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External factors and reproducibility of the behaviour test in German shepherd dogs in Switzerland

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Abstract

The Swiss German Shepherd Club (SC) has applied a standardised behaviour test for over 50 years. A successful test is a prerequisite for breeding approval. The aim of the study was to investigate the influence of external factors like socialisation, husbandry, training and others on the results of the behaviour test, and to verify if these results were still consistent after a year. The tested traits were self-confidence, nerve stability, hardness, sharpness, defence drive, reaction to gunfire, and temperament. Information about husbandry, training, socialisation, and the dog's behaviour in certain situations, etc. was collected by a questionnaire. From a total of 185 owners, 149 handlers with their dogs were willing to take part in this study. After 1 year, 38 dogs were tested a second time and their owners filled out another questionnaire very similar to the first one. Logistic regression analyses were used to measure the association between the results of the behaviour traits and the different external factors.

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Training of the young dog and contact with school aged children were significantly associated with one or more of the behaviour traits. Significant odds ratios were found for the associations between the puppy training and nerve stability and self-confidence, as well as between young dog training and the same character traits (nerve stability and self-confidence). A further positive association was found between defence drive and the contact of the dogs with school age children. Reproducibilities of the results of the behaviour test varied between traits, so the average scores for sharpness and defence drive significantly increased from the first to the second test, for temperament however, the scores decreased. Lower scores meant a more desired behaviour as rated by the club. The results of the other traits were similar in the two tests.

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1. Introduction

There is increasing public concern about aggressive dogs due to recent incidents (Lockwood, 1997; Penny and Reid, 2001; Uchida et al., 2001; Pillonel, 2001; Horisberger, 2002). Behaviour tests should identify dogs with undesirable behaviour traits as well as evaluate dog behaviour in general. One of the most difficult tasks in analysing behaviour is the choice of the appropriate traits which should measure behaviour patterns and under which testing conditions the behaviour should be examined. The choice of the traits will depend on the future use of the dogs. Therefore, it is not surprising that many different behaviour tests have been implemented so far, e.g. for police dogs (Slabbert and Odendaal, 1999), army dogs (Delanoy, 1960), guide dogs (Humphrey, 1934; Goddard and Beilharz, 1984a,b, 1986; Serpell and Hsu, 2001), companion dogs, hunting or working dogs (Murphree and Dykman, 1965; Pfeleiderer-Högner, 1979; Venzl et al., 1989; Palestini et al., 2001), shelter dogs (van der Borg et al., 1991; Weiss and Greenberg, 1997; Ledger and Baxter, 1999), service and breeding dogs (Wilsson and Sundgren, 1997a,b, 1998a,b), laboratory dogs (Hubrecht, 1993), and pet dogs (Hart and Hart, 1985; Hart and Miller, 1985). Further, there are a few tests, which solely focus on the potential aggressiveness (Planta and Netto, 1997; Planta, 2001; Baslertest, 2001; Schalke et al., 2005). The main objective in many of these tests is to obtain a good prediction as to whether a dog will later satisfy as a working or companion dog. For that reason some kennel clubs demand a successful behaviour test as a prerequisite for registered breeding (Ruefenacht et al., 2002). For all behavioural traits grading will be subjective. Significant differences in a large number of judges were found (Ruefenacht et al., 2002) although the judges were annually educated and evaluated. Besides being objective and measurable, traits must display genetic variation to achieve genetic improvement (Scott and Fuller, 1965). Further, it is also essential to know which external factors influence behaviour traits. This knowledge is important for designing better training programs and to make more appropriate recommendations about the husbandry of dogs.

The main objective of this study was to investigate which factors could have a potential influence on the outcome of the official behaviour test of the German shepherd dog (GSD) in Switzerland. In order to validate the test we wanted to know how every-day behaviour, as described by the owner, correlated with the outcome of the behaviour test. Information about possible factors and behaviour in certain situations were collected by a questionnaire

survey of the dog owners that attended the test within a year. A further objective was to obtain data about the reproducibility of the test by repeating the test about a year later. As in the first part a questionnaire was used to validate this second test.

2. Animals and methods

2.1. The behaviour test

The procedure and recorded traits of the behaviour test of German shepherd dogs in Switzerland were described in detail by Rufenacht et al. (2002). In short, the test was performed outside, on a large open place, and lasted 30–40 min. Most dogs were between 1 and 2 years old. The subjective grading of the trained judges was recorded in words and then transformed into scores by one person only. The seven evaluated traits were (Seiferle and Leonhardt, 1984):

- *Self-confidence (ability to react to new situations)*: A calm, interested, self-assured, fearless, uninhibited, dauntless, attentive, and friendly behaviour is desired without any signs of aggression, distrust or tendency to run away in the presence of optical or acoustical stimuli or sudden approach of strangers.
- *Nerve stability (the way the dog reacts to the different test parts)*: The dog should react neither nervously nor hypersensitively nor jumpy.
- *Reaction to gunfire*: The behaviour should be dauntless, maybe interested but not fearful.
- *Temperament (physical flexibility and intensity of reaction to different environmental stimuli)*: The dog should be active and persistently interested in the environment with a big radius of action.
- *Hardness (severity or ability to accept unpleasant perceptions without being deeply impressed afterwards)*: A forceful play with the toy is desired, and the dog should not be frightened nor permanently impressed by the various acoustical and visual objects.
- *Sharpness (ability to react in an aggressive way towards a serious or serious looking attack)*: The sharpness is desired only when the dog is threatened. After the end of the threatening period, the dog has to calm down immediately and has to be friendly towards the participating people and the judge. This kind of sharpness is defined as *desired sharpness*.
- *Defence drive (the ability and desire to guard and protect the threatened handler)*: The dog should show a very well developed *defence drive*.
- In order to obtain a measure of the *overall behaviour*, the grades of the seven particular characteristics are added to an *overall score*.

Depending on the traits four to six scores were possible. Because the two highest scores were very rare they were pooled in one category so that the range of scores went from one (=desirable behaviour) to three (=inadequate behaviour).

One of the following features was sufficient for failing: nervousness, insecurity, anxiety, awe, gun shyness, missing defence drive combined with anxiety, fear-related sharpness, and over-sharpness (=aggression in peaceful situations and continuing aggression after being

threatened). If dogs showed none of these features, they passed the test, regardless of the grades in the other behaviour traits. In case of failure, they were excluded from breeding.

2.2. *Animals and data*

The data were collected during the official behaviour tests in the years 2000–2002. The initial tests took place at eight localities, the repetitions about a year later at three different localities with 149 and 38 dogs, respectively. Although participation in our study was voluntary most owners (81%) with dogs from 80 kennels agreed to join this investigation at the first test. For the repetition about 34% of the asked owners with dogs from 28 kennels participated. The gender ratio male/female in both tests was 0.54/0.46 and 0.68/0.32 for the dogs and 0.73/0.27 and 0.51/0.49 for the owners. The average age of the dogs in the first test was 20 and 29 months in the second one. Eleven judges were involved in the first behaviour test and two of them judged the dogs for the repetition. None of the dogs was judged twice by the same person. The quality of assessment was sufficiently identical for all judges although significant differences were shown in a very large data set involving about 50–60 judges during several decades (Ruefenacht et al., 2002).

In the first test, five dogs failed because of too much sharpness (two), fearfulness (one), missing defence drive or nerve stability (two). Four dogs were excluded from the test for various reasons (heat, unclear tattoo, and absence). In the second test, only one dog failed because of too much sharpness. None of the dogs that failed the first time participated at the second behaviour test. The dog that failed in the second test had good results in the first one, but a lot of factors had changed in the meantime (contacts, training, use, residence, and activity).

2.3. *Questionnaires*

The aim of the questionnaires was two-fold: first, to find out various factors about owner and dog, and to later associate these factors with the outcome of the test. Second, to link the test results with the *every-day* behaviour of the dog as it was perceived by the owner. The first questionnaire contained three different parts: general information about the owner and his/her dog, information about the behaviour of the dog and the owner's evaluation of the behaviour test (Table 1, complete questionnaire see, http://www.vetmed.unibe.ch/itz/housing/housing_dogs.htm). The second questionnaire was very similar to the first but had an additional fourth part, which inquired about the acceptance of the study (Table 1). Like in a Delphi study (Linstone and Turoff, 1975), the often-mentioned problems of the first behaviour test questionnaire were presented for agreement in the second questionnaire. Prior to sending the first questionnaire to the participants, it was tested on ten dogs with two persons per dog (mostly couples owning the dog) who knew the dog very well. For the most part there was a good agreement between the two answers.

2.4. *Statistical methods*

Descriptive and test statistics were performed with the software package SAS[®] (release 8.01, SAS Institute Inc., NC, SA, 2002). Firstly, associations between the behaviour traits and the information of the questionnaire were examined. Due to small-expected

Table 1
Summary of the questionnaires

Part 1: general information	
Owner	
Sex	1
Reason for keeping a dog	3
Experience with dogs	1
Selection criterion (colour, sympathy, etc.)	1
Dog	
Age at the test	1
Age at separation	1
Early contacts	1
Origin	1
Puppy training and socialisation	1
Training for special purposes	2
Trials (tests, test type, result)	3
Contacts (with dogs, men, pets, etc.)	3
Residence (house, kennel, etc.)	3
Activities (playing, walking, education, etc.)	3
Veterinary treatments (castration, hormonal, etc.)	2
Part 2: information about behaviour	
Behaviour in different situations	3
The dog's preferred breed	1
Participation in fights and role	3
Part 3: information about the behaviour test	
Expected result (owner)	3
Appraisal of different behaviour traits	3
Causalities (breeding, education, etc.)	3
Expressiveness (is the test a good tool)	3
Main reason (for participation)	3
Problems (of the test)	3
Propositions of reformation of the test	3
Part 4: information about the study	
Design of questionnaire	2
Collaboration with university	2

1: in first questionnaire only; 2: in second questionnaire only; 3: in both questionnaires.

frequencies in the cells of many contingency tables only Fisher's-Exact Tests were applied. Besides the assessment of the different behaviour patterns of a dog by the official judges, an assessment of the dog by the owner on the same scale was available, too. Systematic differences between the assessment of the official judges and the one by the owner as well as between the first and repeated test were tested with the signed rank test by using the SAS procedure PROC NPAR1 WAY. The three scores for the different behaviour traits were ordinal response variables, which were modelled as cumulative logit functions by performing an ordered logistic regression using the proportional odds model (McCullagh, 1980). The SAS procedure PROC LOGISTIC was applied for this analysis. The exploratory variables for these models came from the information of the questionnaire. For the logistic regression only those variables were chosen, which were significant at a 10%

level in the first screening. In order to find the most parsimonious model a forward selection strategy was chosen. The model considered was:

$$\text{logit}(\text{test results of the behaviour trait}) = \alpha + \beta_i x_i + e_j$$

where α is the intercept; β_i the partial regression coefficient of the i th independent variable; x_i the i th independent variable and e_j is the error of the j th dog. Because this model contained many variables and the sample size was limited, interaction effects were not tested. Logistic regression analyses were performed again but only with the remaining significant independent variables ($p < 0.05$). In these models, however, interaction effects between two independent variables were tested.

All presented p -values are two-sided.

3. Results

Due to the detailed questionnaires a large number of answers resulted. Therefore, only results will be presented that are of general interest or that are related to findings reported in the literature. First, the results of both questionnaires will be presented followed by the external factors, which were significantly associated with the results of the official behaviour test. In the last part, the reproducibility of the results of the first and second test will be addressed. Due to missing values, percentages do not always add up to 100.

In the considered time period, 185 dogs completed the official behaviour test but 36 of their owners did not participate in this study. The scores of the test, however, were available. Except for the reaction to gunfire no significant differences were found between the 149 dogs of the study and the 36 non-participating ones ($p > 0.28$). The dogs that were not included in the study had significantly higher scores for the reaction to gunfire ($p < 0.001$) meaning greater gun-shyness.

3.1. Results of the questionnaires

3.1.1. First questionnaire

Since the results of the first questionnaire were more representative, the descriptive statistics about owners, husbandry, training, contacts, etc. are based on this data set. The dogs in this study were owned primarily by men (71%) and fewer by women (26%); couples kept 3%. The sex ratio of the dogs did not differ between genders of the owners. Women kept their dogs mostly in houses ($p = 0.022$) and men in kennels ($p = 0.016$). At purchase, most owners chose their dog because of sympathy or behaviour (56%), followed by sex or lineage (12%) and only few people mentioned body conformation or colour (4%) as a reason.

Most dogs were taken over directly from the breeders (81%), two-third of them at an age of less than 12 weeks. Only 5% of the dogs came from another source (e.g. various precedent owners, dog shelters, etc.) and their new owners were all experienced. Fifteen percent of the 149 owners presented their first dog for the behaviour test. These first dog owners attended puppy or young dog training more often ($p = 0.052$) as well as other training courses ($p = 0.024$). In general, puppy or young dog training courses were often

visited (79%), both courses, however, were done less often (22%). Most of the experienced owners did their own training program in addition to other courses (83%). Only 28% of the dogs received an exclusive training by the owner himself. A training program in collaboration with other people was done in 69% of the cases. Only a few dogs had passed a companion test before the official behaviour test (12%).

The main activity of the dogs in the period prior to the first test was walking (31%), followed by sports and playing (11% each). The most frequent purpose of keeping a dog was a combination of sports and family (81%), only 4% were kept exclusively for sports (sports can be obedience, agility, schutzhund or other training). The majority of the dogs (>75%) was described as friendly and playful in most situations. Towards joggers (42%) and cyclists (47%) the dogs were assessed as unpredictable or in 6% each even as anxious. An anxious behaviour was also observed in situations with other dogs (>4%). The dogs had by far the most frequent contacts with adults, as puppies (73%) and at the moment of the first test (92%), the contact with little children was moderate to rare (Table 2). During the growing-up period and later, two-third of the dogs had frequent contact with other dogs and one-third had frequent contact with pets (mainly cats and rarely others).

The owners were asked to evaluate various character traits of their dogs. The majority of the dogs (>80%) behaved as desired. Only the traits dominance and sensibility showed a wide variation. In the remaining traits (nerve stability, capacity to fit, self-confidence, fearlessness, and protectiveness) the dogs were often scored as good to average. There were no associations found between the test results and the every-day behaviour of the dog in various situations as the owners described it.

3.1.2. *Second questionnaire*

Sixty percent of the dogs, which repeated the test completed one or more performance tests between the first and the second test, e.g. for agility, working (police, military, and avalanche), guide, etc. A large number of dogs were still used for sports (87%) but mostly in addition to family or companion use. Two-thirds of the dogs were trained by the owner himself mostly in addition to other training courses. Four dogs were castrated, sterilised or

Table 2

Percentage of dogs with contact at an early stage of age and at adulthood with persons of different ages and with dogs and pets (mainly cats, rarely birds or rabbits) ($n = 149$; little children: <6 years; school age children and adolescents: 20, <6; adults: >20)

Contact with ^a	Percentage of dogs with					
	Contact at an early stage ^b			Contact at a later stage ^c		
	Rare	Moderate	Frequent	Rare	Moderate	Frequent
Little child	33	30	20	50	30	18
School age child	19	31	35	22	45	30
Adult	3	14	73	1	7	92
Dog	3	18	69	4	30	65
Pets	34	20	32	42	24	32

^a Rare: exceptional; moderate: from time to time; often: regularly.

^b Period shortly after purchase.

^c Period shortly before the behaviour test.

got a hormonal treatment in the time between the tests but a behaviour problem was never the reason for the treatment. Again owners described the behaviour of the dogs in most situations as playful and friendly (71–80%). Only towards joggers (50%) and cyclists (55%) owners expected an uncertain behaviour more often. Interspecies behaviour was evaluated as anxious in 10–13% of the cases. The reason for a second participation at the test was to support the club, personal interest, for breeding reasons and public relations. Most owners believed that age (63%) and socialisation (42%) followed by experience (29%) and training (21%) could have an influence on the behaviour and could affect the test results. Three quarters of the owners thought, that the applied test was an appropriate method to measure the behaviour of the dogs. Ninety percent shared the opinion that the environment (weather, local organisation, presence of other dogs, etc.) was not considered enough and 40% had the impression that training biased the results. Two-thirds of the owners, however, did not want to change the test. The majority of the owners (>90%) thought the questionnaire was well designed and enjoyed the collaboration with our team.

3.1.3. Comparison between the two questionnaires

The intent of the second questionnaire was to investigate how much handling and housing had changed from the period before the first test and the second. Table 3 shows how the contacts of the dogs changed between these two periods. Generally no large changes could be observed, the largest change was an increase in the frequency of contact with little children from 18% to 32% and an increase of the frequent contact with other dogs by 11%. In the second questionnaire, the proportion of dogs that were held predominantly in the house increased by 18% and those that stayed mainly in the yard also increased by 13%. For the other places of residences no major changes were observed. The most frequent activity of dogs with their owners was walking. The frequency of this activity, however, decreased from the first questionnaire (66%) to the second one (31%). The behaviour of the dogs towards other dogs or persons was generally playful and friendly (>70% both times), except towards joggers and cyclists, where the proportion of friendly behaviour was lower (40–50%) in both questionnaires. Furthermore, there were no significant changes between the first and the second questionnaire of character traits as appraised by the owners.

Table 3

Percentage of a subset of dogs ($n = 38$) having rare, moderate, or frequent contact with persons or with other animals according to the first and second questionnaire

Contact with	Frequency of contacts (%)					
	First questionnaire			Second questionnaire		
	Rare	Moderate	Frequent	Rare	Moderate	Frequent
Little child	50	30	18	47	13	32
School age children	22	45	30	26	45	24
Adult	1	7	92	0	11	84
Dog	4	30	65	0	24	76
Pets	42	24	32	40	26	29

The same dogs are used concerning the first and second questionnaires ($n = 38$).

Table 4

Comparison of the observed scores of the behaviour test with the scores expected by the owners ($n = 149$)

Trait	Compared to the first behaviour test, percentage of owner's scores that were			Signed rank test (p -values)
	Same	Poorer	Better	
Self-confidence	78	17	5	0.010
Nerve stability	76	13	11	n.s.
Reaction to gunfire	90	7	3	n.s.
Temperament	74	19	7	0.011
Hardness	62	17	21	n.s.
Sharpness	57	14	29	0.035
Defence drive	65	31	4	<0.001

3.2. Comparison of the results of the behaviour test and the results expected by the dog's owner

The concordance of the owners' expectation and the behaviour test was variable (Table 4). Owners and judges agreed best for the reaction to gunfire (90% concordance), for self-confidence, nerve stability and temperament they agreed three quarters of the cases (74–78%), the concordance of the other traits as hardness, sharpness, and defence drive was lower, ranging from 57% to 65%. The owners estimated self-confidence, temperament and defence drive of their dogs significantly poorer than the official judges. For sharpness it was just the reverse ($p < 0.05$).

3.3. Effect of external factors on behaviour traits of the behaviour test

Most of the external factors like activity, training, contacts, etc. had no significant effect on the scores of most of the eight behaviour traits. However, dogs that were kept mainly for sports were more often classified as unsatisfactory for temperament ($p = 0.043$) as well as for sharpness ($p = 0.026$) and dogs used for various activities (agility, family, and companion) made often only an acceptable result in sharpness ($p = 0.023$) and an unsatisfactory one in hardness ($p = 0.028$). Dogs with frequent contacts with school age children and adults showed more desired results in defence drive ($p = 0.021$ and 0.019 , respectively). Dogs that were not purchased from recognised breeders were found to achieve unsatisfying results in reaction to gunfire ($p = 0.032$) and hardness ($p = 0.012$) more often than expected. The dogs without young dog training got average results more often and were classified as not self-confident ($p = 0.046$) and also displayed worse results in nerve stability ($p = 0.046$).

3.4. Multivariate analysis of all significant external factors on behaviour traits of the behaviour test

First we applied a logistic regression to all eight behaviour traits of the behaviour test where the following factors were included as explanatory variables: activity of the dog (sport and others), early contacts with school age children (frequent, moderate, and rare),

Table 5
Significant factors which had an effect on behaviour traits

Behaviour trait	Sample size	R^2	Environmental factor	
			Early contact with school age children (p -values)	Young dog training (p -values)
Self-confidence	142	0.07		0.018
Nerve stability	142	0.07		0.018
Defence drive	123	0.10	0.007	
Overall score	127	0.10	0.006	

R^2 : coefficient of determination and it indicates the degree to which the variation of the behaviour trait is explained by the variation of the environmental factor.

original owner (recognised breeders and others) and training (young dog training and others). A second logistic regression analysis was performed with only those factors that were significant in the first analysis (Table 5). Finally, only two factors remained significant: young dog training and contact with school age children, which were able to explain 7–10% of the total variation (R^2). Self-confidence and nerve stability seemed to be the same trait because the scores were identical for each dog (see also Rufenacht et al., 2002). The odds ratio showed (Table 6) that there was a significant association between the desirable behaviour in both traits and the completion of a young dog-training course. The overall score as well as the defence drive improved with increasing levels of contact with school age children (Table 6).

3.5. Reproducibility of the behaviour test

The reaction to gunfire was almost identical in both tests since 94% had the best score in both tests (Table 7). Nerve stability and sharpness were very similar (85%) in both tests but almost all dogs that differed obtained a poorer score in the second test, for sharpness this was almost significant ($p = 0.063$). The traits self-confidence, temperament and hardiness

Table 6
Odds ratios with their 95% confidence intervals for contrasts of three behaviour traits and the overall scores concerning different training and contacts

Behaviour trait	Contrast between	Odds ratio	95% confidence limits	
			Lower	Upper
Self-confidence	Young dog training vs. no young dog training	3.46	1.24	9.68
Nerve stability	Young dog training vs. no young dog training	3.46	1.24	9.68
Defence drive	Frequent early contact with school age children vs. rare early contact with school age children	4.715	1.80	12.38
	Frequent early contact with school age children vs. rare early contact with school age children	4.68	1.83	11.98
Overall score	Moderate early contact with school age children vs. none early contact with school age children	2.75	1.09	6.95

The odds ratios refer to the contrast in the column left to them, for the overall scores two significant contrasts were found.

Table 7

Comparison between the first and the second behaviour test results ($n = 38$), please note that a lower score means more desired behaviour and a higher score means less desired behaviour as rated by the club

Behaviour trait	Changes of scores from the first to the second test (%)			Signed rank test (p -values)
	Same score	Lower score	Higher score	
Self-confidence	73	15	12	n.s.
Nerve stability	85	12	3	n.s.
Reaction to gunfire	94	3	3	n.s.
Temperament	19	3	18	0.094
Hardness	73	9	18	n.s.
Sharpness	85	15	0	0.063
Defence drive	58	36	6	0.008

were not so stable since 21–27% of the scores changed from the first to the second test (Table 7). About half of the altered scores of the trait self-confidence became poorer and half got better (15% and 12%, respectively), for temperament and hardness, however, the majority of the scores decreased, i.e. they became more acceptable for the club (18%). The trait with the lowest reproducibility was defence drive. Only 58% of the scores of the first test remained the same at the second test but 36% increased, i.e. they became less desirable for the club. This increase of the scores was significant ($p = 0.008$).

4. Discussion

The dogs of this study were a representative sample of the future breeding stock but they were not representative for the whole GSD population in Switzerland, due to the fact that only about 10% of an annual birth cohort took part in the behaviour test. Since the test was standardised most dog owners knew how to train their dogs in order to increase their chance to pass the test. This could explain the low failure rate (5 out of 185 dogs). Prior to the test, skilled handlers trained the dogs and most (62%) first dog owners participated in training courses with the support of skilled handlers. This could be a reason why no differences were found between experienced and first dog owners. Several other studies indicated that first dog owners were more likely to experience problematic behaviour in their dogs (e.g. Cameron, 1997; Kobelt et al., 2003; Serpell and Jagoe, 1996). Although the gender of the owner had no influence on the outcome of the behaviour test, the owners' expectations could be a reflection of a different behaviour of the dog towards the genders as in the studies of Wells and Hepper (1999) and Serpell and Podberscek (1997b), or a gender specific appreciation of the same behaviour.

In our data, the sex of the dogs had no influence on the outcome of test results. This is surprising, because in the study of Ruefenacht et al. (2002), which included parts of this material, male dogs obtained a better score on average than females for all analysed behaviour traits. This difference could be explained by the much smaller sample size of the present study. In contrast to our study, other authors found gender differences in the behaviour of the dogs, too (Uchida et al., 2001; Cameron, 1997; Bradshaw et al., 1996; Sato et al., 2001). No difference was found between the dogs that were separated from

their mother before 12 weeks after birth and those separated later, which agreed with Slabbert and Rasa (1993) and Seksel et al. (1999). Goddard and Beilharz (1984b) as well as Appleby (1993), however, showed a positive effect of an early removal of puppies from the dam. It seems, that within our sample a takeover earlier than 12 weeks of age had no negative effect on the outcome of the test, which was probably due to the importance of other factors like good puppy training, socialisation and special training. Dogs from rescue shelters or with several previous owners obtained moderate rather than good results in reaction to gunfire and hardness more frequently. Bad experience or a lack of puppy training, socialisation and special training could have led to this result. Goddard and Beilharz (1984a,b) as well as Serpell and Podberscek (1997a) demonstrated the importance of a broad selection of stimuli in the early life of a dog for the future capacity as a guide dog, and Pfaffenberger and Scott (cited in Scott and Fuller, 1965), showed a similar effect. In our study, this effect could not be shown, probably because of the uniform stimuli. Results of the multivariate analyses showed that training at an early age was associated with greater self-confidence and nerve stability, and early and frequent contact with school age children was associated with a more desired defence drive and more favourable overall scores.

Another significant association obtained with the contingency tables, which could not be demonstrated in the multivariate analyses, suggested that dogs used exclusively in sports achieved lower rates in temperament and sharpness. A tough training for the corresponding sport discipline and a high ambition of the owners could be a reason for the slight negative effect on both behaviour traits. However, Wilsson and Sundgren's investigations with GSD (1997) and Goddard and Beilharz (1985) found no association between the use of the dog and its behaviour. Neither the different kind of activities nor the frequency of them had an effect on the outcome of the behaviour test, which was in agreement with the studies of Goddard and Beilharz (1982a,b, 1984a,b, 1985,1986). However, these findings were in contradiction with the ones of Seksel et al. (1999) who found that activity improved the trainability of the dogs, and Serpell and Jagoe (1996) suggested an association between activity and various kinds of aggression. From the 149 dogs that attended the first behaviour test only a quarter of the owners were able or willing to join the second test, probably because of the restricted practical possibilities of a second participation. There was a poor agreement between the first and the second behaviour test. Most of the results that differed became poorer, e.g. the ability and desire to guard and protect the threatened handler were significantly reduced. These changes could be explained by the emphasis given to the training for specific uses. Between the tests 61% of the dogs passed other tests, e.g. as companion (65%), guard (25%), and police (5%), army or avalanche dogs (5%). A further reason could be that in contrast to the first test, most if not all dogs did not obtain specific training to pass the second test anymore. The degree of agreement in sharpness was better (85%) but all dogs that differed ranked lower. The same arguments as above were valid for this trait, too. Although not significant, it was interesting to notice that most of the dogs with a different score in temperament showed a lower (more desired) score in the second test. This could be explained as an effect of age as shown in the studies of Goddard and Beilharz (1984a,b) with guide dogs and those of Martinek and Lat (1969). Finally, a better-adapted scoring system would help to obtain a better differentiation between dogs and could help to reduce the skewness (ceiling effect) of the data. The test results showed

significant heritabilities and significant influences of external factors (Ruefenacht et al., 2002), so the test was able to measure aspects of the dogs' behaviour.

In summary, this study confirmed results of other investigations that factors like activity, reason for keeping the dog (sports, companion, agility, and family), contact, origin and training of the dog, had an effect on the results of the behaviour test. However, due to the small sample size and the large heterogeneity of the factors affecting behaviour patterns these results have to be considered preliminary. Although a behaviour test always measures a momentary situation and could change with time, these tests can be recommended for all dogs. As shown by Ruefenacht et al. (2002), Wilsson and Sundgren (1998b), and Goddard and Beilharz (1982a,b) and others most behaviour traits are heritable to some extent and it is possible to achieve some genetic improvement with an appropriate selection program.

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