Bei Vorbesitzer/n: ☐ ja ☐nein ☐weiß nicht	☐	☐	☐	☐	☐
Sonstiges: ____________________	bei mir: ☐ ja ☐nein	☐	☐	☐	☐	☐
	bei Vorbesitzer/n: ☐ ja ☐nein ☐weiß nicht	☐	☐	☐	☐	☐

10. Wenn an Ihrem Hund ein Stromimpulsgerät verwendet wurde:

a) welches Gerät wurde verwendet? ____________ _______________ ☐ weiß nicht

(Hersteller) (Gerätetyp)

b) auf welcher Stufe des Gerätes wurde der Hund gearbeitet? __________ ☐ weiß nicht

<u>GENERELLE EINSCHÄTZUNG</u>

13. Mein Hund ist generell:

☐ konfliktmotiviert

☐ beutemotiviert

14. Mein Hund zeigt generell:

☐ immer hohe Erregungslage (im/außerhalb d. Trainings)

☐ im Training hohe Erregungslage, außerhalb des Trainings entspannt

☐ immer entspannt (im/außerhalb d. Trainings)

15. Mein Hund ist selbstbewusst gegenüber Menschen:

☐ ja ☐ nein

Mein Hund ist selbstbewusst gegenüber der Umwelt (unbelebte Reize):

☐ ja ☐ nein

Table 20: Frequency table-age

age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,5	2	4,8	4,8	4,8
	3,0	8	19,0	19,0	23,8
	3,5	2	4,8	4,8	28,6
	4,0	5	11,9	11,9	40,5
	4,5	2	4,8	4,8	45,2
	5,0	9	21,4	21,4	66,7
	6,0	2	4,8	4,8	71,4
	6,5	3	7,1	7,1	78,6
	7,0	4	9,5	9,5	88,1
	8,0	2	4,8	4,8	92,9
	8,5	1	2,4	2,4	95,2
	9,0	1	2,4	2,4	97,6
	10,0	1	2,4	2,4	100,0
	Total	42	100,0	100,0	

Table 21: Frequency table-duty period

duty

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	,5	1	2,4	2,4	2,4
	1,0	5	11,9	12,2	14,6
	1,5	3	7,1	7,3	22,0
	2,0	11	26,2	26,8	48,8
	2,5	2	4,8	4,9	53,7
	3,0	7	16,7	17,1	70,7
	4,0	2	4,8	4,9	75,6
	5,0	6	14,3	14,6	90,2
	6,0	3	7,1	7,3	97,6
	7,0	1	2,4	2,4	100,0
	Total	41	97,6	100,0	
Missing	System	1	2,4		
Total		42	100,0		

Table 22: Frequency table-past owner

past_owner

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	10	23,8	25,0	25,0
	1	18	42,9	45,0	70,0
	2	7	16,7	17,5	87,5
	3	5	11,9	12,5	100,0
	Total	40	95,2	100,0	
Missing	System	2	4,8		
Total		42	100,0		

Table 23: Frequency table-housing

housing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	kennel	15	35,7	36,6	36,6
	haus	13	31,0	31,7	68,3
	both	13	31,0	31,7	100,0
	Total	41	97,6	100,0	
Missing	System	1	2,4		
Total		42	100,0		

Table 24: Frequency table-number of training in a week

No_training_w

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,0	4	9,5	9,8	9,8
	2,0	14	33,3	34,1	43,9
	3,0	7	16,7	17,1	61,0
	3,5	2	4,8	4,9	65,9
	4,0	3	7,1	7,3	73,2
	5,0	1	2,4	2,4	75,6
	5,5	1	2,4	2,4	78,0
	7,0	2	4,8	4,9	82,9
	9,0	3	7,1	7,3	90,2
	10,0	2	4,8	4,9	95,1
	14,0	2	4,8	4,9	100,0
	Total	41	97,6	100,0	
Missing	System	1	2,4		
Total		42	100,0		

Table 25: Frequency table-number of training in a day

no_training__d

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	,0	5	11,9	14,7	14,7
	1,0	12	28,6	35,3	50,0
	1,5	6	14,3	17,6	67,6
	2,0	9	21,4	26,5	94,1
	2,5	1	2,4	2,9	97,1
	3,0	1	2,4	2,9	100,0
	Total	34	81,0	100,0	
Missing	System	8	19,0		
Total		42	100,0		

Table 26: Frequency table-order of training sessions

Order of training sessions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	obedience first	14	33,3	35,0	35,0
	parallel	26	61,9	65,0	100,0
	Total	40	95,2	100,0	
Missing	System	2	4,8		
Total		42	100,0		

Table 27: Frequency table-gender

gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	31	73,8	73,8	73,8
	Castrated male	2	4,8	4,8	78,6
	female	7	16,7	16,7	95,2
	Castrated female	2	4,8	4,8	100,0
	Total	42	100,0	100,0	

Table 28: Frequency table-criminal contact

criminal_contact

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Missing	3	7,1	7,1	7,1
	yes	29	69,0	69,0	76,2
	no	10	23,8	23,8	100,0
	Total	42	100,0	100,0	

Table 29: Frequency table-motivation

motivation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	conflict	15	35,7	35,7	35,7
	prey	23	54,8	54,8	90,5
	both	4	9,5	9,5	100,0
	Total	42	100,0	100,0	

Table 30: Frequency table-level of arousal

level_of_arousal

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	always high	8	19,0	19,0	19,0
	high in training	32	76,2	76,2	95,2
	always relaxed	2	4,8	4,8	100,0
	Total	42	100,0	100,0	

Table 31: Frequency table-self-confidency

Confident_human

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	36	85,7	85,7	85,7
	no	6	14,3	14,3	100,0
	Total	42	100,0	100,0	

Table 32: Frequency table-self confidency

Confident_environment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	39	92,9	92,9	92,9
	no	3	7,1	7,1	100,0
	Total	42	100,0	100,0	

Table 33: Correlations between submissive body posture-gender

Correlations

		Sub_obedience	gender
Sub_obedience	Pearson Correlation	1,000	-,014
	Sig. (2-tailed)		,931
	N	42,000	42
gender	Pearson Correlation	-,014	1,000
	Sig. (2-tailed)	,931	
	N	42	42,000

Table 34: Correlations between submissive body posture-age

Correlations

		age	Sub_obedienc e
age	Pearson Correlation	1,000	-,049
	Sig. (2-tailed)		,758
	N	42,000	42
Sub_obedience	Pearson Correlation	-,049	1,000
	Sig. (2-tailed)	,758	
	N	42	42,000

Table 35: Correlations between submissive body posture-criminal-contact

Correlations

		Sub_obedienc e	gender
Sub_obedience	Pearson Correlation	1,000	-,014
	Sig. (2-tailed)		,931
	N	42,000	42
gender	Pearson Correlation	-,014	1,000
	Sig. (2-tailed)	,931	
	N	42	42,000

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