

Michelle Argir

Fra: Björn Forkman [bjf@life.ku.dk]
Sendt: 13. oktober 2009 14:46
Til: Michelle Argir
Emne: Re: Databaser over hunderacer

Vedhæftede filer: Personality traits.pdf; Kenth - MH & everyday life.pdf



Personality
traits.pdf (250 KB...



Kenth - MH &
everyday life.pdf...

Kære Michelle,

her er noget der er skrivet om testet, artikelen af Svartberg og Forkman indholder også en beskrivelse af selve testet.

Mvh,

Björn

Björn Forkman, PhD
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>>> "Michelle Argir" <MAR@jm.dk> 10/12/09 10:13 AM >>>
Kære Bjørn Forkman

Jeg har hørt fra Stine B. Christiansen, at du er involveret i forskningen vedr. forskellige hunderacer og kender databaserne (og resultaterne) indgående. Vil du ikke ringe til mig, da jeg har et par spørgsmål vedrørende dette.

På forhånd tak.

Mvh

Michelle Argir

Justitsministeriet

Michelle Argir
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En svensk med resultater for mentaltestning af racer:

http://www.genetica.se/mh_data.htm

En amerikansk temperamentsevaluerings-database: <http://www.cbarq.org>

Begge har dannet grundlag for en del forskning i forskelle på hunderacer. Hvis du gerne vil vide mere om det, vil jeg foreslå at kontakte Björn Forkman, lektor i etologi her på KU. Han er involveret i forskningen og kender databaserne (og resultaterne) indgående. Han rejser rundt de næste par uger, men jeg formoder han er tilgængelig på
mail: bjf@life.ku.dk

Stine

>>> "Michelle Argir" <MAR@jm.dk> 09-10-2009 10:59 >>>

Kære Stine

Tak for nedenstående - det noterede jeg mig også.

Den database, hvor man kan se forskelle på racer, som du nævnte på seminaret i går - er den offentligt tilgængelig?

Mvh

Michelle

-----Oprindelig meddelelse-----

Fra: Stine Billeschou Christiansen [<mailto:sbc@life.ku.dk>]

Sendt: 8. oktober 2009 15:39

Til: Michelle Argir

Cc: Cristina Angela Gulisano

Emne: Møde om farlige hunde

Kære Michelle,

Jeg fik ikke fanget dig efter mødet idag, men ville lige følge op på noget der kom frem og som umiddelbart - i mine øjne - så brugbart ud.

Der blev vist en skala med graduering af hundebid med 6 stadier fra "snappen i luften" til "død". I relation til overvejelserne om, hvornår politiet umiddelbart skal kunne kræve aflivning og hvornår der skal en hundesagkyndig ind over, kunne det måske være en idé at se nærmere på en sådan graduering? Lidt ligesom der ved vurdering af trædepudesvidninger hos fjerkræ og skuldarsår hos søer laves forskellige "handlingsplaner" afhængig af problemets omfang.

Blot et forslag.

Stine

Stine B. Christiansen

Cand.med.vet. (DVM), MSc, PhD-stud.

Det Dyreetiske Råd (fgl.sekr.)/The Danish Animal Ethics Council (scient. secr.) Center for Bioetik og Risikovurdering/Centre for Bioethics and Risk Assessment

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Personality traits in the domestic dog (*Canis familiaris*)

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Abstract

The domestic dog (*Canis familiaris*) has been subjected to a huge range of selection pressures during domestication that has resulted in a considerable diversity in morphology and behaviour. This, together with the many uses the dog is put to in our society, makes the dog an interesting model for studies of animal personality. However, only a few attempts have been done to study individual differences in dogs. In this study, behavioural data from 15,329 dogs of 164 different breeds were used to investigate the existence of personality traits in dogs. The data were collected at a personality test that tested the dogs' reactions to strangers, "fleeing" prey-like objects, and several potential fear- and aggression-eliciting stimuli. Factor analyses revealed the existence of five narrow traits: "Playfulness", "Curiosity/Fearlessness", "Chase-proneness", "Sociability" and "Aggressiveness". Higher-order factor analyses showed that all factors except "Aggressiveness" were related to each other, creating a broad factor that influences behaviour in a range of situations. Both narrow and broad factors were found in a dataset including data from a large number of breeds, as well as within eight of Fédération Cynologique Internationale's (FCI's) 10 breed groups. This indicates that the personality dimensions found in the study are general for the dog as a species. The finding of a major behavioural dimension in different groups of dog breeds, together with comparable results previously found for wolves (*Canis lupus*), suggests that the dimension is evolutionarily stable and has survived the varied selection pressures encountered during domestication. The broad factor is comparable to the shyness–boldness axis previously found in both humans and animals, and to human "supertraits" (a combination of Extraversion and Neuroticism). The results of this study can be used to describe and compare individual dogs, as well as breeds. This, in turn, can be used in applications like selection of service dogs and breeding animals, as well as predicting behaviour problems in pet dogs.

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Keywords: Dogs; Personality; Temperament; Individual differences; Shyness–boldness; Aggression

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1. Introduction

During the last decades there has been an increased interest in the study of behavioural variations between individuals. With this, an earlier view that such differences are merely a bias around a mean has shifted (Slater, 1981), and the findings of individual behavioural differences in animals, consistent over time or across situations, have proven to be useful in the understanding of the evolution of behaviour (e.g. Benus et al., 1991; Wilson et al., 1994) as well as in applied animal behaviour (e.g. Le Scolan et al., 1997; Slabbert and Odendaal, 1999; Grignard et al., 2001).

The results of personality studies in animals have revealed suggestions of human personality traits in different species of animals. The shyness–boldness axis, a fundamental dimension in humans that can be defined as an individual's general tendency to approach novel objects and willingness to take risks (Kagan et al., 1988; Wilson et al., 1994), has been studied and detected in a range of species of different taxa, e.g. octopus (Mather and Andersson, 1993), fish (Wilson et al., 1993), cat (Feaver et al., 1986), and primate (Stevenson-Hinde et al., 1980). For humans, there is today a consensus for the existence of five major human personality dimensions; the “Big Five” (Digman, 1990; Goldberg, 1990; Costa and McCrae, 1992). The Big Five includes the traits Extraversion (associated with sociability and activity), Neuroticism (anxiety and moodiness), Conscientiousness (competence and self-discipline), Agreeableness (trust and compliance), and Openness (fantasy and ideas). There have been attempts to apply this model to nonhuman animals, with some success. Gosling and John (1999) found support for the Big Five in a review including data, mostly from exploratory analyses, from 12 different species. Extraversion, Neuroticism, and Agreeableness were, according to the authors, those factors that showed the strongest cross-species generality. Theory driven research on the personality of animals has mainly focused on Extraversion and Neuroticism. Examples include the work of Broadhurst (1960), Eysenck and Broadhurst (1964) and Garcia-Sevilla (1984), who have used open field test to detect these traits in rodents.

One species that is interesting in the study of animal personality is the domestic dog (*Canis familiaris*). Dogs are found in great numbers within our own society, yielding good opportunities to make valid behavioural observations. Dogs are held as pets, companion animals, and they are used for different purposes; e.g. as guide dogs, for hunting, herding, and for search for different chemicals like explosives and drugs. This makes knowledge about personality dimensions in dogs important. In addition to this, the dog is an interesting species because of its evolutionary history. In the ancestor of the dog, the wolf (*Canis lupus*), a major behavioural dimension has been found related to the shyness–boldness axis (Fox, 1972; MacDonald, 1987). During the domestication there have probably been a variety of selective pressures in different places and in different time periods (Clutton-Brock, 1999), which have resulted in a variation in morphology, and behaviour as well as in the genome seen in few other species (Coppinger and Schneider, 1995; Clutton-Brock, 1999; Wayne and Ostreder, 1999). If the same personality traits are found both in wolves and dogs of different types and breeds, it is a strong indication of the evolutionary stability of these traits. Despite this, there have been remarkably few attempts to study personality in dogs. In the review by Gosling and John (1999) indications for the traits Extraversion, Neuroticism, Agreeableness and Openness/Conscientiousness were found in

dogs. However, the studies included in the review assigned subjective interpretations of the behaviour of either individual dogs or in some cases dog breeds (Draper, 1995; Wilsso and Sundgren, 1997; Coren, 1998; Gosling and John, 1998 (in Gosling and John, 1999)). A method that uses fewer initial assumptions is direct observation and strict descriptions of behaviours. Three studies using this methodology on dogs, but with a small number of breeds, are those by Brace (1961) (in Scott and Fuller, 1965) and Goddard and Beilharz (1984, 1985).

The present study is based on behavioural descriptions of 15,329 dogs from 164 breeds collected in a standardised test. The test exposed the dogs to a number of different situations included meetings with strangers, play tests, and several potential fear- and aggression evoking stimuli. We used factor analysis to investigate possible narrow and broad personality traits in dogs.

2. Methods

2.1. Subjects

The subjects used in this study were in total 15,329 dogs from 164 breeds, including both males and females. The dogs, which were pets living with their owners, were 365 days of age or older when tested. The average test age was 599.6 days (S.D. \pm 323.4 days). For the analyses in this study, the data were separated into two datasets. The first set included data from 25 randomly chosen dogs from all breeds with 25 or more tested dogs (47 breeds: American Staffordshire Terrier, Australian Cattle dog, Australian Kelpie, Australian Shepherd, Bearded Collie, Beauceron, Belgian Malinois, Belgian Sheepdog, Belgian Tervuren, Bernese Mountain Dog, Border Collie, Border Terrier, Bouvier des Flandres, Boxer, Briard, Collie (rough), Dalmatian, Danish Fox Terrier, Doberman Pinscher, English Springer Spaniel, Finnish Reindeer Herder, Flat-Coated Retriever, German Shepherd dog, German Shorthaired Pointer, German Spaniel, Giant Schnauzer, Golden Retriever, Greater Swiss Mountain Dog, Hovawart, Iceland Sheepdog, Irish Soft Coated Wheaten Terrier, Irish Terrier, Kerry Blue Terrier, Labrador Retriever, Leonberger, Miniature Schnauzer, Nova Scotia Duck Tolling Retriever, Parson Jack Russell Terrier, Pinscher, Rhodesian Ridgeback, Rottweiler, Russian Black Terrier, Samoyed, Staffordshire Bull Terrier, Standard Poodle, Standard Schnauzer, Swedish Vallhund), in total 1175 dogs (611 males, 564 females). By this operation a dataset was constructed that could be assumed to represent dogs in general without the risk of numerous large breeds influencing the results more than smaller breeds. To validate the results from factor analyses on this dataset, and to investigate if the pattern of correlations found was general for different dog types, a second dataset was analysed. This set included data from all dogs, separated into breed groups according to the official breed classification by Fédération Cynologique Internationale (FCI). The FCI classification is based on the breeds' history regarding function and geographic distribution, and separates dog breeds into 10 groups. All 10 breed groups were represented in the sample (Group 1, Sheepdogs and Cattle dogs (referred to as "Sheepdogs"): $N = 6673$ (34 breeds represented), 51.6% males; Group 2, Pinschers, Schnauzers, Mastiffs and Swiss mountain and Cattle dogs ("Pinschers"): $N = 5798$ (29 breeds), 50.3%

males; Group 3, Terriers: $N = 727$ (21 breeds), 51.4% males; Group 4, Dachshunds: $N = 5$ (1 breed), 80% males; Group 5, Primitive type dogs and Spitzes (“Primitive dogs”): $N = 192$ (22 breeds), 54.7% males; Group 6, Scent hounds and related breeds (“Scent hounds”): $N = 386$ (9 breeds), 50.0% males; Group 7, Pointing dogs (“Pointers”): $N = 92$ (12 breeds), 52.2%; Group 8, Retrievers, Water dogs and Flushing dogs (“Retrievers”): $N = 1298$ (16 breeds), 54.2% males; Group 9, Companion and Toy dogs (“Companion dogs”): $N = 138$ (15 breeds), 54.3% males; Group 10, Sighthounds (5 breeds): $N = 20$, 80% males). However, data from Dachshunds and Sighthounds were not used in this study because of the low number of tested dogs. By this separation, analyses within breed groups could be carried out, and the results could be compared with the results from analyses of the first dataset.

2.2. *Testing procedure: general*

The data were collected during a standardised behavioural test (“dog mentality assessment”, DMA), which is used by the Swedish Working Dog Association (SWDA; Fält, 1997a). The test was developed mainly as a tool for dog breeding of working dogs. Using the test the behavioural reactions of the parents and, later on, of the progenies can be compared (Fält, 1997b). The test is now used for other breeds than working breeds, and has in many breed clubs in Sweden come to be considered a general behavioural test, which can reveal a dog’s reactions to different stimuli.

In the test, the dogs are exposed to several different novel situations and their reactions are described according to a standardised score sheet by official observers, one at every test. During the test the dog is accompanied by a handler, in most cases its owner or another person well known to the dog. A test-leader (TL) is responsible for the practical aspects of the test. All persons conducting the test are trained and certified by SWDA. The training programme for observers is conducted in several steps in which the observer is trained to score dogs’ reaction in the test according to pre-set standards. Emphasis is put on an objective and neutral description of the behaviour and the inter-observer reliability is tested several times during the training.

The data were collected during the years of 1997–2001 from 2017 tests at 235 different testing arenas in Sweden. Two hundred and one official observers scored the dogs’ reactions. The scores were reported to SWDA, and further to the Swedish Kennel Club.

2.3. *The test*

The test consists of 10 separate subtests, which are carried out outdoors in a specific order. A handler (the owner or another familiar person) accompanies the dog during the whole test. The subtests of the test are Social contact, Play 1, Chase, Passive situation, Distance-play, Sudden appearance, Metallic noise, Ghosts, Play 2, and Gunshot. The set-ups for the different subtests are built up in advance at different stations along a path in a wooded area. Dog and handler are not allowed to watch when the test situations are arranged. The functionaries are either visually hidden from the dogs’ position, or remain passive until it is time to act. The direction of the wind is taken into consideration in order to avoid disturbances from hidden functionaries.

At the start of the test, observer and functionaries are positioned before the dog and handler are guided to the first station by the TL. In order to standardise the test situation the TL instructs the handler as to what to do and how to act before and during each subtest. As a rule, the handler is asked to be passive and quiet during the subtests. The TL guides handler and dog from station to station from the first subtest and forward. During the test the official observer, who follows the TL from station to station, describes the dog's reaction in the score sheet. The observer or the handler can terminate the test, for example if the dog shows intense and remaining avoidance reactions.

2.4. Behavioural rating

The score sheet contains scales for 33 behavioural variables. The aim of the score sheet is to describe the dogs' behaviour as objectively as possible without inferring subjective opinions (like "good behaviour", "too slow", "fearful", etc.). All 33 variables are scored from 1 to 5 according to intensity of the behavioural reaction, where a low score equals a low intensity in the dogs' behavioural reaction. Each step in the scale, for each variable, is described on the score sheet. In the presentation of the subtests below only descriptions for steps 1 and 5 of each scale are given. During every subtest 1–5 behavioural reactions are recorded. The variables generally correspond to different phases during each subtest.

2.5. Description of subtests and behavioural variables

2.5.1. Social contact

The dog's reaction to a stranger is tested and described. Handler and dog approaches a passive person, whom the dog has not met earlier (TL). The TL greets the handler and shakes his hand, after which he greets the dog. The TL takes the leash and takes a short walk (10 m) with the dog, but without the handler. During the walk the TL stops and pets the dog at a distance from the handler, after which he returns to the handler with the dog. Back with the handler the TL makes physical contact with the dog (bends over the dog and touches the sides of the body, the ears and the region of the mouth). The dog's reaction is described by the following behavioural variables.

2.5.1.1. *Greeting reaction.* Score from "rejection of greeting" (1), to "intense greeting with jumping and whining" (5). Described during the first phase of greeting.

2.5.1.2. *Cooperation.* Score from "refusal to walk with stranger" (1), to "high willingness to walk with stranger, combined with intense greeting reactions towards stranger" (5). Described during the short walk.

2.5.1.3. *Handling.* Score from "rejection of physical contact" (1), to "intense social behaviour towards stranger" (5). Described during the phase of physical contact.

2.5.2. Play 1

The dog's interest to play with a stranger is tested and described. The stranger (test-leader) gives the handler a strong piece of rag. The handler invites the unleashed dog to

play with the rag by dragging it on the ground in front of the dog. Before the dog grabs the toy, if the dog is willing to do so, the handler throws it to the TL, who is positioned approximately 4 m away. He throws the toy back to the handler, who throws it back once more. The TL then throws the rag away from the dog (approximately 10 m), which is free to run after and catch it. If the dog grabs it the TL tries to call the dog back. When TL has called the dog back and taken the rag, all steps are repeated once. After this, the TL tries to make the dog interested in the rag by dragging it in front of the dog on the ground. If the dog grabs the rag, the TL “fights” back and carries out an easy tug-of-war during a maximum of 30 s. During this tug-of-war the TL alternates between active pulling and passive holding. The dog’s reaction is described by the following behavioural variables.

2.5.2.1. Interest in play. Score from “no interest in the tossing of the rag” (1), to “active play and following of the thrown rag” (5). Described during the first phase of throwing between handler and the TL.

2.5.2.2. Grabbing. Score from “no grabbing” (1), to “immediate and intense grabbing” (5). Described when the TL has thrown the rag away from the dog.

2.5.2.3. Tug-of-war. Score from “no biting at all” (1), to “immediate grabbing the rag with twitches and fighting until the TL releases the rag” (5). Described during the tug-of-war phase.

2.5.3. Chase

The dog’s reaction to a small and rapidly moving object is tested and described. An approximately 40 cm long prey-like object (by fur, or similar material) is fixed to a long thin cord (approximately 50–60 m), which is put in a course around 10 small wheels or poles at ground level. The cord around the wheels forms a zigzag pattern with a corridor of approximately 2.5 m width. A hidden functionary, who can pull the cord quickly by running away, holds the other end of the cord. This set-up makes it possible to make the object “flee” in an irregular pattern away from the dog. Handler and dog approach the start-point, and the leash is taken off. The object is put into movement and the dog is free to run after it. The object stops when it has passed all wheels. This makes it possible for the dog to run after the object and grab it, and even bring it back to the handler together with the fixed cord. If the dog does not approach the object, the handler takes a walk with the dog to the object, though without allowing the dog to grab it. The test is then repeated once. The dog’s reaction is described by the following behavioural variables.

2.5.3.1. Following 1. Score from “no attempts to run after the fleeing object” (1), to “immediate reaction when seeing the object and running towards it with high speed” (5) during first repetition. Described when the object “flees”.

2.5.3.2. Grabbing 1. Score from “no attempts to grab the object” (1), to “immediate and intense grabbing combined with holding of the object in at least 3 s” (5) during first repetition. Described when, and if, the dog approaches the object.

2.5.3.3. *Following 2*. Score as “Following 1” at the second repetition.

2.5.3.4. *Grabbing 2*. Score as “Grabbing 1” at the second repetition.

2.5.4. *Passive situation*

The dog’s behaviour during a period without any change in the stimulus situation is tested and described. The dog, leashed but with the possibility to move in the full length of the leash (approximately 2 m), walks together with the handler into a position approximately 10 m from the observer. The handler and functionaries remain in passivity during 3 min. The dog’s reaction is described by the following behavioural variable.

2.5.4.1. *Activity*. Score from “non-active” (1) to “active behaviour with switches between different modes of activity” (5). Described during the whole period.

2.5.5. *Distance-play*

In this subtest, the dog’s reaction to a play-inviting and oddly behaving unfamiliar person at a distance away from handler is tested and described. A functionary dressed in a cape with hood is hidden at a distance of approximately 40 m away from the dog. The handler holds the dog with a grip in the leash. In the beginning the functionary claps his hands to catch the dog’s attention. Thereafter he starts to move towards the dog and handler in a crouching manner. When the functionary has moved 3 m, he widens the cape and crouches at the same time. The movement towards the dog and the crouching is repeated twice. The functionary now changes appearance. He un-hoods himself and starts to invite the dog to play by tossing a rag up in the air three times. The functionary thereafter runs to a hiding place and takes off the cape, and the dog is released. If, and when, the dog approaches the functionary, he reveals himself and invites the dog to play by dragging the rag on the ground in front of the dog. If the dog engages in play, after 10 s the functionary lets go of the rag and remains passive during a period of the same length. If the dog has not engaged in play, the functionary keeps the rag in his hand and stands still during 10 s. After the passivity, the functionary once more tries to engage the dog to play by movements and vocal display during 10 s. These last sequences by the functionary—passivity followed by play invitations—are thereafter repeated once. If the dog does not approach the functionary on his own, the handler supports the dog in steps until the dog approaches or until the last step is carried out:

1. Functionary talks to the dog from the hiding place (during 10 s).
2. Functionary reveals himself and tries to attract the dog to him by tossing the rag in the air (during 10 s).
3. Handler and dog walk together towards the functionary.

If the dog still hesitates to contact the functionary, the handler and dog take a walk together with the functionary. The dog’s reaction is described by the following behavioural variables.

2.5.5.1. *Interest*. Score from “no interest in functionary” (1), to “repeated attempts to run towards the functionary” (5). Described when the dog is still held by the handler.

2.5.5.2. *Aggression*. Score from “no signs of aggression or threat display” (1), to “threat display (growling, snarling, raised hackles, raised tail, etc.) directed against the functionary during both phase of threat and invitation” (5). Described when the dog is still held by the handler.

2.5.5.3. *Exploration*. Score from “no approach attempts towards the functionary, even when he is actively calling the dog” (1), to “immediate approach, even to the passive functionary” (5). Described after the release of the dog.

2.5.5.4. *Tug-of-war*. Score from “no attempts to play tug-of-war” (1), to “immediate attempts to play with active pulling even when functionary is passive” (5). Described when, and if, the dog is in close proximity to the functionary.

2.5.5.5. *Play invitation*. Score from “no interest in the functionary” (1), to “urgent play invitations from the dog to the functionary, even when he is passive” (5). Described when, and if, the dog is in close proximity to the functionary.

2.5.6. *Sudden appearance*

The dog's reaction to a suddenly appearing human-like dummy is tested and described. The set-up for this subtest is a boiler suit arranged in such a way that it can be suddenly pulled up in front of the dog. The legs of the dummy are fastened to the ground. The arms of the dummy are attached to ropes that lead up to a wooden batten, horizontally fixed between two trees approximately 2 m up. The ropes are led through metal loops fastened in the batten, and further away to a functionary who can pull up the dummy. In the starting position the dummy is laid down tight on the ground, and is therefore not visible for the dog. Handler walks the dog in a long loose leash straight towards the place of the dummy. When the dog is 3 m from the dummy, it is suddenly pulled up. The handler stops at the same time and releases his grip of the leash. The handler remains passive during 15 s, which gives the dog opportunity to freely approach and investigate the dummy. If the dog does not approach the dummy on his own, the handler supports the dog in steps until the dog approaches the dummy or until the last step is carried out:

1. Handler approaches the dummy halfway.
2. Handler approaches the dummy.
3. Handler talks to the dummy and touches it, and calls the dog.
4. Handler returns to the dog, while the dummy is taken down and laid on the ground by the TL. After which the handler together with the dog walk back to the dummy.

The test-leader instructs the handler throughout all these steps (each step is 15 s). When the dog has investigated the dummy, or the last step is carried out, the handler takes the dog on a walk close to the dummy. Ten meters beyond the dummy the handler turns back, and once again passes the dummy. This is repeated twice. The dog's reaction is described by the following behavioural variables.

2.5.6.1. *Startle reaction*. Score from “short hesitation” (1), to “a flight of >5 m” (5). Described when the dummy appears.

2.5.6.2. *Aggression*. Score from “no signs of aggression, or threat display” (1), to “threat display and attacks against dummy” (5). Described at and after the sudden appearance of the dummy.

2.5.6.3. *Exploration*. Score from “great need of support (no approach of dummy until handler lowers it and sits close to it), or no approach” (1), to “immediate approach to dummy without need of support” (5). Described after the appearance of the dummy.

2.5.6.4. *Remaining avoidance behaviour*. Score from “no signs of avoidance behaviour (e.g. no evasive manoeuvre or reduction of speed)” (1), to “significant avoidance behaviour during all passes by the dummy” (5). Described during the repeated walks.

2.5.6.5. *Remaining approach behaviour*. Score from “no interest in the dummy” (1), to “approaches, together with grabbing and/or playing with the dummy, in at least two passings” (5). Described during the repeated walks.

2.5.7. *Metallic noise*

The dog's reaction to metallic noise is tested and described. A chain with large links is resting on a sheet of corrugated metal (approximately 1.5 m long), which lies horizontally on the ground. A rope is fixed to the chain. A functionary, who is hiding from the dog at a distance, holds the other end of the rope. This arrangement makes it possible to create a metallic noise by pulling the rope. The metal sheet and chain are placed 1.5 m at the side of a trail, on which the handler and dog walks during the subtest. The rope is pulled when the dog's front passes the metal sheet. When this happens, the handler stops and releases the grip on the leash. The handler remains passive during 15 s, which gives the dog opportunity to freely approach and investigate the source of the noise. If the dog does not approach the source of the noise on his own, the handler supports the dog in steps until the dog approaches it or until the last step is carried out.

1. Handler approaches the sheet of metal halfway.
2. Handler approaches the sheet of metal.
3. Handler touches the sheet of metal without causing any noise, and calls the dog.

The test-leader instructs the handler throughout these steps (each step lasts for 15 s). When the dog has investigated the sheet of metal, the handler takes the dog for a walk close to it. Ten meters beyond the sheet the handler turns back, and once again passes it. This is repeated twice. The dog's reaction is described by the following behavioural variables.

2.5.7.1. *Startle reaction*. Score from “short hesitation” (1), to “a flight of >5 m” (5). Described when the chain is pulled over the sheet of corrugated metal.

2.5.7.2. *Exploration*. Score from “no approach of the sheet of metal, even if handler sits close to it” (1), to “immediate approach without need of support” (5). Described after the noise.

2.5.7.3. *Remaining avoidance behaviour.* Score from “no avoidance behaviour (e.g. no evasive manoeuvre or reduction of speed)” (1), to “significant avoidance behaviour during all passes by the source of noise” (5). Described during the repeated walks.

2.5.7.4. *Remaining approach behaviour.* Score from “no approaches or looks towards the source of noise” (1), to “approaches, together with grabbing and/or playing with the chain, in at least two passings” (5). Described during the repeated walks.

2.5.8. *Ghosts*

The dog's reaction to two slowly approaching persons covered in white sheets (“ghosts”) is tested and described. Two functionaries who wear white sheets covering the whole body except for the head are used in this subtest. Over the head the functionaries have white plastic buckets with holes for the eyes. The outlines of the eyeholes, as well as the mouth, are marked in black to make them salient against the white background.

At the beginning of the test the two ghosts hide 20 m from the dog and handler, who are positioned at the starting point. The distance between the hidden ghosts is 25 m, forming a triangle with ghosts in two corners and dog together with handler in the remaining corner.

During this first phase of the subtest the dog is on leash with opportunity to move in the full length of the leash. Initially, both ghosts move out slowly from the hiding places. After that, one ghost at the time moves towards handler and dog in several short intermittent stages (3 m for each stage). All movements are slow with constant speed. The TL, from a position beyond handler and dog, instructs the functionaries by hand signals through these movements. The ghosts are stopped at a distance of about 4 m from the dog or, if the dog has positioned himself behind the handler, 4 m from the handler. The functionaries, after they have come into position in front of the dog, turn around and expose their backs to the dog. After that the handler releases the leash, which enables the dog to investigate one or both ghosts while the handler remains passive. If the dog does not investigate the functionaries on his own, the handler is instructed to move towards the ghosts in steps until the dog attempts to contact them or until the last step is carried out.

1. Handler approaches one of the ghosts halfway (the one the dog seems to be most focused on).
2. Handler approaches the ghost.
3. Handler talks to one of the ghosts, and calls for the dog.
4. Handler helps the ghosts undress.
5. Functionaries (ghosts) attract the dog vocally.

The test-leader instructs the handler to carry out these steps (each step lasts for 15 s). After the dog has contacted and greeted one of the ghosts the same undressing-procedure is repeated with the other ghost. The dog's reaction is described by the following behavioural variables.

2.5.8.1. *Aggression.* Score from “no signs of aggression or threat display” (1), to “threat displays and several attacks against the ghosts” (5). Described while the ghosts approach the dog.

2.5.8.2. Attention towards ghosts. Score from “occasional glances towards the ghosts” (1), to “constant staring and activity towards ghosts during the whole period of approaching” (5). Described during the period while the ghosts approach the dog.

2.5.8.3. Avoidance behaviour. Score from “constant position ahead or beside handler” (1), to “flight away from the ghosts longer than the length of the leash” (5). Described during the period while the ghosts approach the dog.

2.5.8.4. Exploration. Score from “no approach, at least not before step 4 above” (1), to “immediate approach after the dog is unleashed” (5). Described after the dog is unleashed.

2.5.8.5. Contact with ghosts. Score from “avoidance of the ghosts during the contact phase” (1), to “intense greeting with jumping and whining” (5). Described after the dog is unleashed.

2.5.9. Play 2

This subtest is a repetition of “Play 1”, with the exception of the final tug-of-war. Description of behaviour is the same as for Interest in play and Grabbing.

2.5.10. Gunshot

The dog’s reaction to gunshots is tested and described. A functionary with a starter’s gun (9 mm) hides 20 m away from the starting point, where the leashed dog and handler are positioned. During the first phase of this subtest the handler tries to play tug-of-war with the dog using a rag. If the dog is not willing to play, the handler is instructed to engage the dog in some other activity (like running together). After 15 s of activity the first shot is fired. The handler is instructed not to react at the moment of fire and to keep up the activity. This is repeated once, where after the activity is interrupted. During passivity two more gunshots are fired. During the passive phase, the dog has opportunity to freely move in the full length of the leash. If the dog flees longer than the length of the leash the handler releases it. The dog’s reaction is described by the following behavioural variable.

2.5.10.1. Avoidance reaction. Score from “none or small reaction in response to the noise with no remaining affect” (1), to “remaining anxiety where the dog interrupts play or activity and show attempts to flee” (5). Described during the whole subtest.

2.6. Data treatment and statistical analyses

The patterns of correlation among the behavioural variables were studied using factor analyses. Common factor analyses were used in favour of principal component analyses because the method is better suitable for identifying latent dimensions, especially when there is little knowledge about specific and error variance (Hair et al., 1998). The communalities were estimated by computing the diagonal of the correlation matrix as the multiple *R*-square of the respective variable with all other variables. The criterion of eigenvalue >1 was used in each factor analysis. The primary factors were rotated using the Varimax normalised rotation method. In order to investigate whether there was any broader

construct to which the primary factors related to, a higher-order, or second-order, factor analysis was carried out. When using oblique rotation the primary factors are not constrained to be orthogonal. By this procedure, possible correlations between primary factors can be found and higher-order factors can be revealed. Factor analyses, both primary and second-order, were done with a sample that consisted of data from 1175 dogs (25 randomly picked individuals from 47 breeds). The same analyses were also done on the data from all dogs in 8 of the 10 breed groups of the FCI-classification. This was done despite the fact that two of these eight breed groups had lower variable-to-case ratio than 1:5, an often-used lower boundary to create a stable matrix of correlation (Hair et al., 1998). The risk with unstable matrix of correlation taken into consideration, cautious interpretations of the results may however give valuable information of the generalisability of the factors between dog types. The statistical package used was STATISTICA™.

3. Results

The factor analysis based on the data from 25 randomly picked dogs from 47 breeds ($N = 1175$) extracted five primary factors with eigenvalues >1 (Table 2). Any loading of 0.40 or above is considered highly significant for this sample size (Hair et al., 1998), and was used as a criterion when considered the relevancy of the variable loading on each factor. Twenty-seven of the 33 behavioural variables fulfilled this criterion for any of the five factors. The first factor had seven high loadings and was the factor that explained the greatest proportion of variance (11.0%). Five variables from the two Play subtests loaded on this factor. In addition, two play-variables from the subtest Distance-play had loadings >0.50 . However, these two variables also loaded high on the fourth factor (0.47–0.48), which suggests that these variables are less representative for this factor. Based on the pattern of loadings, this first factor was labelled “Playfulness”. The second factor had both positive and negative high loadings: positive loadings from the three exploration variables in the subtests of Sudden appearance, Metallic noise and Ghosts, negative loadings from Startle reaction and Remaining avoidance behaviour from subtests Sudden appearance and Metallic noise. The second factor was labelled “Curiosity/Fearlessness”. The third factor was related to one subtest: Chase. All four variables from this subtest loaded high, which made the label “Chase-proneness” appropriate. The fourth factor was loaded by three variables from the subtest Social contact and the Greeting variable from Ghosts subtest, together with three variables from Distance-play (two of them also loading high on factor “Playfulness”). The factor was labelled “Sociability”. The fifth and final factor was loaded by four variables from three subtests: The Aggression variables from subtest Distance-play, Sudden appearance and Ghosts. In addition, the variable Attention from the Ghost subtest had loading >0.40 . This factor was labelled “Aggressiveness”. The loadings of each variable, and the factor labels, are presented in Table 1.

A higher-order (or second-order) factor analysis, which can reveal broader constructs that the primary factors are related to, revealed one secondary factor. Four of the five primary factors—“Playfulness”, “Curiosity/Fearlessness”, “Chase-proneness”, and “Sociability”—had loadings well >0.40 (0.54–0.74) on this general factor (Table 2). The loading for the factor “Aggressiveness” was 0.30, which indicates that this primary

Table 1
Results from the factor analysis

Subtest	Variable	Primary factors					Secondary factor
		Playfulness	Curiosity/Fearlessness	Chase-proneness	Sociability	Aggressiveness	
Social contact	Greetings	0.06	0.06	0.07	0.59	0.11	0.38
	Cooperation	0.11	0.02	0.04	0.59	0.05	0.36
	Handling	0.09	0.08	0.01	0.61	-0.01	0.36
Play 1	Interest in play	0.70	0.04	0.16	0.18	0.16	0.55
	Grabbing	0.72	0.02	0.12	0.06	0.11	0.47
	Tug-of-war	0.66	0.12	0.12	0.18	0.12	0.53
Chase	Following 1	0.09	0.11	0.71	0.10	0.07	0.39
	Grabbing 1	0.15	0.14	0.72	0.06	0.06	0.41
	Following 2	0.16	0.10	0.72	0.11	-0.01	0.43
	Grabbing 2	0.23	0.12	0.70	0.07	0.04	0.44
Passive situation	Activity	0.09	-0.03	0.04	0.04	0.10	0.09
Distance-play	Interest	0.19	0.11	0.13	0.14	0.32	0.30
	Aggression	-0.02	-0.08	-0.09	-0.13	0.46	-0.03
	Exploration	0.34	0.23	0.23	0.50	-0.09	0.56
	Tug-of-war	0.57	0.20	0.17	0.48	-0.05	0.64
	Play invitation	0.51	0.17	0.12	0.47	-0.02	0.58
Sudden appearance	Startle reaction	0.01	-0.53	-0.01	-0.09	-0.11	-0.20
	Aggression	0.10	-0.07	0.04	0.01	0.50	0.13
	Exploration	0.09	0.63	0.05	0.11	-0.10	0.31
	Remaining avoidance	-0.08	-0.62	0.02	-0.06	0.02	-0.26
	Remaining approach	0.06	-0.13	0.14	0.03	0.12	0.07
Metallic noise	Startle reaction	-0.04	-0.56	-0.06	-0.02	-0.03	-0.24
	Exploration	0.11	0.52	0.13	0.04	0.17	0.32
	Remaining avoidance	-0.07	-0.54	-0.01	-0.03	-0.11	-0.25
	Remaining approach	0.06	-0.19	0.06	0.08	0.05	0.05
Ghosts	Aggression	0.06	0.05	0.04	-0.01	0.64	0.16

Table 1 (Continued)

Subtest	Variable	Primary factors					Secondary factor
		Playfulness	Curiosity/Fearlessness	Chase-proneness	Sociability	Aggressiveness	
Play 1	Attention	0.01	0.05	0.04	0.12	0.50	0.20
	Avoidance	-0.03	-0.27	0.03	-0.19	0.14	-0.16
	Exploration	0.02	0.43	0.03	0.25	-0.07	0.27
	Greeting	0.04	0.26	0.07	0.43	0.08	0.35
Play 2	Interest in play	0.78	0.10	0.16	0.04	0.13	0.53
	Grabbing	0.78	0.09	0.16	-0.01	0.11	0.51
Gunshot	Avoidance	-0.13	-0.18	-0.13	-0.05	-0.04	-0.20
Proportion of explained variance (%)		11.0	7.8	7.2	6.7	4.3	

The result of factor analysis based on a sample including 1175 dogs of 47 breeds reveals five primary factors (with eigenvalue >1) and one secondary factor. The numbers represent the loading of each variable on the factors. Loadings on the primary factors equal or >0.40, which can be considered as relevant in this sample, are in bold.

Table 2
Results from higher-order factor analyses

Sample	Playfulness	Curiosity/ Fearlessness	Chase- proneness	Sociability	Aggressiveness	Playfulness at distance
Dataset 1 (47 breeds)	0.74	0.54	0.56	0.70	0.30	–
Sheepdogs	0.77	0.60	0.63	0.58	0.24	–
Pinschers	0.74	0.52	0.61	0.64	0.28	–
Terriers	0.70	0.35	0.58	0.64	0.21	–
Primitive dogs	0.53	0.63	0.17	0.67	–0.16	–
	0.51	–0.16	0.60	0.15	0.51	–
Scent hounds	0.71	0.31	0.61	0.71	0.14	–
Pointers ^a	0.63	0.22	0.56	0.38	–0.16	0.69
Retrievers ^b	0.63	0.55	0.50	–	0.10	–
Companion dogs	0.75	0.20	0.51	0.24	0.07	0.71

The table presents the results from the higher-order factor analysis for the sample including 1175 dogs from 47 breeds, as well as the results from the analyses within each of the eight FCI-breed groups. The numbers represent the loadings of the primary factors on the higher-order factor, i.e. the correlation between primary factors and higher-order factor. Loadings of 0.40 or above are in bold.

^a Two secondary factors were extracted in this breed group: one resembling the pattern found in other breed groups (presented here) and one with loadings from mainly two primary factors; “Curiosity/Fearlessness” and a factor specific for this group (loadings from the two variables Remaining approach in addition to Activity).

^b “Playfulness” and “Sociability” were in this breed group merged into one factor, here presented as “Playfulness”.

factor is less related to the secondary factor. This pattern is supported by the pattern of loadings from the variables on the secondary factor (Table 1). The variables related to “Aggressiveness” have relatively low loadings on the secondary factor (0.03–0.20), compared to the variables representing “Playfulness” (0.47–0.64), “Curiosity/Fearlessness” (0.20–0.32), “Chase-proneness” (0.39–0.41) and “Sociability” (0.35–0.38).

3.1. Factors within breed groups

Even though the factor analysis described above is based on data from a large number of breeds there is a possibility that the correlation structure of the variables is different in different dog types due to variation in selection history. To test the generality of the extracted factors factor analyses were, therefore, made within eight breed groups. The result showed a pattern of correlations that generally agreed with the result from the original analysis (Table 3). The factor “Chase-proneness” had the same pattern of relevant loadings within all eight breed groups, as well as in the original analysis. The factor “Curiosity/Fearlessness” was represented in the same way in most of the breed groups as it was in the original analysis. The three variables from subtests Sudden appearance had high loadings in all groups. The same pattern was found for the subtest Metallic noise, with the exception of the variable Remaining avoidance, which had lower loadings in two groups (Pointers and Retrievers). In all breed groups, as well as in the original analysis, the variable exploration from subtest Ghosts loaded >0.40, or near, on this factor. In addition,

Table 3

The results from the factor analyses within eight breed groups (classification according to the FCI)

Breed group	"Playfulness"	"Curiosity/ Fearfulness"	"Chase- proneness"	"Sociability"	"Aggressiveness"	"Playfulness at distance"
Group 1: Sheepdogs and Cattle dogs, N = 6667	Play 1	Interest Grabbing Tug-of-war Exploration	Startle reaction (-) Exploration Remaining avoidance (-) Startle reaction (-) Exploration	Chase Following 1 Grabbing 1 Following 2 Grabbing 2	Social contact Greetings Cooperation Handling Greeting	Distance-play Sudden appearance Ghosts Aggression Attention
	Distance-play	Metallic noise Tug-of-war Play invitation Interest Grabbing	Remaining avoidance (-) (Avoidance -) Exploration		Ghosts	Aggression Attention
	Play 2	Ghosts				
	Play 1	Interest Grabbing Tug-of-war Exploration	Startle reaction (-) Exploration Remaining avoidance (-) Startle reaction (-) Exploration	Chase Following 1 Grabbing 1 Following 2 Grabbing 2	Social contact Greetings Cooperation Handling (Tug-of-war) (Play invitation) Greeting	Distance-play (Aggression) Sudden appearance Ghosts Aggression (Attention)
	Distance-play	Metallic noise Tug-of-war Play invitation Interest Grabbing	Remaining avoidance (-) Exploration		Distance-play Ghosts	Aggression (Attention)
	Play 2	Ghosts				
Group 3: Terriers, N = 734	Play 1	Interest Grabbing Tug-of-war Interest Grabbing	Startle reaction (-) Exploration Remaining avoidance (-) Startle reaction (-) Exploration	Chase Following 1 Grabbing 1 Following 2 Grabbing 2	Social contact (Cooperation) Handling Exploration Tug-of-war Play invitation	Aggression Sudden appearance Ghosts Aggression Attention
	Play 2	Metallic noise Exploration Remaining avoidance (-) Exploration		Distance-play Tug-of-war Play invitation	Aggression Attention	
	Play 1	Interest Grabbing Tug-of-war Interest Grabbing	Startle reaction (-) Exploration Remaining avoidance (-) Startle reaction (-) Exploration	Chase Following 1 Grabbing 1 Following 2 Grabbing 2	Social contact Greetings Cooperation Handling Exploration Tug-of-war Play invitation	Aggression Sudden appearance Ghosts Aggression Attention
	Distance-play	Metallic noise Tug-of-war Play invitation Interest Grabbing	Remaining avoidance (-) Exploration		Distance-play Ghosts	Aggression (Attention)
	Play 2	Ghosts				
	Play 1	Interest Grabbing Tug-of-war Interest Grabbing	Startle reaction (-) Exploration Remaining avoidance (-) Startle reaction (-) Exploration	Chase Following 1 Grabbing 1 Following 2 Grabbing 2	Social contact (Cooperation) Handling Exploration Tug-of-war Play invitation	Aggression Sudden appearance Ghosts Aggression Attention
Group 5: Primitive type dogs and Spitzes, N = 195	Play 1	Interest Grabbing Tug-of-war (Exploration) Tug-of-war Play invitation Interest Grabbing	Startle reaction (-) Exploration Remaining avoidance (-) Startle reaction (-) Exploration Remaining avoidance (-) Exploration	Chase Following 1 Grabbing 1 Following 2 Grabbing 2	Social contact Greetings Cooperation Handling (Tug-of-war) (Play invitation) Greeting	Distance-play Sudden appearance Ghosts Aggression (Avoidance)
	Distance-play	Metallic noise Tug-of-war Play invitation Interest Grabbing	Remaining avoidance (-) Exploration		Distance-play Ghosts	Aggression (Avoidance)
	Play 2	Ghosts				
	Play 1	Interest Grabbing Tug-of-war Interest Grabbing	Startle reaction (-) Exploration Remaining avoidance (-) Startle reaction (-) Exploration	Chase Following 1 Grabbing 1 Following 2 Grabbing 2	Social contact Greetings Cooperation Handling (Tug-of-war) (Play invitation) Greeting	Distance-play Sudden appearance Ghosts Aggression (Avoidance)
	Distance-play	Metallic noise Tug-of-war Play invitation Interest Grabbing	Remaining avoidance (-) Exploration		Distance-play Ghosts	Aggression (Avoidance)
	Play 2	Ghosts				

Group 6: Scent hounds and related breeds, <i>N</i> = 383	Play 1	Interest Grabbing	Sudden appearance	Startle reaction (-)	Chase	Following 1 Grabbing 1	Social contact (Cooperation) (Handling)	Distance-play	(Interest) Aggression	
		Tug-of-war Interest Grabbing	Metallic noise	Remaining avoidance (-)		Following 2 Grabbing 2	Distance-play Tug-of-war Play invitation	Sudden appearance Ghosts	Aggression Aggression Attention	
	Play 2		Chaos	Remaining avoidance (-)						
				Exploration (Greeting)						
Group 7: ^{a,b} Pointers, <i>N</i> = 92	Play 1	Interest Grabbing	Sudden appearance	Startle reaction (-)	Chase	Following 1 Grabbing 1	Social contact Greetings	Distance-play	Interest	
		Tug-of-war Interest Grabbing	Metallic noise	Remaining avoidance (-)		Following 2 Grabbing 2	Cooperation Handling Greeting	Sudden appearance Ghosts	Aggression Aggression Attention (Avoidance) Exploration (-)	
	Play 2		Chaos	Remaining avoidance (-)						
				Exploration						
Group 8: ^c Retrievers, Water Dogs and Flushing dogs, <i>N</i> = 1295	Social contact	Greetings Cooperation	Sudden appearance	Startle reaction (-)	Chase	Following 1 Grabbing 1		Distance-play	(Aggression) (Aggression)	
		Handling Interest Grabbing	Metallic noise	Remaining avoidance (-)		Following 2 Grabbing 2		Sudden appearance Ghosts	Aggression Attention	
	Play 1		Chaos	Remaining avoidance (-)						
				Exploration (Avoidance -)						
	Distance-play	Tug-of-war	Ghosts	Exploration						
		Tug-of-war Play invitation								
Play 2		Interest Grabbing	Sudden appearance	Startle reaction (-)	Chase	Following 1 Grabbing 1		Distance-play	(Aggression) (Aggression)	
			Metallic noise	Remaining avoidance (-)		Following 2 Grabbing 2		Sudden appearance Ghosts	Aggression Attention	
Group 9: ^a Companions and Toys, <i>N</i> = 137	Play 1	Interest Grabbing	Sudden appearance	Startle reaction (-)	Chase	Following 1 Grabbing 1	Social contact Greetings	Distance-play	Aggression	
		Tug-of-war Interest (Tug-of-war) (Play invitation)	Metallic noise	Remaining avoidance (-)		Following 2 Grabbing 2	Cooperation Handling Greeting	Sudden appearance Ghosts	Aggression Attention	
	Distance-play		Chaos	Remaining avoidance (-)						
				Exploration						
	Play 2		Interest Grabbing	Sudden appearance	Startle reaction (-)	Chase	Following 1 Grabbing 1	Social contact Greetings	Distance-play	Aggression
				Metallic noise	Remaining avoidance (-)		Following 2 Grabbing 2	Cooperation Handling Greeting	Sudden appearance Ghosts	Aggression Attention
		Chaos	Remaining avoidance (-)							
		Exploration								

All variables with relevant loadings are presented (loadings >0.40 without brackets, loadings close to 0.40 (>0.35) are put in brackets). Variables with negative relevant loadings are marked with (-).

^a In these groups, the variables exploration, tug-of-war and play invitation in subtest Distance-play formed a separate factor.

^b In this group, the variables Activity (Passive situation), Remaining approach (Sudden appearance and Metallic Noise) and Greeting (Ghosts) formed a separate factor.

^c In this group, the variables from subtest Social contact loaded on the same factor as the play-variables (here presented as factor "Playfulness").

and different from the original analysis, variable Ghost–Avoidance loaded high, and negatively, in four breed groups, and variable Ghost–Greeting loaded high in one group. A similar slightly heterogeneous pattern was found for the factor Aggressiveness. The Aggression variables from subtests Sudden appearance and Ghosts had high loadings in all groups. The Aggression variable in the subtest Distance–play, as well as the variable Attention from subtest Ghosts were highly or moderately loaded in seven of the eight breed groups. Different from the pattern found in the original analysis, the variable Ghost–Avoidance loaded on this factor in two groups (Primitive dogs and Pointers), and the variable exploration from the Ghost subtest loaded high and negative in one breed group (Pointers).

In the original analysis, three variables from subtest Distance–play (exploration, tug-of-war and play invitation) had high loadings on both factor “Playfulness” and “Sociability”, which indicates that these variables measure something that is influenced by the dog’s degree of playfulness and interest in strangers. These further analyses confirm that the three Distance–play variables represent a tendency in the dogs that is related to both “Playfulness” and “Sociability”, but are also slightly separated from these two dimensions. In all breed groups but one the two factors “Playfulness” and “Sociability” are found, whereas the three Distance–play variables are in different breed groups differently related to the two factors. Three patterns were found: (1) the Distance–play variables loads higher on “Playfulness” compared to “Sociability” (Sheepdogs, Pinschers, and Primitive dogs), (2) the Distance–play variables load higher on “Sociability” compared to “Playfulness” (Terriers and Scent hounds), and (3) the Distance–play variables form one specific factor—a “Playfulness at distance”-factor—besides the factors “Playfulness” and “Sociability” (Pointers and Companion dogs). In breed group Retrievers a more unique pattern was found. The factor “Playfulness”—including the variables from subtest Distance–play—and factor “Sociability” were here merged into one major “Sociability–Playfulness”-factor. Together with a factor found in Pointers, with high loadings from the variables Remaining interest (Sudden Appearance and Metallic noise) and Activity (Passive situation), this factor is the only one in the analyses within breed groups that has no counterpart in the original analysis.

In summary, even though the pattern of loadings varied slightly between breed groups, the five factors found in the original analysis, together with a possible sixth factor (“Playfulness at a distance from handler”), were found in all FCI-breed groups that were analysed. In order to see if the relationship between those primary factors in the original analysis is general, second-order factor analyses were carried out within each breed group. These second-order factor analyses revealed one secondary factor in six breed groups (Sheepdogs, Pinschers, Terriers, Scent hounds, Retrievers, and Companion dogs) and two secondary factors in two breed groups (Primitive dogs and Pointers). One major factor with loadings similar to the one found in the original analysis was found in most of the breed groups. In Sheepdogs, Pinschers and Retrievers the pattern of highly loaded primary factors was exactly the same (considering that “Playfulness” and “Sociability” were merged into one factor in Retrievers), and close to it in Terriers and Scent hounds. In these groups “Curiosity/Fearlessness” had loadings close to 0.40 on the secondary factor. In one breed group (Primitive dogs) one factor, compared to what was expected from the original analysis, had low loadings (“Chase-proneness”). In the remaining two breed

groups (Pointers and Companion dogs) two primary factors loaded low or moderately. The loading from each primary factor on the secondary factor/factors is presented in Table 2.

4. Discussion

The results from the factor analyses in this study give evidence for personality traits in dogs with cross-situational stability. Five narrow dimensions have been revealed, which have been labelled “Playfulness”, “Curiosity/Fearlessness”, “Chase-proneness”, “Sociability” and “Aggressiveness”. In addition, one broad personality dimension, which influences behaviour in a range of test situations, is also revealed. This higher-order personality factor correlates positively to playfulness, interest in chase, exploratory behaviour and sociability towards strangers, and negatively to avoidance behaviour. The broad personality dimension do not relate to aggressive behaviour, which is indicated by low correlations between the “Aggressiveness” factor, as well as the behavioural variables representing “Aggressiveness”, and the higher-order factor.

The analyses within breed groups show that the factors are general for dogs, and not due to specific selection pressures in a few dog types. The factors “Curiosity/Fearlessness”, “Chase-proneness” and “Aggressiveness” from the original analysis are found in all eight groups with only small, if any, differences in variable loadings. Also “Sociability” and “Playfulness” are found to be general, with the exception of one breed group—Retrievers, Water dogs and Flushing dogs—where “Playfulness” and “Sociability” are merged into one-dimension. Further, the results suggest that three variables from subtest Distance-play, which measures the dog’s tendency to interact and play with an unfamiliar person at a distance from the handler, form a separate factor that represents a dimension related to both playfulness and sociability. The broad dimension is evident in a similar way as in the original analysis in almost all breed groups. “Aggressiveness” is in all breed groups less related to the broad dimension than the other four primary factors. A major part of the few deviations found in variable loadings and factor structure is found in Pointers and Companion dogs. This could be explained by the few number of dogs in these groups, which can lead to unstable matrixes of correlations.

The data, which this study is based on, are collected in a large number of test situations in different arenas and with several official observers scoring the dogs’ reactions during the tests. Because of the large number of observers and testing arenas used the data are noisy. However, the functionaries were well trained and the test arenas were as standardised as possible in a test like this. There is no reason to believe that there is any systematic variation that influences the results of the study. The relationships between variables, which create factors, could not be caused by variations between test situations. What could be caused by erroneous variation between tests is a larger variation within the dogs behavioural reactions not caused by different personalities or temperaments. Even if this makes the score for individual dogs less reliable, it should not affect the pattern of correlations between variables in such a large sample. However, the low degree of variation explained by the five primary factors, 37%, could possibly be due to variation in test situations.

The primary factors depend to a great extent on the construction of the test, and how the behavioural responses are described in the specific situations. The factor analysis is

sensitive to correlating variables, irrespective of whether they come from different subtests or from a single test situation. Therefore, factors with loadings from only one subtest, as “Chase-proneness”, can be caused by situation specific parameters, and do not necessarily say anything about the generality of the trait. Because of this, it is necessary to be careful with generalisations. However, in support of the validity of the primary factors is the fact that they all, except “Chase-proneness”, are associated with variables from more than one subtest. Factors “Playfulness”, “Curiosity/Fearlessness”, and “Aggressiveness” seem to be general, based on the spread of loadings from at least three subtests for each factor. If the reactions are consistent from one subtest to another, it is likely that the factor, which the variables correlate to, relates to a stable and general personality trait.

Further support for the primary factors found in this study, is that their counterparts have been found in other species. Dimensions similar to the factor “Sociability”—consistent differences in reactions to strangers and handling—have been reported in several mammals, both in domestic species (e.g. horses: Le Scolan et al., 1997) and in captive non-domestic species (e.g. spotted hyenas: Gosling, 1998). Social playfulness, as in factor “Playfulness”, is also something which has been seen as a personality trait, for example in primates (e.g. Hoof, 1973; McGuire et al., 1994). The factor “Curiosity/Fearlessness”, analogue to fearfulness, but inverted, seems to be detectable in many species, as a review by Gosling and John (1999) indicates. They found factors related to Neuroticism, with fear and “nerve stability” as core elements, in nine out of 12 reviewed species. A general tendency of fearfulness, which influences approach and avoidance behaviour in a range of situations has also been found earlier in dogs (Goddard and Beilharz, 1984). The factor “Aggressiveness” has counterparts in dimensions found previously in other species (e.g. cats: Feaver et al., 1986; pigs: Forkman et al., 1995; rhesus monkeys: Bolig et al., 1992) as well as in dogs. Royce (1955) investigated data from five breeds by factor analysis. One of the extracted factors was related to aggressive behaviour in different situations. Goddard and Beilharz (1985) also found consistent tendencies of Aggressiveness in dogs. The last factor, “Chase-proneness”, is the factor with the least correspondence in other animals. This could be due to the specificity of test situation from which all loading variables come from, a situation that is not included in personality tests in animals in general. Another explanation could be that the type of behavioural reactions the factor corresponds to is species-specific. The running and grabbing of the rag is related to predation, and more specifically the canine way of hunting (Fox, 1969; Coppinger et al., 1987). In the ancestor of the dog, the wolf, there are documented individual differences in killings of living prey (Fox, 1972; MacDonald, 1987). The “Chase-proneness” factor in dogs, which is associated with tendencies to run after and grab an artificial prey, might be analogous to prey killing in wolves.

The higher-order factor, which relates to playfulness, exploration, interest in chase and sociability, indicates that to a great extent it is one single dimension that influences the dogs’ behaviour during the whole test. There are previous studies that indicate the existence of a similar major behavioural dimension in dogs. Brace (1961) (in Scott and Fuller, 1965) found one general behavioural dimension related to activity in several test situations and performance in different intelligence and problem-solving tests. This dimension, which was labelled “Activity-success”, ranged from “. . . general good performance and active, confident, behaviour. . .” to “. . . timidity, or fear, particularly of

strange apparatus but also involving some fear of human beings..." (Scott and Fuller, 1965, pp. 374–375). Similarly to the results in the present study, this behavioural dimension was unrelated to aggressive behaviour.

Goddard and Beilharz (1985) reported a similar result when they described the social behaviour of dogs in different situations. Two principal components were extracted from the variables describing the dog's behaviour in the interaction with the test-dogs. The factors were labelled Confidence and Aggression-dominance, respectively. The factor Confidence had high positive loadings for approach, social exploration, high tail position and tail wagging, while biting was negatively correlated to this factor. The other factor was correlated with behaviour related to dominant behaviour: high tail position in combination with lack of tail wagging, and aggressive behaviour as raised hackles and bites. These results can be combined with an earlier study by the same authors (Goddard and Beilharz, 1984), in which the same dog's fearfulness in other situations was investigated. Three fear-related factors were correlated (inversely) to the factor Confidence, but not to the factor Aggression-dominance, which indicates that dogs that show low confidence when meeting unknown dogs are generally fearful.

The results from previous studies supports the finding in the present study of a broad personality dimension general in different types and breeds of dogs. This indicates that this trait has survived differences in selection pressures during the domestication. Also in the ancestor of the dog, the wolf (*Canis lupus*), a similar major behavioural dimension has been found. A close relationship between reactivity, exploration and prey-killing ability in 7.5–9 weeks old wolves was reported by Fox (1972). The most fearless pups, in response to different novel stimulus, were also more exploratory, dominant, and showed less hesitation to kill in a prey-situation with live rats, compared to more fearful individuals. Interestingly, the scores collected at young age correlated well with dominance rank at one year of age. Fox's results are, at least in parts, supported by results from another wolf study by MacDonald (1987). The similarity between this behavioural dimension found in wolves and the broad dimension revealed in dogs indicates that the two-dimensions are analogous. This, in turn, suggests that the dimension is evolutionarily stable, and originates from before domestication of the dog took place.

Such broad dimensions have also been detected in other species, and might be analogous to the boldness–shyness continuum. This dimension has been found in humans (Kagan et al., 1988), related to the supertraits Extraversion and Neuroticism (Zuckerman, 1991; Matthews and Deary, 1998), and in a range of other species from different taxa (reviewed in Wilson et al., 1994). The characteristics of the broad dimension found in this study is largely in agreement with the general description of the axis: Shy individuals are generally cautious, timid and evasive in novel situations—both in social and in non-social situations—while bolder individuals are more spontaneous, social, and exploratory.

5. Conclusion

Our results give evidence for the existence of a five narrow personality traits in the domestic dog—"Playfulness", "Curiosity/Fearlessness", "Chase-proneness", "Sociability" and "Aggressiveness"—and a broad personality dimension that relates to all narrow

traits with the exception of “Aggressiveness”. Interestingly, the broad dimension, which is supported by earlier studies in dogs, can be detected in a single test session. The dimension has similarities with major personality traits found in other studies. One of them is the shyness–boldness continuum, which could be seen as a combination of the two supertraits Extraversion and Neuroticism. The results of this study can be used for a better description and comparison of individual dogs and breeds. This, in turn, can be useful for selecting individual dogs for specific purposes, e.g. service dogs and suitable breeding dogs. It is also possible that the test result, which gives the dogs score on each of the five factors, can predict behaviour in other situations. This could make the test useful for prediction, and prevention, of different behavioural problems, like aggression towards humans and other dogs.

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A comparison of behaviour in test and in everyday life: evidence of three consistent boldness-related personality traits in dogs

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Abstract

Six specific personality traits – playfulness, chase-proneness, curiosity/fearlessness, sociability, aggressiveness, and distance-playfulness – and a broad boldness dimension have been suggested for dogs in previous studies based on data collected in a standardized behavioural test (“dog mentality assessment”, DMA). In the present study I investigated the validity of the specific traits for predicting typical behaviour in everyday life. A questionnaire with items describing the dog’s typical behaviour in a range of situations was sent to owners of dogs that had carried out the DMA behavioural test 1–2 years earlier. Of the questionnaires that were sent out 697 were returned, corresponding to a response rate of 73.3%. Based on factor analyses on the questionnaire data, behavioural factors in everyday life were suggested to correspond to the specific personality traits from the DMA. Correlation analyses suggested construct validity for the traits playfulness, curiosity/fearlessness, sociability, and distance-playfulness. Chase-proneness, which I expected to be related to predatory behaviour in everyday life, was instead related to human-directed play interest and non-social fear. Aggressiveness was the only trait from the DMA with low association to all of the behavioural factors from the questionnaire. The results suggest that three components of dog personality are measured in the DMA: (1) interest in playing with humans; (2) attitude towards strangers (interest in, fear of, and aggression towards); and (3) non-social fearfulness. These three components correspond to the traits playfulness, sociability, and curiosity/fearlessness, respectively, all of which were found to be related to a higher-order shyness–boldness dimension.

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Chase-proneness and distance-playfulness seem to be mixed measures of these personality components, and are not related to any additional components. Since the time between the behavioural test and the questionnaire was 1–2 years, the results indicate long-term consistency of the personality components. Based on these results, the DMA seems to be useful in predicting behavioural problems that are related to social and non-social fear, but not in predicting other potential behavioural problems. However, considering this limitation, the test seems to validly assess important aspects of dog personality, which supports the use of the test as an instrument in dog breeding and in selection of individual dogs for different purposes.

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Keywords: Dogs; Personality; Temperament; Boldness; Aggression; Validity; Questionnaire; CBARQ

1. Introduction

The study of temperament, or personality, in animals has during the last few decades generated several personality constructs, which have been found useful in explaining individual behavioural differences. Aggressiveness, fearfulness, and boldness are examples of traits that have been suggested for a range of animal species (e.g. Wilson et al., 1994; Boissy, 1995; Gosling and John, 1999). Two requirements that should be met regarding personality constructs, as for all behavioural measures, are reliability and validity (Martin and Bateson, 1993; Gosling, 2001). Reliability refers to the repeatability and consistency of the measurement, whereas validity concerns how accurately an instrument measures what it is meant to measure, and how well it provides information that is relevant for the questions asked (Martin and Bateson, 1993). Within human personality research, where the study of personality traits has a long tradition, reliability and validity are criteria that must be satisfactorily met for any trait to be considered relevant (Matthews and Deary, 1998). In the study of animal personality on the other hand, these requirements have been assessed for only a few trait constructs and species, at least when behaviour-coding methods have been used (Gosling, 2001).

Behavioural tests are, besides ratings and behavioural observations in natural situations, a common approach in animal personality research. The advantages of this method are the possibility to study the animal's responses to environmental challenges and to control the situation (Manteca and Deag, 1993). Personality constructs from behavioural tests – often suggested from data reduction methods such as factorial analyses – can be validated by correlation with external and independent measures. One way of doing this is to test for correlations between behaviour in different tests. Fearfulness, for example, is one construct that has been validated by this methodology (e.g. Jones, 1988; Boissy and Bouissou, 1995; Durr and Smith, 1997). However, the controlled test situation might be inappropriate, resulting in abnormal and maladaptive behaviour, which is specific to the test situation (Boissy, 1995; Timberlake, 1997). To avoid this, it is of major importance to validate test results with information on the animal's behaviour in its home environment. Furthermore, knowledge of how trait constructs in animals are related to outcomes in the “real world” is necessary for the understanding of the evolution of animal personality. It is also of great importance for applied reasons in domesticated species and zoo animals.

Related to the evolution of personality traits, a few studies have investigated the relationship between personality assessments and life history traits, such as reproductive success, in wild-living species. For example, Armitage (1986) investigated the validity of personality constructs from mirror image stimulation in trapped yellow-bellied marmots using measures of social behaviour and lifetime reproductive success, although without finding any significant correlations. A similar approach was used for wild bighorn ewes in a study by Réale et al. (2000), who found some correlations between boldness in a trapping situation and measures of reproductive success. There are also some studies where assessments of individual differences have been validated against behavioural data in zoo animals. For example, ratings of assertiveness in spotted hyena have been found to correlate with dominance status (Gosling, 1998), and assessments of sociability and confidence were found to correlate with measures of affiliative and aggressive behaviour, respectively, in a study of rhesus macaques (Capitanio, 1999).

Validation of personality traits against behavioural data from the home environment has also been done in farm animals (i.e. sheep: Syme, 1981; cattle: Schrader, 2002; pigs: Thodberg et al., 2002). However, when it comes to constructs suggested for companion species, such as cats and dogs, there are problems associated with this validation methodology. The cause for this is the highly specific home environment that each individual lives in, which creates insurmountable obstacles if a construct is to be validated by behavioural observations in each animal's home environment. This is a paradox, considering the general suitability of companion animals in the study of animal personality due to their availability, variability and population sizes, as well as for the applied importance. Thus, other methods than direct observation have to be used to collect information about the pet animal's behaviour in the home environment. One such is the use of the owners or carers knowledge of the animal's typical behaviour, collected by interview or in a questionnaire. This method is frequently used in human personality research, where judgements made by informants well acquainted with the subject, like friends or parents, are used to describe the person's characteristic behaviour (i.e. Kolar et al., 1996; Halverson et al., 2003). The use of questionnaires in behavioural studies of companion animals, where the owner assesses the animal's typical behaviour in relevant situations, seems to be more and more common. Especially in studies of dog behaviour, this trend is pronounced. For example, questionnaires have been used during the latest years to evaluate dog temperament (Goodloe and Borchelt, 1998; Serpell and Hsu, 2001), describe dog-owner relationship (Topal et al., 1997; Rooney et al., 2000), evaluate training methods (Hiby et al., 2004), investigate behavioural problems in dogs (Overall et al., 2001; Guy et al., 2001; Kobelt et al., 2003) and to study breed-typical behaviour (Bradshaw and Goodwin, 1999). Even though this method of data collecting has grown in popularity, the use of questionnaires has some inherent problems. One such is the large number of observers, which may bias the data. Therefore, it is of great importance that questionnaires used are examined regarding reliability and validity. Fortunately, these issues have, at least in some studies, been addressed and considered, resulting in a critical use of questionnaires that have yielded important knowledge of dog behaviour (e.g. Serpell and Hsu, 2001; Sheppard and Mills, 2002; Hsu and Serpell, 2003; Gosling et al., 2003). Thus, the use of questionnaires, where the owner or the carer assesses the typical behaviour of the animal in specific situations, may be a useful method in investigations of how personality is expressed in the companion animal's home environments.

A previous study based on data from a standardized behavioural test (“dog mentality assessment”, DMA) has suggested five or six specific personality traits in addition to one broad higher-order trait – interpreted as a shyness–boldness dimension – in dogs (Svartberg and Forkman, 2002). Results from a study where 40 dogs carried out the test three times (one month between the tests) showed high test-retest reliability for all of the traits, with correlations between 0.57 and 0.90 (Svartberg et al., in press). The shyness–boldness continuum has been found to be valid for working dogs, according to results showing positive correlations between boldness and success in working dog trials (Svartberg, 2002). However, the standardized behavioural test is also used as an instrument in assessing pet dog personality, which makes a validation of the traits against behavioural data from the dogs’ home environments important.

In the present study, the construct validity of the six specific personality traits found in the DMA is investigated by using a questionnaire that was sent to owners of dogs that had previously carried out the behavioural test. The questionnaire was a Swedish version of a questionnaire developed at the University of Pennsylvania—CBARQ (Hsu and Serpell, 2003), with the addition of items covering social and playful behaviour. To test for the construct validity of the personality traits, the dogs’ trait scores from the behavioural test were correlated with the corresponding typical behavioural reactions from the questionnaire. Besides investigating the validity of the traits, the relationship between the personality traits and different potential behavioural problems was investigated.

2. Methods

2.1. *Subjects and procedure*

The subjects of the present study were chosen from a large number of dogs that had carried out a standardized behavioural test for dogs, the “dog mentality assessment”, which is given and organized by the Swedish Working Dog Association (SWDA). Data was collected for dogs that had carried out the behavioural test during the last year (24 September 2000 to 23 September 2001), and were between 12 and 24 months of age when the test was carried out. The database included 16 breeds with data from 50 dogs or more, and 10 breeds with at least 70 dogs. In order to avoid breed-specific biases, seventy dogs were randomly sampled from each of the 10 breeds with at least that number of dogs tested, and all dogs were included in the sample from the six other breeds with at least 50 tested dogs.

The dog-owners’ addresses were obtained from the Swedish dog-owner register, with kind help from the Swedish Kennel Club (permission for the use of the owner register was given from the Swedish Board of Agriculture). However, due to missing addresses and owners living outside of Sweden (this was regarded as disqualifying because of possible language problems with the questionnaire), the questionnaire was for some of the 16 breeds sent to less than 50 dog-owners. In total, the questionnaire was sent to 981 owners. Twenty-nine dogs were excluded for different reasons (unknown addressee, dog reported dead, or dog reported to have a new owner). Within three months, questionnaires for 697 dogs were

answered by the owners and returned in the pre-paid return envelope. This corresponded to a general response rate of 73.3%. The response rate for the breeds ranged from 50.0 to 89.8%. In the sample were 50.5% males and 49.5% females. The age of these 697 dogs when they carried out the behavioural test ranged from 368 to 729 days (average 501.4 days, S.D. = ± 77.0). The time between the behavioural test and the sending of the questionnaire ranged from 352 to 716 days (average 521.1 days, S.D. = ± 121.1). The numbers of dogs per breed, sex ratios and return ratios are presented in Table 1.

2.2. The behavioural test

The behavioural test used in this study (DMA) was developed by the Swedish Working Dog Association as a tool in dog breeding, in which the behaviour of parents, as well as the progeny, can be tested (Fält, 1997a, 1997b). The test is now used for other breeds than working dog breeds, and has in many breed clubs in Sweden become a general behavioural test, in which the dog's reactions to a range of different stimuli are described.

The test consisted of 10 subtests (described below), which were carried out consecutively without any breaks except for the time it took to move from the station of one subtest to the next. The owner of the dog (handler) accompanied the dog during the test. A test-leader informed the handler how to act before the test, and guided the handler through the test. The dogs' behavioural reactions were scored by one authorized observer

Table 1
A presentation of the sample used in the study, with breeds, number of dogs per breed and sex ratios

Breed	Questionnaires				Males %
	Sent out		Returned		
	N	Missing ^a N	N	%	
Australian Shepherd	52		38	73.1	52.6
Belgian Malinois	42		23	54.8	52.2
Belgian Tervuren	70		55	78.6	49.1
Briard	55		43	78.2	55.8
Collie (rough)	70	2	53	77.9	58.5
Bernese Mountain Dog	70	2	52	76.5	59.6
Boxer	70	2	43	63.2	41.9
Dobermann Pinscher	68	4	41	64.1	58.5
Flat-coated Retriever	46		40	87.0	57.5
German Shepherd	69	4	41	63.1	53.7
Giant Schnauzer	70	4	52	78.9	46.2
Golden Retriever	60	1	53	89.8	45.3
Hovawart	70	2	54	79.4	50.0
Irish Soft Coated Wheaten Terrier	55	1	43	79.6	41.9
Rhodesian Ridgeback	43	2	31	75.6	45.2
Rottweiler	70	5	35	53.8	37.1
Total	980	29	697	73.3	50.5

^a These missing dogs were either reported dead or had new owners, or the questionnaire was returned due to unknown addressee.

for each dog (a total of 119 observers scored the 697 dogs), using a standardized score sheet. The sheet contained scales for 33 pre-defined variables, which were, as far as possible, free from subjective opinions. The variables were scored from 1 to 5 according to the intensity of the reaction, where a low score equalled a low intensity in the dog's behavioural reaction. Besides the test-leader and the observer, two or three assistants were used in each test.¹ The data were collected in 291 behavioural tests (152 test arenas). For a more detailed description of the behavioural test and the behavioural variables, see Svartberg and Forkman (2002).

2.3. The subtests

2.3.1. Social contact

The dog and handler approached a stranger (the test-leader), who greeted the handler and the dog. The test-leader took the leashed dog for a short walk, during which the test-leader stopped and petted the dog. Back with the handler the test-leader made a brief physical examination of the dog (behavioural variables: greeting reaction, cooperation and reaction to physical handling).

2.3.2. Play I

The dog was unleashed, whereafter a rag was thrown between the handler and the test-leader, and further away from the dog. If the dog ran after and caught the rag, the test-leader tried to call the dog back. This was repeated once. After the repetition the dog was invited to play tug-of-war with the test-leader (behavioural variables: interest in playing, intensity in grabbing and interest in playing tug-of-war).

2.3.3. Chase

A rag was fixed to a long cord that was put in a course around 10 small wheels at the ground in a zigzag pattern. By pulling the cord, the rag could rapidly "flee" away from the dog. When the rag started to move the dog was released and could freely run after and bite the rag (which stopped after the tenth wheel). The test was repeated once (behavioural variables: interest in chasing the object and grabbing it in both trials).

2.3.4. Passive situation

The handler and the leashed dog were positioned by the test-leader approximately 10 m from the observer, where they remained during three minutes. The handler was instructed not to make any movements or sounds during the subtest (behavioural variable: activity level during this period).

¹ All functionaries that are involved in the organization of the DMA are trained and certified by the SWDA: assistants in two or three training steps (24–38 h of education), test-leaders in four steps (64 h), and the observer in five steps (94 h). To be certified, all types of functionaries have to pass tests at each level. In the authorization of the observers, tests on inter-observer reliability are included. Ten dogs are scored, and the criterion to pass is a minimum of 72% of the scored variables (239 scores of 330) identical to the scores of a reference observer (the teacher, authorized by the SWDA). A maximum of 25% of the scores (81 of 330) can deviate one step on the five-point scale, and a maximum of 3% of the scores (10 scores of 330) can deviate more than one step. The reference observer, in turn, is supervised during the test by one of a few central reference observers.

2.3.5. *Distance play*

A stranger, dressed in a cape with a hood, moved and crouched several times at a distance (approximately 40 m) from the handler and the leashed dog. Then the assistant unhooded and tossed a rag in the air, and ran a short distance to a hiding place. The dog was then un-leashed, and was free to approach the assistant. If so happened, the assistant played with the dog using the rag, whereafter he was passive for 10 s. The play and passivity was repeated once (behavioural variables: interest in the stranger, aggressive behaviour, exploratory behaviour, interest in playing tug-of-war and play invitations to the stranger).

2.3.6. *Sudden appearance*

A human-like dummy was suddenly pulled up in front of the dog at a distance of 2 m from the dog during a walk (handler and leashed dog). The handler was instructed to release the leash when the dummy was pulled up. Thus, the dog was free to escape from the dummy and/or explore it. If the dog did not approach the dummy by itself, the handler supported the dog according to four successive standardized steps (described in Svartberg and Forkman, 2002) or until the dog had investigated the dummy. Thereafter, handler and dog walked close by the dummy four times (behavioural variables: startle reaction, aggressive behaviour, exploratory behaviour, and remaining avoidance behaviour and approach behaviour during walks).

2.3.7. *Metallic noise*

A chain with large links was dragged over a sheet of corrugated metal at a distance of 2 m from the dog during a walk (handler and leashed dog). Thereafter, the same procedure as in the subtest “Sudden appearance” was carried out (behavioural variables: startle reaction, exploratory behaviour, and remaining avoidance behaviour and approach behaviour during walks).

2.3.8. *Ghosts*

Two strangers that wore white sheets, each with a white plastic bucket over their head (“ghosts”), moved slowly towards the leashed dog and the handler. The distance between the two “ghosts”, who were positioned 25 m from each other, and the dog was at the beginning 20 m (in a triangle pattern). The “ghosts” moved in short intermittent stages towards the dog during approximately 3 min, until they were close to the handler and dog. Thereafter, the dog was released and could freely investigate the assistants, who removed the sheets and buckets when the dog had approached them (behavioural variables: aggressive behaviour, attention towards ghosts, avoidance behaviour, exploratory behaviour and greeting behaviour).

2.3.9. *Play 2*

This subtest was a repetition of the second subtest, play 1, with one exception: the tug-of-war part was excluded (behavioural variables: interest in playing and intensity in grabbing).

2.3.10. *Gunshots*

In this subtest the dog’s reaction to gunshots (from a 9 mm handgun, 25 m) that were fired during activity (handler played with the dog) and passivity (handler and dog were

standing passive) were tested. Two gunshots were fired in each phase (behavioural variable: avoidance reaction).

2.4. Calculation of the trait scores

In a previous study (Svartberg and Forkman, 2002) based on data from a large number of dogs ($N = 15,329$) that had carried out the same behavioural test as the one used in the present study, five specific personality traits and one high-order dimension – “boldness” – were found. The specific traits were labelled “playfulness”, “curiosity/fearlessness”, “chase-proneness”, “sociability”, and “aggressiveness”. They were, together with boldness, found in all breed groups. One more specific trait, “distance-playfulness”, was found in some of the breed groups. The aim of this study was to validate these six suggested specific personality constructs. The first step was to calculate the trait scores. The representative variables (i.e. variables with high loadings on a factor), according to the results in Svartberg and Forkman (2002), were used to calculate the dogs’ trait scores for each of the six specific traits in the present study. For the playfulness score, the variables from subtests “play 1” and “play 2” were used, five variables in total. The curiosity/fearlessness score was based on startle reactions, exploratory behaviour, and avoidance behaviour from the two subtests “sudden appearance” and “metallic noise”, together with the exploration variable in the subtest “ghosts”. The variables describing startle reactions and avoidance behaviour were negatively correlated with this trait. The chase-proneness score was based on the four variables in the subtest “chase”. For the calculation of the sociability score, the three variables in subtest “social contact” were used. The trait score for aggressiveness was based on the variables describing aggressive behaviour in subtests “distance play”, “sudden appearance” and “ghosts”, together with the attention variable in the subtest “ghosts”. The score for the last specific trait – distance-playfulness – was based on exploratory behaviour, interest in playing tug-of-war, and play invitations in the subtest distance play. The dog’s score (1–5) on each variable that represented a trait was standardized (by subtracting the mean and dividing by the standard deviation). The standardized values for the representative variables for each trait were then averaged, creating individual trait scores for the personality traits.

2.5. The questionnaire

The questionnaire used in this study was based on the Canine behavioural assessment and research questionnaire (CBARQ) developed by Dr. James A. Serpell and Dr. Yuying Hsu. The CBARQ was developed based on data from a large number of dogs (Hsu and Serpell, 2003²). A factor analysis suggested that eleven categories of dog behaviour were covered in the questionnaire, which were labelled “stranger-directed aggression”, “owner-directed aggression”, “stranger-directed fear”, “non-social fear”, “dog-directed fear or aggression”, “separation-related behaviour”, “attachment or attention-seeking behaviour”, “trainability”, “chasing”, “excitability”, and “pain sensitivity” (Hsu and Serpell, 2003; the behavioural categories and the representative items in the CBARQ are

² The questionnaire was in Hsu and Serpell (2003) named PennBARQ.

presented in Appendix). The internal consistency of the factors was found to be satisfactory with the exception of “pain sensitivity”, and seven of the factors were found to be valid according to owner-reports of behavioural problems (the first seven of the factors listed above).

It seemed that the CBARQ covered aspects of behaviour that were related to the traits curiosity/fearlessness, chase-proneness and aggressiveness at least, which made a Swedish version of this questionnaire suitable for a validation analysis of these traits. The translation into Swedish was made by the author with help from colleagues, and the intelligibility of the items was tested on a number of Swedish dog-owners before the study. To ensure that the questionnaire should cover behaviour related to playfulness, sociability and distance-playfulness I added 17 items to the translated CBARQ items. In total, there were 122 items in the questionnaire that were divided into nine sections according to behavioural category with a short description of each category (I used a former version of the CBARQ that included a few additional items compared to the version presented in Hsu and Serpell (2003)). These additional items were, however, not analysed in the present study). Seven of the sections were from the CBARQ: Training and obedience (eight items describing the dog’s trainability and tendency to obey commands), Aggression (27 items describing the dog’s aggressive responses such as growling, biting and snapping in different situations), Fear and anxiety (19 items describing signs of fear and anxiety in the dog, such as crouching, freezing, avoidance and escape attempts, in different situations), Separation-related behaviour (nine items describing signs of anxiety and abnormal behaviour in the dog when left alone), Excitability (six items describing the dog’s excitability, such as heightened alertness, barking and over-reactivity, in different situations), Attachment and attention-seeking (seven items describing signs of attachment and attention-seeking in the dog towards the owner and other household members), and Miscellaneous (29 items covering other behavioural responses, such as tendency to chase, interest in own and other animals’ faeces, patterns of urinating and defecation, and signs of stereotypy). In addition, there were two more sections in the questionnaire: playfulness (nine items describing playful behaviour in the dog towards humans and other dogs) and Social contact (eight items describing the dog’s social behaviour towards strangers and unfamiliar dogs, such as greetings and approach behaviour). For each section there was a brief explanation of typical signs of the particular behavioural category that the respondent could use as a guide. The respondents were requested to score the typical behaviour of their dog in the recent past (i.e. the latest 1–2 months).

Two forms of five-point rating scales were used in the different sections in the questionnaire, which allowed for quantitative assessments of the dogs’ typical responses in the described situations. One was a semantic differential-type rating scale (Osgood et al., 1957) used in CBARQ sections aggression, fear and anxiety, and excitability. The owners were asked to rate their dog’s typical behaviour on a scale from 0 to 4, where 0 equalled no signs of the actual behavioural reaction (e.g. “no visible signs of aggression”) and 4 equalled extreme reactions (e.g. “serious aggression: snaps, bites, or attempts to bite”). The other rating scale used included five options, graded “never”, “seldom”, “sometimes”, “usually”, and “always”, referring to a frequency description of the specific reaction (used in the CBARQ sections training and obedience, separation-related behaviour, attachment and attention-seeking, miscellaneous, and in the sections playfulness and social contact).

In the cover letter that followed the questionnaire, the owner was instructed to answer the questions as objectively as possible. The owners were also instructed to avoid spending long time answering the questions, and that the questions were meant to give a rough description of the dog's behaviour rather than a precise one. In the cover letter, nothing was mentioned about the planned analyses on the relationships between test behaviour and the owners' assessments via the questionnaire. Thus, the dog-owners were unaware of the purpose of the study, something that otherwise could have biased the owners' opinions.

The average response rate for the questionnaire items was 97.6% (median 99.4%), and all items that were included in the analysis had a response rate of 92.8% or higher. If there were one or two missing values in the calculation of scores for the questionnaire factors the average of the remaining representative variables – if the number of these were >3 – was used as the dog's factor score. If there were more than two representative variables missing, or if one or two were missing with less than four remaining representative variables, the factor score was not calculated for that dog and factor.

2.6. Statistical analyses

Analyses of data from the CBARQ by Hsu and Serpell (2003) yielded eleven behavioural factors. Based on the results of that study, I calculated summated scales for these factors. This was done by averaging the representative items for each factor in accordance with scale calculation for the CBARQ (James A. Serpell, personal communication). The items in the sections playfulness and Social contact were analysed using common factor analysis. The communalities were estimated by computing the multiple R^2 of the respective variable with all other variables (Hair et al., 1998). Mean substitution was used when data was missing. As the selection criteria for the number of factors extracted, the latent root, or Kaiser, criterion was used (where all factors with eigenvalues >1 are extracted; Hair et al., 1998). The factor solution was rotated using the Varimax normalized rotation method. Scores for each of the factors that the factor analysis yielded were calculated. The average of variables with loadings of 0.50 or higher on each factor, and with low cross-loadings on other factors (<0.30), was used as the factor's score.

The internal consistency of the scales for each questionnaire factor, as well as for the traits from the behavioural test, was examined by calculating the Cronbach's alpha (α). I used Spearman rank order correlation analysis with adjustments for tied ranks for all correlation analyses (the significance level was set to $P < 0.05$). To investigate whether there were any relationships between the personality trait from the DMA, which could indicate a broader personality dimension, I used Spearman rank order correlation analysis and principal component analysis (PCA). The factor solution was rotated using the Varimax normalized rotation method, and factors with eigenvalues >1 were extracted. Adjustments for the large number of correlations in each analysis were done with the standard Bonferroni technique, where the significance level is divided with the number of correlations in the analysis in order to calculate adjusted significance levels ($P = \alpha/k$, where k is the number of correlations; Sokal and Rohlf, 1995). The statistical package used in all analyses was STATISTICATM.

3. Results

3.1. Factor analysis of items covering social and playful behaviour

The factor analysis based on the 17 items that related to social and playful behaviour yielded three factors with eigenvalue >1 , which explained 46.9% of the total variance (Table 2). According to the loadings it seemed that the first factor was related to social interest in and approach behaviour towards unfamiliar adults and children (labelled “stranger-directed interest”). The second factor was related to play behaviour directed to humans, especially object-play, according to the highly loading variables (“human-directed play interest”). The third factor seemed to be related to social and playful behaviour towards other dogs (“dog-directed interest”).

3.2. Internal consistency

The internal consistency of the traits from the behavioural test, as well as of the factors from the questionnaire, was examined by calculating the Cronbach's α for each trait and factor. The α -values for five of the six traits were above 0.7 – playfulness (0.85), chase-proneness (0.82), curiosity/fearlessness (0.74), sociability (0.75) and distance-playfulness (0.87) – which suggests that these traits have an adequate internal consistency (Hair et al., 1998). Aggressiveness had an α -value of 0.56, which suggests a somewhat lower correlation between the representative variables for this trait.

The α -values for the CBARQ factors ranged from 0.60 to 0.84 (see Table 3), with two factors with α -values below 0.7 (“pain sensitivity” and “attachment or attention-seeking

Table 2

The result of a factor analysis of questionnaire item describing the dogs' typical behaviour in playful and social situations that were added to the CBARQ questionnaire

Item	Factor 1	Factor 2	Factor 3
Eager to play with family members	0.06	0.67	0.08
Eager to play with strangers	0.39	0.59	0.11
Retrieves play objects and initiates play	0.02	0.61	0.06
Eager to play with other male dogs	0.12	0.10	0.62
Eager to play with other female dogs	-0.02	0.13	0.63
Enjoys play-wrestling	0.01	0.31	0.23
Quick to respond to other dogs play invitations	0.01	0.22	0.71
Enjoys tug-of-war with familiar persons	-0.05	0.75	0.08
Eager to run after thrown balls	0.02	0.69	0.05
Loves being the center for attention	0.42	0.29	0.11
Greets visiting adults in a friendly manner	0.70	-0.11	0.06
Greets visiting children in a friendly manner	0.72	-0.12	0.07
Greets visiting dogs in a friendly manner	0.27	-0.07	0.53
Eager to approach adults away from home in a friendly manner	0.78	0.16	0.19
Eager to approach children away from home in a friendly manner	0.79	0.10	0.16
Eager to approach dogs away from home in a friendly manner	0.30	0.06	0.65
Enjoys being petted by strangers	0.75	0.12	0.07
Proportion of explained variation (%)	19.4	14.9	12.6

Table 3
The correlations between the personality trait scores from the behavioural test and the factor scores from the questionnaire

Personality trait from test	Factor from the questionnaire													
	SDA ^a	ODA ^a	DDFA ^a	TRAIN ^a	CHASE ^a	SDF ^a	NSF ^a	SRB ^a	PS ^a	EX ^a	AAS ^a	SDI	HDPI	DDI
Playfulness	0.01	-0.01	-0.05	0.20	0.04	-0.15	-0.12	0.05	-0.06	0.06	0.10	0.05	0.36	0.01
Chase-proneness	0.01	0.01	0.03	0.09	<i>0.05</i>	0.09	-0.14	-0.03	-0.03	0.04	0.02	0.06	0.22	0.01
Curiosity/fearlessness	0.03	0.05	-0.05	0.03	0.02	-0.16	-0.26	-0.01	0.01	0.01	0.06	0.08	0.14	0.05
Sociability	-0.21	0.03	-0.13	0.07	-0.05	-0.27	-0.07	-0.10	-0.12	-0.07	0.01	0.36	0.07	0.12
Aggressiveness	<i>0.12</i>	-0.03	0.06	0.12	0.04	0.04	-0.03	-0.03	-0.04	0.06	0.07	-0.05	0.05	-0.02
Distance-playfulness	-0.14	0.05	-0.05	0.16	0.01	-0.19	-0.17	0.01	-0.07	0.01	0.02	0.16	0.29	0.07
Boldness	-0.10	0.02	-0.13	0.15	-0.01	-0.28	-0.21	-0.03	-0.10	-0.01	0.07	0.25	0.29	0.10
Cronbach α -values	0.84	0.71	0.73	0.70	0.76	0.83	0.71	0.74	0.60	0.75	0.66	0.85	0.79	0.79

Values in italics represent expected significant correlations, whereas coefficients in bold indicate statistically significant correlations at $P < 0.05$ after correction for the number of comparisons. SDA: stranger-directed aggression, ODA: owner-directed aggression, SDF: stranger-directed fear, NSF: non-social fear, DDFA: dog-directed fear or aggression, SRB: separation-related behaviour, AAS: attachment or attention-seeking behaviour, TRAIN: trainability, CHASE: chasing, EX: excitability, PS: pain sensitivity, SDI: stranger-directed interest, HDPI: human-directed play interest, and DDI: dog-directed interest.

^a Indicates factors from the CBARQ (Hsu and Serpell, 2003).

behaviour”). These values are roughly in line, though somewhat lower, with the α -values that were obtained by Hsu and Serpell (2003), and suggest high internal consistency for all factor scores with the exception of the scores for “pain sensitivity” and “attachment/attention-seeking”. The α -values for the remaining three questionnaire factors (“stranger-directed interest”, “human-directed play interest” and “dog-directed interest”) indicated adequate internal consistency (0.79–0.85, see Table 3).

3.3. Validation analysis of the personality traits

Based on similarities between characteristics of the traits and the questionnaire factors, following correlations were expected to be significant (convergent validity):

- Playfulness with “human-directed play interest” (positively).
- Curiosity/fearlessness with “non-social fear” (negatively).
- Chase-proneness with “chasing” (positively).
- Sociability with “stranger-directed fear” (negatively) and “stranger-directed interest” (positively).
- Distance-playfulness with “human-directed play interest” (positively), “stranger-directed fear” (negatively), and “stranger-directed interest” (positively).
- Aggressiveness with “stranger-directed aggression” (positively).

Correlation analyses between trait scores from the behavioural test and corresponding factor scores from the questionnaire were carried out. After adjustments for the large number of comparisons ($k = 84$) the results showed that playfulness, curiosity/fearlessness, sociability, and distance-playfulness correlated significantly with their respective corresponding questionnaire factors (Table 3). In contrast, the correlations that were expected for chase-proneness and aggressiveness were not significant.

Besides the correlations that were expected, significant correlations between trait scores and questionnaire factor scores were found for five of the personality traits (Table 3). Playfulness was positively correlated with “trainability” and negatively with “stranger-directed fear”. Chase-proneness, which did not correlate with its expected corresponding factor “chasing”, was significantly and positively correlated with “human-directed play interest” and negatively with “non-social fear”. Curiosity/fearlessness correlated positively with “human-directed play interest” and negatively with “stranger-directed fear”. Sociability was negatively correlated with “stranger-directed aggression”. Furthermore, distance-playfulness was negatively correlated with “non-social fear” and “stranger-directed aggression”, and positively correlated with “trainability”. A summary over all significant correlations is presented in Table 4.

3.4. Validation analysis of the behavioural test measures describing aggressive behaviour

The results from the correlation analyses showed no relationships between the aggressiveness trait and the dogs’ typical behaviour according to the questionnaire data. This could indicate that the aggressiveness trait does not correspond to the behaviours in

Table 4

A summary of the significant correlations found between questionnaire factor scores and personality trait scores from the behavioural test

Factor from the questionnaire	Personality trait					
	Playfulness	Chase-proneness	Curiosity/fearlessness	Sociability	Distance-playfulness	Boldness
Stranger-directed aggression ^{a,b}				+++	+	
Trainability ^a	++				+	+
Stranger-directed fear ^{a,b}	+		+	+++	++	+++
Non-social fear ^{a,b}		+	+++		++	+++
Stranger-directed interest				++++	+	+++
Human-directed play interest	++++	+++	+		+++	+++

^a Indicates factors from the CBARQ (Hsu and Serpell, 2003).

^b Indicate inverse relationships between traits and questionnaire factor.

+ $R_s \geq 0.14$, $P < 0.05$.

++ $R_s \geq 0.18$, $P < 0.001$.

+++ $R_s \geq 0.21$, $P < 0.001$.

++++ $R_s \geq 0.30$, $P < 0.001$. P -values are adjusted for the number of comparisons (Bonferroni; $P = \alpha/k$; $k = 90$).

the dogs' everyday life covered by the questionnaire. Another possibility, which the low α -value for aggressiveness indicates, is that this trait includes different components of aggressive behaviour. These components could relate separately to different aspects of the dog's typical aggressive behaviour. In order to investigate this further, correlation analyses were carried out between the three aggression variables from the behavioural test that relate to the aggressiveness trait (aggression variables in subtests "distance play", "sudden appearance", and "ghosts") and the three aggression-related questionnaire factors ("stranger-directed aggression", "owner-directed aggression" and "dog-directed fear or aggression"). After adjustments for the number of comparisons ($k = 9$), the aggression variable in subtests "distance play" and "ghosts" were found to correlate significantly and positively with "stranger-directed aggression", although with low correlations coefficients (0.11 and 0.15, respectively; see Table 5). No significant correlations or tendencies were found for the aggression variable in subtest "sudden appearance".

3.5. The shyness–boldness dimension and its correspondence to questionnaire factors

According to the results of Svartberg and Forkman (2002), all specific traits from the DMA with the exception of aggressiveness were related to each other. This indicates that playful, curious, fearless and stranger-friendly behaviour in the test seems to be under influence of a broad personality dimension, interpreted as a shyness–boldness continuum. In order to investigate if this dimension was valid for the present sample, I studied the relationships between the specific traits by principal component analysis. The PCA extracted two components with eigenvalues >1 (Fig. 1). The first component, which

Table 5

The correlations between the variable scores from the behavioural test related to aggressiveness and the scores for the aggression-related questionnaire factors

Variable from test	Factor from questionnaire		
	Stranger-directed aggression	Owner-directed aggression	Dog-directed fear or aggression
Aggression in "distance play"	0.11	-0.05	0.05
Aggression in "sudden appearance"	0.05	-0.02	0.01
Aggression in "ghosts"	0.15	-0.03	0.08

Bold coefficients indicate significance at $P < 0.05$ after adjustment for the number of comparisons (Bonferroni; $P = \alpha/k$; $k = 9$).

explained 36.3% of the total variance, had high loadings from two traits: distance-playfulness and playfulness (0.76). Also chase-proneness, curiosity/fearlessness and sociability had relevant loadings (0.53–0.63) on the first component, whereas aggressiveness had a loading of 0.14. In contrast, aggressiveness was highly loaded on the second component, which explained 17.2% of the total variance, where the other traits all had loadings < 0.40 (Fig. 1). This pattern was supported by the results of a cross-correlation analysis of the specific traits. The mean correlation between the trait score for each trait and the scores for the (other) traits that are presumed to be related to the shyness–

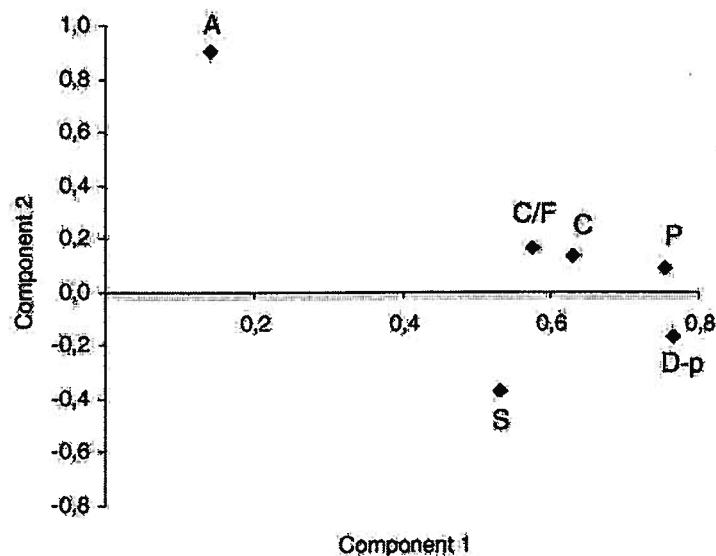


Fig. 1. The result of the principal component analysis of the scores from the six specific personality traits. The first component, which explains 36.3% of the variation, had high or moderate loadings from distance-playfulness (D-p), playfulness (P), chase-proneness (C), curiosity/fearlessness (C/F), and sociability (S). Aggressiveness (A) had low loadings on the first component, but was instead the only trait that loaded high on the second component (explaining 17.2% of the variation).

boldness dimension were 0.35 for distance-playfulness (range 0.29–0.47), 0.32 for playfulness (0.22–0.47), 0.26 for chase-proneness (0.11–0.34), 0.25 for curiosity/fearlessness (0.14–0.31), 0.19 for sociability (0.11–0.29) and 0.06 for aggressiveness (0.02–0.12). Thus, even though sociability seems to be less correlated with the other presumed boldness-traits, it seems that the suggestion by Svartberg and Forkman (2002) of a broad shyness–boldness dimension in the DMA unrelated to aggressiveness is valid also for this sample. Therefore, I calculated a boldness score, by averaging the scores for playfulness, curiosity/fearlessness and sociability, which could be correlated with the factor scores from the questionnaire (the scores for chase-proneness and distance-playfulness were not used due to the results in the present study that indicated that they are mixed measures of playfulness, curiosity/fearlessness and sociability). Using the same significance level as in the analysis of the specific traits, five significant correlations between the boldness score and the questionnaire factor scores were found: “human-directed play interest” (positively), “stranger-directed fear” (negatively), “stranger-directed interest” (positively), “non-social fear” (negatively) and “trainability” (positively; Tables 3 and 4).

4. Discussion

The results from this study suggest that four of the six specific personality traits in dogs previously found in a behavioural test (Svartberg and Forkman, 2002) – playfulness, curiosity/fearlessness, sociability and distance-playfulness – are associated with corresponding behaviour in the dogs’ home environment, which was assessed by the dogs’ owners in a questionnaire. Thus, convergent validity was shown for these traits. The chase-proneness trait was related to play interest and non-social fear in everyday life, and not, as expected, to predatory behaviour. The only trait that had no obvious association with the dogs’ typical behaviour was aggressiveness, even though weak associations were found between two of its representative variables and aggression directed to strangers. The results also indicate discriminant validity. For example, none of the personality traits from the DMA were correlated with separation-related behaviour, predatory behaviour, owner-directed aggression, or any dog-directed behaviour in the home environment. The pattern of correlations in this study suggests that three components in the personality of dogs, all related to a broad boldness dimension, are validly measured in the test—playfulness, behaviour towards strangers, and non-social fear. Furthermore, the results indicate long-term consistency (1–2 years) for these components in adult dogs.

Even though the significant correlations that were found validate all traits with the exception of chase-proneness and aggressiveness, the correlations seem to be relatively low: from 0.14 to 0.36. One cause for this could be the time span between behavioural test and questionnaire. According to previous results in studies on long-term consistency in animals, correlations of behavioural traits over time (1–2 years) rarely exceed 0.45 (Goddard and Beilharz, 1986; Carlstead et al., 1999; Lowe and Bradshaw, 2001; Visser et al., 2001). This implies that even though consistencies in traits are found, some changes over time can be expected. Such changes in behaviour over time may be due to maturation. In a domestic species like the dog, factors such as castration, training and drug therapy may

also cause stable changes in behaviour (e.g. Beaver, 1999; Lindsay, 2001). The relatively low correlations in the present study might indicate that there are some changes over time in the traits studied, even though the correlations also imply that playful, stranger-friendly and fearful behaviour in dogs show long-term consistency in the adult dog.

A second cause for the relatively low correlations is probably the measurement error in the owners' assessments of their dogs. The method used to validate the personality constructs – a questionnaire by which the owner can describe the typical behaviour of their dog – involves nearly as many observers as dogs. This brings variation between different owners and their opinions into the data, which may contribute to the low correlation coefficients (see Lewis, 2001, for a discussion of this issue in human personality research). In addition, the number of test arenas, assistants and observers used in the testing of the dogs may have influenced the correlations. Even though the test was highly standardized and the assistants were well trained, some variation due to this should be expected. In total, considering the time between the test and the questionnaire, and the probable measurement errors, the correlations are not remarkably low. The problem with this is the low statistical power—there might be other relationships between test behaviour and behaviour in the home environment than the ones found in this study.

The lack of correlations between aggression-related questionnaire factors and the aggressiveness trait is notable. This could be due to the relatively low internal consistency for this trait that was found ($\alpha = 0.56$), i.e. that the trait construct has low reliability. However, also on the variable level there were only weak associations found between aggressive behaviour in test and in everyday life. One possible explanation could be that this trait is more difficult to assess by the dog-owners, compared to other aspects of dog behaviour. However, the factors that were related to aggression in the CBARQ have previously been validated against data from clinical behavioural problems (Hsu and Serpell, 2003). This indicates that these CBARQ factors are reliable in measuring the dog's tendency to be aggressive, at least towards strangers, the owner, and other dogs. Another possible explanation is that aggressiveness in dogs is less consistent than the other traits investigated in this study. Results from a study by Goddard and Beilharz (1985) give some support for this. They reported that dominance-related aggression was less stable in dogs from age 6 months to 12–18 months, compared to "confidence", a measure of dog-related fearfulness. However, in the results from a study on the test-retest reliability and short-time consistency (2 months) of the investigated personality traits, the aggressiveness trait was as consistently measured as the other specific traits (Svartberg et al., in press). If the low association between the aggressiveness trait and the owners' reports of the dogs' typical behaviour is not due to measurement errors or low consistency, the cause is probably found in the nature of the aggressive behaviour observed in the test. It is possible that the aggressiveness trait is related to the first exposure of aggression-eliciting stimuli. Repetitions of the DMA have shown that, even though the rank-order consistency is high, the aggressiveness scores in general drop significantly from tests 1 to 2 (Svartberg et al., in press). This may indicate that the trait aggressiveness is a measurement of aggression towards novel stimuli – a "first time-aggression" – that was not covered by the items in the questionnaire.

According to the correlations found (summarized in Table 3) the sociability trait is related to the dog's attitude towards unfamiliar humans, and seems to describe a continuum

from fear of being close to and approached by strangers, to social boldness and friendliness. Corresponding traits have been reported in several animal species, both domesticated (Belyaev, 1979; Hansen, 1996; Thodberg et al., 1999; Grignard et al., 2001; Lowe and Bradshaw, 2001) and non-domesticated species in captivity (Gosling, 1998; Carlstead et al., 1999), as well as in humans (Kagan et al., 1988). Similar dimensions have also been described previously in dogs (Royce, 1955). However, there is also a component of aggression in the sociability trait according to the present results, which is negatively related to social interest and positively related to fear of strangers. Fear related aggression has been found to be one of the most common types of behavioural problems in dogs (Beaver, 1999). In contrast, there are relatively few results from studies of dog personality or temperament where positive relationships between social shyness and aggressiveness are reported. Goddard and Beilharz (1984, 1985) reported that fearfulness and aggressiveness were independent traits, which is supported by results from studies on breed or strain differences in behaviour (Thorne, 1944; Scott and Fuller, 1965; Murphree et al., 1969). Royce (1955) found a relationship between fear and aggression, but this relationship was negative. It should be noted, however, that Hsu and Serpell (2003) reported finding that questionnaire items relating to sociability loaded negatively on both stranger-directed fear and stranger-directed aggression CBARQ factors.

The trait curiosity/fearlessness is mostly associated with the CBARQ factor “non-social fear”. This factor is related to fear of novel non-social stimuli in general, but also to fearful behaviour when exposed to heavy traffic and thunderstorms (see Appendix). This suggests that curiosity/fearlessness is a measure of general non-social fearfulness in novel situations, which also seems to indicate a tendency to develop certain phobias. This tendency to behave fearfully is also to some degree expressed in social situations, which the correlations to “stranger-directed fear” and “human-directed play interest” indicate. Similar relationships have been found previously in dogs (Brace, 1961, in Scott and Fuller, 1965; Murphree et al., 1969; Goddard and Beilharz, 1984, 1985).

Playfulness seems to be a measure of the dog's interest in playing with humans, especially with objects such as balls and rags, including pursuit and retrieval. No relationships with playful behaviour towards conspecifics were found suggesting that the play interest measured in the trait playfulness is restricted to play with humans. Play is a characteristic behaviour in the domestic dog, often directed towards the owner (e.g. Stallones et al., 1988). In contrast, there are few reports on playfulness as a trait in dogs. One exception is a study by Goodloe and Borchelt (1998) based on data from a questionnaire similar to the one used in the present study where three different owner-related play factors were found. There are some reports on playfulness in primates, but mostly regarding play with conspecifics (Bolig et al., 1992; McGuire et al., 1994; Capitanio, 1999). These traits may be analogous to the playfulness trait in this study, considering that pet dogs are socialized to humans, and may see us as conspecifics in this respect (Rooney et al., 2001). The present results, together with previous studies (Svartberg, 2002; Svartberg and Forkman, 2002; Svartberg et al., in press), suggest that the tendency to play with humans can be regarded as a personality trait in dogs.

The remaining two specific traits that were correlated with the dogs' typical behaviour in every day life – chase-proneness and distance-playfulness – seem to be mixed measures of components of dog personality that are more specifically captured by the traits

sociability, curiosity/fearlessness and playfulness. Chase-proneness seems to be influenced by the dog's interest in playing with objects and its degree of non-social fearfulness. Distance-playfulness seems to be a mix of different tendencies, which was suggested in Svartberg and Forkman (2002) based on the results of the factor analyses in that study. This implies that three components of dog personality may be validly measured in the DMA: (1) interest in playing with humans (playfulness); (2) attitude towards strangers (interest in, fear of and aggression towards; sociability); and (3) non-social fearfulness (curiosity/fearlessness). According to the present results that show inter-correlations between playfulness, sociability and curiosity/fearlessness, these components seem to be facets of the higher-order boldness dimension that were suggested in Svartberg and Forkman (2002). Thus, the boldness dimension seems to be related to fearlessness and confidence in a range of situations. A similar dimension has been suggested previously in dogs (Brace, 1961, in Scott and Fuller, 1965) and in other species (Wilson et al., 1994). One question that may be addressed is whether this dimension is analogous to any of the human supertraits. It includes behavioural reactions as exploration, sociability and playfulness, which in animals have been interpreted in terms of the human supertrait extraversion (Gosling and John, 1999). The boldness dimension also relates (negatively) to inhibition and avoidance, which are reactions associated with neuroticism in animals (Zuckerman, 1991; Gosling and John, 1999). A possible explanation is that these two human traits do exist in dogs as well, but that they are correlated with each other. Interestingly, it seems that the two traits also correlate in human adults to some degree. For example, a mean correlation of -0.27 between extraversion and neuroticism was found in a comparison between three questionnaires that are used to measure the five major supertraits (John and Sristava, 1999). Suggestions have been made that this relationship indicates a shyness–boldness dimension in humans, which runs from neurotic-introversion to stable extraversion (Kagan et al., 1988; Zuckerman, 1991; Matthews and Deary, 1998). This view implies that the shyness dimension found in children serves as a base for neuroticism or extraversion, or both, in adulthood. However, the suggestion that extraversion and neuroticism are correlated in humans is far from generally accepted (e.g. John and Sristava, 1999), and there are recent results that suggest that these personality traits are independent in dogs (Sheppard and Mills, 2002; Gosling et al., 2003). Thus, further studies are needed to elucidate the structure of and the relationships between the basic personality dimensions in dogs.

In a previous study (Svartberg, 2002), a positive relationship was found between the broad boldness dimension and success in working dog trials. The results suggested that boldness may predispose the dog to success in training situations in general, and not to a specific task or ability. This relationship is supported by other results, which indicate that confident and fearless behaviour in dogs is related to success in several different training tasks (Scott and Fuller, 1965). In the present study, the CBARQ factor “trainability” was correlated with two traits from the DMA: playfulness and distance-playfulness. No significant correlations were found between “trainability” and the three other boldness-related specific traits curiosity/fearlessness, chase-proneness and sociability. This indicates that a playful attitude may be more important in training situations than a stranger-friendly and fearless attitude. A plausible explanation is that play can be used as an efficient

reinforcer in dog training, especially for dogs with a playful personality. However, an examination of the items that are related to the CBARQ factor “trainability” indicates that it mostly describes the dog’s trainability in obedience situations close to its owner (see Appendix). Trainability in complex tasks, like problem-solving, or tasks that require performance independently from its owner is not covered in “trainability”. Thus, it is possible that social and non-social fearlessness may be more important when a dog is trained to perform in working dog trials, which, besides obedience tasks, involve tasks like tracking, searching for hidden persons and running long distances far from the owner or handler.

According to the present results the behavioural test can be used to predict social fearfulness, non-social fearfulness related to novelty and a tendency to develop certain phobias, and to some degree fear-related aggression towards unfamiliar humans. These are common sources of problems for pet owners, and for the dog itself (e.g. Beaver, 1999; Lindsay, 2001). However, other behaviour that can cause problems for dogs and owners that was included among the CBARQ factors – separation distress, excessive excitability, owner-directed aggression, and inappropriate chasing – are not related to any of the traits measured in the behavioural test. This can be compared with a study of van der Borg et al. (1991), who used a behavioural test to successfully predict future behavioural problems like pulling on leash, play-aggression, jumping up and mounting at people, disobedience, separation anxiety, and aggression over food. However, the behavioural test used in van der Borg et al. (1991) was to a higher degree developed for predictions of behavioural problems. It is possible that the DMA can be similarly successful in predicting behavioural problems other than fear- and aggression-related, if subtests corresponding to the behavioural problems that are to be predicted are added.

5. Conclusions

The present results suggest that the DMA is a useful instrument in describing three components of a dog’s personality that are expressed in everyday life, which all are related to a broad boldness dimension: (1) attitude towards strangers – interest in, fear of, and aggression towards – measured in the trait sociability; (2) non-social fearfulness measured in the trait curiosity/fearlessness; and (3) interest in playing with humans, measured in the trait playfulness. The results suggest that the two traits chase-proneness and distance-playfulness are mixed measures of these components, and are not associated with any additional aspect of the dog’s personality. The aggressiveness trait was not validated by this study, and seems to be a poor predictor of aggressive behaviour in a dog’s everyday life. The present results also validate several of the CBARQ factors, and indicate that this questionnaire reliably captures several important aspects of a pet dog’s personality.

From an applied point of view, these results show that the standardized behavioural test used in this study validly assesses several important aspects of dog personality, as it is expressed in the home environment. Given that these traits are genetically based, as heritability studies suggest (Saetre et al., 2002; Strandberg et al., in press), the behavioural test seems to be a useful tool for breeding of pet dogs. The correlation between playfulness

and trainability, together with previous results that suggests a relationship between boldness and success in working dog trials (Svartberg, 2002), indicate that the DMA may be useful in selection of potential working or service dogs, as well as in breeding of this type of dogs. Furthermore, the results suggest that the test is a potential instrument for the prediction of behavioural problems related to social and non-social fear.

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Appendix

The items and behavioural factors of the CBARQ (from Hsu and Serpell, 2003).

Behavioural factor	Questionnaire item
Stranger-directed aggression	Dog acts aggressively When approached directly by an unfamiliar male adult while being walked or exercised When approached directly by an unfamiliar female adult while being walked or exercised When approached directly by an unfamiliar child while being walked or exercised Toward unfamiliar persons approaching the dog while it is in the owner's car When an unfamiliar person approaches the owner or a member of the owner's family at home When an unfamiliar person approaches the owner or a member of the owner's family away from home When mailmen or other delivery workers approach the home When strangers walk past the home while the dog is in the yard When joggers, cyclists, roller skaters, or skateboarders pass the home while the dog is in the yard Toward unfamiliar persons visiting the home

Appendix (Continued)

Behavioural factor	Questionnaire item
Owner-directed aggression	<p>Dog acts aggressively</p> <p>When verbally corrected or punished by a member of the household</p> <p>When toys, bones, or other objects are taken away by a member of the household</p> <p>When bathed or groomed by a member of the household</p> <p>When approached directly by a member of the household while it is eating</p> <p>When food is taken away by a member of the household</p> <p>When stared at directly by a member of the household</p> <p>when stepped over by a member of the household</p> <p>When a member of the household retrieves food or object stolen by the dog</p>
Stranger-directed fear	<p>Dog acts anxious or fearful</p> <p>When approached directly by an unfamiliar male adult while away from the home</p> <p>When approached directly by an unfamiliar female adult while away from the home</p> <p>When approached directly by an unfamiliar child while away from the home</p> <p>When unfamiliar persons visit the home</p>
Non-social fear	<p>Dog acts anxious or fearful</p> <p>In response to sudden or loud noises</p> <p>In heavy traffic</p> <p>In response to strange or unfamiliar objects on or near the sidewalk</p> <p>During thunderstorms</p> <p>When first exposed to unfamiliar situations</p> <p>In response to wind or wind-blown objects</p>
Dog-directed fear or aggression	<p>Dog acts aggressively</p> <p>When approached directly by an unfamiliar male dog while being walked or exercised on a leash</p> <p>When approached directly by an unfamiliar female dog while being walked or exercised on a leash</p> <p>Toward unfamiliar dogs visiting the home</p> <p>Dog acts anxious or fearful</p> <p>When approached by an unfamiliar dog of the same size</p> <p>When approached by an unfamiliar dog of a smaller size</p>

Appendix (Continued)

Behavioural factor	Questionnaire item	
Separation-related behaviour	Dog displays	<p>Shaking, shivering, or trembling when left or about to be left on its own</p> <p>Excessive salivation when left or about to be left on its own</p> <p>Restlessness, agitation, or pacing when left or about to be left on its own</p> <p>Whining when left or about to be left on its own</p> <p>Barking when left or about to be left on its own</p> <p>Howling when left or about to be left on its own</p> <p>Chewing or scratching at doors, floor, windows, and curtains when left or about to be left on its own</p> <p>Loss of appetite when left or about to be left on its own</p>
Attachment or attention seeking behaviour	Dog	<p>Displays a strong attachment for a particular member of the household</p> <p>Tends to follow a member of the household from room to room about the house</p> <p>Tends to sit close or in contact with a member of the household when that individual is sitting down</p> <p>Tends to nudge, nuzzle, or paw a member of the household for attention when that individual is sitting down</p> <p>Becomes agitated when a member of the household shows affection for another person</p> <p>Becomes agitated when a member of the household shows affection for another dog or animal</p>
Trainability	Dog	<p>Returns immediately when called while off leash</p> <p>Obeys a sit command immediately</p> <p>Obeys a stay command immediately</p> <p>Will fetch or attempt to fetch sticks, balls, and other objects</p> <p>Seems to attend to or listen closely to everything the owner say or does</p> <p>Is slow to respond to correction or punishment*</p> <p>Is slow to learn new tricks or tasks*</p> <p>Is easily distracted by interesting sights, sounds, or smells^a</p>

Appendix (Continued)

Behavioural factor	Questionnaire item	
Chasing	Dog	Acts aggressively toward cats, squirrels, and other animals entering the yard Chases cats if given the chance Chases birds if given the chance Chases squirrels and other small animals if given the chance
Excitability	Dog overreacts or is excitable	When a member of the household returns home after a brief absence When playing with a member of the household When the doorbell rings Just before being taken for a walk Just before being taken on a car trip When visitors arrive at its home
Pain sensitivity	Dog acts anxious or fearful	When examined or treated by a veterinarian When having its claws clipped by a household member When groomed or bathed by a household member

^a Indicates negative loading, i.e. a negative correlation between item and behavioural category.

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Sendt: 9. oktober 2009 11:35
Til: Michelle Argir
Cc: Cristina Angela Gulisano
Emne: Svar: SV: Møde om farlige hunde

Kære Michelle,

Jeg kender til to databaser:
En svensk med resultater for mentaltestning af racer:
http://www.genetica.se/mh_data.htm
En amerikansk temperamentsevaluerings-database: <http://www.cbarq.org>

Begge har dannet grundlag for en del forskning i forskelle på hunderacer. Hvis du gerne vil vide mere om det, vil jeg foreslå at kontakte Björn Forkman, lektor i etologi her på KU. Han er involveret i forskningen og kender databaserne (og resultaterne) indgående. Han rejser rundt de næste par uger, men jeg formoder han er tilgængelig på
mail: bjf@life.ku.dk

Stine

>>> "Michelle Argir" <MAR@jm.dk> 09-10-2009 10:59 >>>
Kære Stine

Tak for nedenstående - det noterede jeg mig også.

Den database, hvor man kan se forskelle på racer, som du nævnte på seminaret i går - er den offentligt tilgængelig?

Mvh
Michelle

-----Oprindelig meddelelse-----
Fra: Stine Billeschou Christiansen [mailto:sbc@life.ku.dk]
Sendt: 8. oktober 2009 15:39
Til: Michelle Argir
Cc: Cristina Angela Gulisano
Emne: Møde om farlige hunde

Kære Michelle,

Jeg fik ikke fanget dig efter mødet idag, men ville lige følge op på noget der kom frem og som umiddelbart - i mine øjne - så brugbart ud.

Der blev vist en skala med graduering af hundebid med 6 stadier fra "snappen i luften" til "død". I relation til overvejelserne om, hvornår politiet umiddelbart skal kunne kræve aflivning og hvornår der skal en hundesagkyndig ind over, kunne det måske være en idé at se nærmere på en sådan graduering? Lidt ligesom der ved vurdering af trædepudesvidninger hos fjerkræ og skuldarsår hos søer laves forskellige "handlingsplaner" afhængig af problemets omfang.

Blot et forslag.

Stine

Stine B. Christiansen
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Det Dyreetiske Råd (fgl.sekr.)/The Danish Animal Ethics Council (scient. secr.) Center for Bioetik og Risikovurdering/Centre for Bioethics and Risk Assessment

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Michelle Argir

Fra: jkm@olintern.dk
Sendt: 9. oktober 2009 15:01
Til: Michelle Argir
Cc: Cristina Angela Gulisano
Emne: SV: Svar: SV: Møde om farlige hunde

Prioritet: Høj

Kære Michelle.

Jeg nåede ikke at fange dig, inden du gik til faglig dag.

Jeg er enig med dig i, at spørgsmålet om gradueringen af hundebid (i høj grad) er relevant for det lovforslag, I skal fremsætte sidst på måneden, men næppe for udvalgets delbetænkning.

Mht. raceinddeling er jeg umiddelbart tøvende over for, om der - på dette sene tidspunkt i arbejdet - er behov for at inddrage yderligere faktuelle oplysninger i arbejdet. Tilfører databaserne ikke væsentligt nyt i forhold til, hvad vi allerede ved, synes jeg, at vi skal lade det ligge. Er der tale om nye oplysninger, som rokker ved, hvad vi lægger til grund eller overvejer, må vi dog på den anden side nok overveje at tage det med. På det foreliggende grundlag er det lidt svært for mig at vurdere betydningen af de (evt.) nye oplysninger.

Mvh.
jens

-----Oprindelig meddelelse-----
Fra: Michelle Argir [mailto:MAR@jm.dk]
Sendt: 9. oktober 2009 13:28
Til: jkm@olintern.dk
Cc: Michelle Argir
Emne: VS: Svar: SV: Møde om farlige hunde

Kære Jens

Er nedenstående noget som du synes, at jeg skal gå videre med? Vi har afsnittet om den historiske raceinddeling inspireret fra Irene Jarnveds indlæg og jeg har bedt Pernille Hansen lave et resume af den amerikanske undersøgelse fra 2008, som hun henviste til på sidste møde ("Breed differences in canine aggression", som tidligere er fremsendt til udvalget). Jeg er ikke klar over, om den amerikanske database kunne have noget med den amerikanske undersøgelse at gøre.

Jeg er lidt i tvivl om, hvorvidt vi behøver yderligere eller om jeg skal kontakte Bjørn Forkman for at få ham til at sige noget generelt raceforskelle?

Hvad synes du?

For så vidt angår gradueringen af hundebid, så regner jeg med, at det er mere relevant i forhold til definitionen af skambidning i det kommende lovforslag end for delbetænkningen? Hvis du ikke er enig, så sig endelig til, så sender jeg mere om de 6 trin.

Mvh
Michelle

-----Oprindelig meddelelse-----
Fra: Stine Billeschou Christiansen [mailto:sbc@life.ku.dk]
Sendt: 9. oktober 2009 11:35
Til: Michelle Argir
Cc: Cristina Angela Gulisano
Emne: Svar: SV: Møde om farlige hunde

Kære Michelle,

Jeg kender til to databaser:

Justitsministeriet
Dyrevelfærdskontoret 2009 NR. 54 30-1 0159