Testing German shepherd puppies to assess their chances of certification

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Abstract

Behavioral activity of 7-week-old German shepherd puppies was tested and the activities analyzed if they could be used for predicting police efficiency of the individual. In total 206 individuals sired by 42 sires and 44 dams were used. The activities were divided into 10 tasks in which reactions and behavior of pups were scored from 0 to 5 points. All pups were tested separately from other conspecifics. Probability that the puppy will pass the certification was tested by a logistic regression. Of the 206 puppies, 148 passed the certification while 58 failed. Some tested behavioral variables were moderately to highly correlated with one another. Therefore we applied a factor analysis. Three factors were retained accounting for 100% of the shared variance. After inspection of the rotated factor pattern matrix and its confidence intervals, it appeared that variables "Independent movement and interactions with the tester", "Negotiating obstacles", "Entering a room", "Behavior toward a person", and "Behavior in new environments" loaded on Factor 1 ("Factor for movement"), while variables "Response to distracting stimuli caused by a shovel", "Response to a distracting noise while left alone in a room", and "Response to loud distracting stimuli" on Factor 2 ("Factor for responding to noise") and variables "Retrieval" and "Tug of war" on Factor 3 ("Factor for attitude to predation"). In the final logistic regression model, the probability that the puppy will pass the certification depended on the higher weight at the time of testing ($\chi^2_{(1)} = 12.00$, $P = 0.0005$), on the "Factor for attitude to predation" ($\chi^2_{(1)} = 11.63$, $P = 0.0007$), on the "Factor for responding to noise", where the higher the score, the weaker was the response ($\chi^2_{(1)} = 5.16$, $P = 0.0232$), and on the "Factor for movement" showing an increasing probability with decreasing score ($\chi^2_{(1)} = 5.25$, $P = 0.0219$). The tests in our study seem to be a good base which might enable selection for suitable dogs as early as 7 weeks of age. The puppies having high probability to pass certification in adulthood were heavy individuals willing to

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chase, catch, and fetch a tennis ball, and follow a rag drawn away from them, while weakly responding to a distracting noise in various situations and showing low activity while negotiating obstacles and moving and interacting with the tester. To conclude, contrary to skeptical assumptions expressed by various authors, the specific puppy tests for police dogs provide a reliable tool for predicting future service ability of a puppy. Differences in methodology are likely to contribute to a lack of consensus among various studies.

1. Introduction

Since the time when Clarence J. Pfaffenberger with his co-workers started testing puppies supposed to become guide dogs (Pfaffenberger, 1963; Lambin, 1994), the puppy behavior tests have become a frequently used tool to choose individuals suitable for specific tasks (Slabbert and Odendaal, 1999) or just as household pets (Campbell, 1972). The number of papers on canine temperament, including puppy behavior tests, has rapidly increased over the last three decades (Jones and Gosling, 2005). Opinions on predictive value of puppy behavior tests have remained controversial, however. For example, Goddard and Beilharz (1984a) studied correlations between measurements of a variety of responses, including approach avoidance, nature of contact with stimulus, tail position and posture, to a large number of stimuli and reported that adult performance could be predicted to some degree from fearfulness at 3 months of age, but that the accuracy of the prediction improved with age. Beaudet et al. (1994) administered the behavioral evaluation test as suggested by Campbell (1972) but results showed that when applied at 7 weeks of age without any additional criterion, the test had no predictive value regarding future social tendencies. Wilsson and Sundgren (1998) tested 630 German shepherd puppies to find out if adult behavior could be predicted at 8 weeks of age. They came to the conclusion that correspondence of puppy test results to performance at adult age was negligible and the puppy test therefore was found unuseful as a predictor of later behavior and trainability as police and military dogs. Lindsay (2000) suggested that puppy temperament tests should not be used to predict adult efficiency or the potential exhibition of adult behavior patterns but should be used to identify puppy's strengths and weaknesses at the time of testing. Rooney et al. (2003) presented a study examining the validity of a puppy test for dogs intended for specialist search work. Puppies tested were Labrador retrievers at the age of 8 weeks and the results were compared with the retest at 11 months of age. They concluded that puppy behavior tests at least in Labrador retrievers are unlikely to be useful predictors of adult behavior. In the most recent review on temperament and personality in dogs, Jones and Gosling (2005) stated that ''although the overall convergent findings were generally encouraging, our review suggests that tests of young puppies are not valid predictors of their future behavior''. In contrast to this, there are studies suggesting that puppy behavior tests can be used as reliable predictors of adult efficiency and behavioral traits. In the early 1960s, Pfaffenberger (1963) performed behavior tests on puppies from 8 weeks of age and subsequent 5 weeks. The tests were designed to reveal the puppies' inherited character traits so that it could be determined if they had any of the faults which would prevent them from becoming guide dogs. The testing consisted of reactions to various startling stimuli, novel situations, tactile stimuli and willingness to fetch. Selection done in accordance with the results of the tests helped him to improve overall training results. Remarkable results were achieved also by Martínek et al. (1970, 1975) who tested German shepherd pups' rate of habituation and learning as early as at the

age of 2 and 4 months and compared the results with the performance of the same individuals at the age of 1 year. The results achieved from puppy testing were in good correlation with the tests performed on 1-year-old dogs. The same team tested also habituation of the neonatal puppies moving from cold to a warm surface as early as at the age of 3–9 days. The results showed good accordance with the tests done at 4 months of age of the puppies (Martínek et al., 1977). This suggests that at least some behavioral activity of a puppy may be a good predictor of the dog's behavior in adulthood. The question remains which testable behavioral activities of a puppy could be used for predicting police and/or military efficiency of the individual. More recently, Slabbert and Odendaal (1999) tested in the South African Police Canine Facility German shepherd puppies at 8, 12, 16 weeks and 6 months of age. The most significant tests were retrieval at 8 weeks and aggression at 9 months. These tests thus enabled selection for suitable dogs as early as 8 weeks of age. In this study we are presenting results of the German shepherd puppy behavior testing implemented at the Czech Law Enforcement Canine Breeding Facility, the Czech Republic, over the period from 1992 to 2002, based on a similar approach to that of Slabbert and Odendaal (1999), in reality performed more or less concurrently with them. We used 1 month younger animals than the youngest ones in their study.

2. Animals, materials and methods

2.1. Animals

The German shepherd puppies that were tested ($n = 965$) were all bred at the Czech Republic Police Breeding Facility (CRPBF), Prackovice, Czech Republic, from January 1992 to March 2002. They came from 105 different litters and were sired by 42 sires and 44 dams. Only 206 individuals out of 965 could be traced till adulthood. For most of the puppies not involved in the study we just failed to get records of their destiny. This was partly because some of them have been removed from the training program for medical reasons and serious behavioral faults such as lack of drive to bite, fearfulness in the strange environment, etc. Nevertheless, many redundant females were also sold outside the police force for no particular reason as the demand for the females is not as high as for males that are usually bigger and thus more suitable for law enforcement tasks. The CRPBF is located at the edge of the small village in the area with almost no traffic. The breeding program is based exclusively on German shepherds and around 70 pups are bred annually. Unlike most of the similar facilities in the Czech Republic, all dogs in the CRPBF are kennelled in large fenced enclosures with doghouses.

Strict hygienic measures and feeding program are part of the whole breeding program. The CRPBF has its own veterinarian who provides veterinary care for all kenneled animals and oversees the feeding program. All dams have been vaccinated once a year against distemper, rabies, kennel cough, and parvovirus. If the female was pregnant during vaccination, her vaccination was postponed. At the beginning of the testing period the females were checked for pregnancy with palpation and later with ultrasound, starting in 1998. The puppies were vaccinated at 6 weeks of age with Parvo C, at 9 weeks with Nobivac DHPP (Intervet), at 12 weeks by Nobivac DHPPi L, and at 15 weeks against rabies by Rabisin (Ron Merie). Feces of the dams were checked for parasites up to 4 times a year. Whenever the examination was positive, an antiparasitic was used. The puppies were dewormed at 8–9th day of age, at 3 weeks, at 5th or 6th week, at 7 weeks, and at 9 weeks of age, and later according to feces examination. Under normal circumstances the parturition took place without any human assistance. The mothers were just checked once or twice an hour by a veterinarian or a chief of the CRPBF. A day after birth the whelping puppies were weighed and their umbilical cords were cropped and treated. Weighing was done regularly till 6 months of age once a week and once a month in older puppies. The puppies were marked with cuts in the hair and after 7 weeks of age tattooed and later also microchipped. Doghouses and kennels were regularly washed with hot steam and disinfected with SAVO, Kresolan or Desam OX. Kennels were cleaned at least twice a day and pens once a week. From 1992 to 1997 two persons fed the puppies and

4 *I. Svobodová et al. / Applied Animal Behaviour Science xxx (2007) xxx–xxx*

from 1998 to 2002 six persons took care of them. Puppies under 6 month of age, pregnant and nursing bitches were fed 3 times a day. All other dogs were fed twice a day. At the beginning the dogs were fed with traditional food such as boiled meat, rice, pasta and carrot. Later dry food (SUSA Dog, Royal Canin, Happy dog, Mera dog, or Twinner) was introduced. Puppies were fed from 3 weeks of age with cow's milk and from 1998 with special milk for puppies. Water was available all the time *ad libitum.*

Approximately 1 week before the parturition the bitches were moved into the delivery kennels located inside a building. Heaters were on from the very beginning of the parturition for 1 week, day and night. The dams remained in the delivery kennels for 4 weeks and the temperature was gradually lowered so that the pups would get used to the temperature outside the delivery kennel.

The litters with the mothers were moved outside the building into fenced enclosures of 15 m × 15 m size when the pups were 4 weeks old at the latest. Puppies stayed with their mothers till 7 weeks of age when they were weaned. For a short period after the weaning the puppies stayed together in the outside pens, then they were kenneled in pairs and at the age of about 9 weeks they stayed in the pens alone.

During the first 3 weeks post partum the contact of the puppies with humans was limited to treatment, weighing, feeding mothers and cleaning of the delivery kennels. From 3 to 7 weeks of age the puppies were walked outside kennels without their mothers. The routes of the walks had always led beyond the area where the testing was later performed. The puppies had never been supposed to negotiate any stairs as climbing steps up and down was later part of the testing. Raisers aimed their work with the puppies on the movement in various environments, recall, fetching, biting a rag, and response to startling stimuli. After the weaning the puppies were assigned to their raisers. Some of them were also taken from the CRPBF by canine officers and the raising took place at police departments throughout the country.

During the raising period the interest in retrieving moving toys and in biting rags or dummies was developed. Puppies were also taken for walks within and outside the CRPBF premises and were gradually accustomed to a collar and leash. Further training consisted of exposing puppies to different kinds of footings like polished floor, tiles, and unstable surfaces. Basic obedience training included recall on command, sit, down, stay, walking at heel, down-stay, sit-stay, and speak on command. Before 1 year of age the puppies were also able from a short distance to bite an agitator who wore a protective sleeve, search for a hidden person and to follow a short track.

2.2. Testing

Testing and evaluation during the whole 10-year-period was performed by the same tester (PV). The puppies were always tested before feeding at the age of 7 weeks ± 1 day. Only healthy puppies were involved. The testing was performed in days with temperature between −15 and +25 °C (in hot days the testing was done early in the morning) and no rain. During the testing 4 main types of responses were evaluated: response to environments, response to a person, response to objects, and response to noises. This has been divided into 10 tasks in which reactions and behavior of pups were scored from 0 to 5 points (the higher the score, the better the response and/or behavior). These points were treated as a continuous variable in the following statistical analysis. All pups were tested separately from other conspecifics.

2.2.1. Independent movement and interactions with the tester

The tester evaluated responses of the puppy to distracting stimuli (such as hand slaps) while being led along the testing route of 50 m. The closer to the tester the puppy was and the more interactions with the tester it initiated, the higher the score.

2.2.2. Negotiating obstacles

The tester evaluated the animal's speed and hesitation in overcoming the 20 cm wooden obstacle and climbing up and down 5 concrete steps. The higher the speed with less hesitation, the higher the score.

2.2.3. Response to distracting stimuli caused by a shovel

Right before entering a room, on a distance of approximately 1 m from the puppy, the tester caused a loud noise by hitting a metal sewer lid with a shovel three times in three series (total of nine hits)

within 30 s and the response of the puppy to the noise was scored. Running away and showing fear was scored 0. With less fear pronounced and increased exploratory interest in the noise, the score was increased.

2.2.4. Entering a room

The courage of the puppy while entering an unknown room (10 m × 1.4 m × 2.5 m with 3 windows 1 m × 1 m) and its behavior, while being left alone there, were scored. With shorter time the puppy spent by entering the room, the higher the score.

2.2.5. Behavior toward a person

Behavior of the puppies toward a familiar tester who entered the room and remained motionless was evaluated. In case the puppies did not display any distinct reaction, they were provoked by a tester by a movement, calling, or petting. Behaviors of the pup toward the tester in other tests were also scored as a part of this test. The more the puppy approached the tester behaving friendly to him, the higher the score.

2.2.6. Behavior in new environments

The exploring activity of the puppy left by the tester alone in a closed room (the same as above) for 2 min was scored. Any exploration for the rest of the testing (further 8 min) performed in the room was additionally assessed (the more activity shown the higher the score). The more the movement and exploratory behavior, the higher the score.

2.2.7. Response to a distracting noise while left alone in a room

A reaction of each pup while left by the tester alone in the closed room to the noises caused by repeated knocking on the window was evaluated. Running away and showing fear was scored 0. With less fear pronounced and increased exploratory interest in the noise, the score was increased.

2.2.8. Response to loud distracting stimuli

After returning to the room with the puppy, the tester caused loud, sudden noises by hitting twice a weight against a tabletop. Reactions of the puppy to loud noises in presence of a person were evaluated. Running away and showing fear was scored 0. With less fear pronounced and increased exploratory interest in the noise, the score was increased.

2.2.9. Retrieval

A tennis ball was tossed away from each puppy. Willingness to chase, catch, and fetch the ball were scored. The more chasing, catching, and fetching the ball, the higher the score.

2.2.10. Tug of war

The test was aimed at the courage and hunting behavior of the puppies while exposed to a rag being drawn away from them. Ability of the pup to take a grip and fight the rag being drawn away from it was scored. The higher vigor in the response, the higher the score.

2.3. Statistics

Probability that the puppy will pass the certification was tested by a logistic regression (PROC GENMOD, SAS v. 9.1.3). Since unique identification of the clusters required both variables mother and father of the puppy, the mother was nested within the father in the SUBJECT = option in the REPEATED statement to account for the repeated measures within the litter. The effects in the model statement consisted of explanatory variables and combination of them. In using linear models to determine the relationship between a set of predictor variables and a response variable the type of data like ours poses several potential problems. It is common that such variables are correlated with one another. The

collinearity among the variables may cause unstable linear models, etc. To cope with these potential problems, we applied the factor analysis (FA) as a solution. One advantage of FA is that we could create a smaller number of variables without losing much of the useful variation in the original data (Truxillo et al., 2005). In order to pool information from all variables into one value, we calculated a maximum-likelihood (ML) factor (PROC FACTOR, SAS, version 9.1.3.) from behavioral test score variables. Continuous explanatory variables were factors based on reactions of the puppies (rated 0–5 points) in the 10 testing situations (independent movement and interactions with the tester, negotiating obstacles, response to distracting stimuli caused by a shovel, entering a room, behavior toward a person, behavior in new environments, response to a distracting noise while left alone in a room, response to loud distracting stimuli, retrieval, and tug of war), and body weight at the time of testing. Class variables were sex, day time, month and year of the delivery and the same of the testing. All interaction terms were tested, but are not reported unless statistically significant.

3. Results

Of the 206 puppies which could be traced till adulthood, 148 passed the certification while 58 failed. First we calculated correlations between the body weight at the time of testing and correlation matrix showing interrelationships among the behavioral test variables (Table 1). Body weight at the time of testing was not correlated with any of the tested behavioral characteristics and could enter the following logistic regression as a single effect. On the other hand, as we can see, some tested behavioral variables are moderately to highly correlated with one another. This is a good prerequisite for applying the factor analysis (Truxillo et al., 2005). Decision on the number of factors was based on three criteria beginning with the scree test and followed by the proportion criterion. We gave special consideration to the usefulness of retaining factors that only accounted for a very small proportion of the variance, and avoided retaining factors that accounted for negative variance. Finally, we applied the interpretability criterion. Using these criteria, three factors were retained accounting for 100% of the shared variance. Then we applied a Promax rotation. It is an oblique rotation method that is performed in two steps. In the first step, a varimax rotation is performed to generate orthogonal factors. In the next step, the orthogonality requirement is relaxed and factors are further rotated to maximize the variance of the structure matrix (Gorsuch, 1983; Comrey and Lee, 1992; Truxillo et al., 2005). Items had high loadings or near-zero loadings and none of the items loaded on multiple factors. After inspection of the rotated factor pattern matrix and its confidence intervals, it appeared that variables "Independent movement and interactions with the tester", "Negotiating obstacles", "Entering a room", "Behavior toward a person", and "Behavior in new environments" loaded on Factor 1, variables "Response to distracting stimuli caused by a shovel", "Response to a distracting noise while left alone in a room", and "Response to loud distracting stimuli" on Factor 2 and variables "Retrieval" and "Tug of war" on Factor 3. From the meaning of the variables, the first factor measures the puppy's movement, exploration and attitude to a person ("Factor for movement"). The second factor seems to be measuring perception of distractive noise ("Factor for responding to noise") and the third factor activities resembling predatory motivation ("Factor for attitude to predation").

In the final logistic regression model, the probability that each puppy will pass the certification (ranging from 0 to 100%) depended on the higher weight at the time of testing (Fig. 1, $\chi^2_{(1)} = 12.00$, $P = 0.0005$), on the "Factor for attitude to predation" (Fig. 2, $\chi^2_{(1)} = 11.63$, $P = 0.0007$), on the "Factor for responding to noise", where the higher the score, the weaker the probability (Fig. 3, $\chi^2_{(1)} = 5.16$, $P = 0.0232$), and on the "Factor for movement" (Fig. 4, $\chi^2_{(1)} = 5.25$, $P = 0.0219$).

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Table 1
Correlation between the weight of a puppy at the time of testing and behavioral tests and correlation matrix showing interrelationships among the behavioral test variables

	Independent movement and interactions with the tester	Negotiating obstacles	Entering a room	Behavior toward a person	Behavior in new environments	Response to distracting stimuli caused by a shovel, entering a room	Response to a distracting noise while left alone in a room	Response to loud distracting stimuli	Retrieval	Tug of war
Weight at the time of testing	−0.09	−0.07	0.00	0.04	0.09	0.03	0.03	0.15[*]	0.06	0.07
Independent movement and interactions with the tester		0.68[***]	0.66[***]	0.67[***]	0.53[***]	0.23[**]	0.20[**]	0.25[**]	0.23[**]	0.17[*]
Negotiating obstacles			0.49[***]	0.49[***]	0.36[***]	0.23[**]	0.17[*]	0.13	0.13	0.08
Entering a room				0.55[***]	0.66[***]	0.25[**]	0.13	0.27[***]	0.28[***]	0.22[**]
Behavior toward a person					0.67[***]	0.29[***]	0.15[*]	0.23[***]	0.29[***]	0.23[***]
Behavior in new environments						0.30[***]	0.31[***]	0.34[***]	0.32[***]	0.23[***]
Response to distracting stimuli caused by a shovel, entering a room							0.39[***]	0.32[***]	0.16[*]	0.14[*]
Response to a distracting noise while left alone in a room								0.46[***]	0.10	0.05
Response to loud distracting stimuli									0.15[*]	0.14[*]
Retrieval										0.66[***]

[*] $P < 0.05$.
[**] $P < 0.01$.
[***] $P < 0.001$.

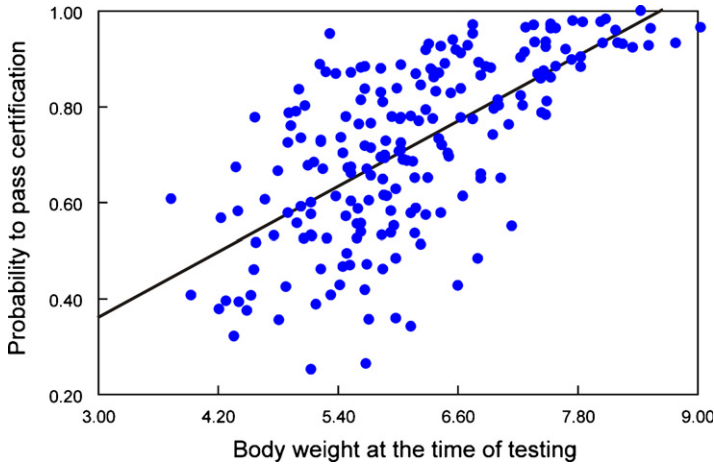8   *I. Svobodová et al. / Applied Animal Behaviour Science xxx (2007) xxx–xxx*

Fig. 1. Predicted values of the probability that the puppy will pass the certification plotted against body weight at the time of testing.

4. Discussion

In agreement with Slabbert and Odendaal (1999) this study has also indicated that suitability of adult behavior to become a police dog can be predicted by their performance as puppies through the use of special aptitude tests. While Slabbert and Odendaal (1999) were able to select their dogs in the range between 8 weeks and 9 months of age, the tests in our study give a good base for possible selection for suitable dogs as early as 7 weeks of age. The puppies having a high probability to pass certification in adulthood were heavy individuals willing to chase, catch, and fetch a tennis ball, and follow a rag drawn away from them (Factor for attitude to predation), while weakly responding to a distracting noise in various situations (Factor for responding to noise) and showing low activity while negotiating obstacles and moving and interacting with the
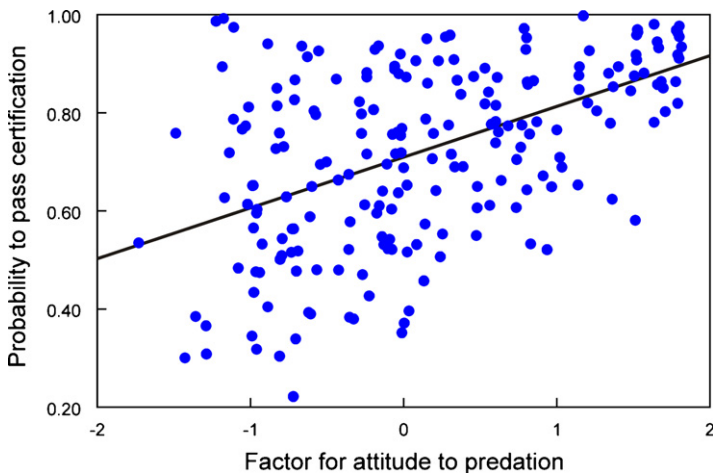

Fig. 2. Predicted values of the probability that the puppy will pass the certification plotted against the Factor for attitude to predation.
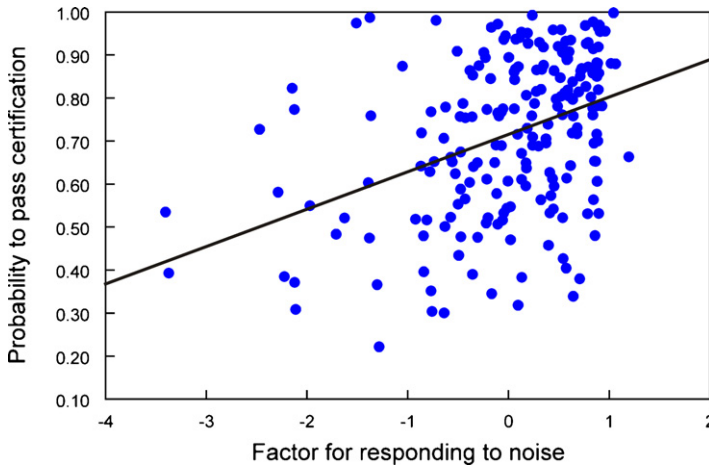
Fig. 3. Predicted values of the probability that the puppy will pass the certification plotted against the Factor for responding to noise.

tester (Factor for movement). The best predictor of all seems to be body weight at the time of testing. This has no relationship with behavioral activities and may reflect just general preference of the local police to use large animals. Because we did not find any correlation between the weight and any of the tested behavioral characteristics, our results do not support the previously published suggestion, that maturation is affected by weight which then would explain the correspondence between weight and successful behavior (Wilsson and Sundgren, 1998). On the other hand, willingness to chase, catch, and fetch a tennis ball may be well associated with the future attitude to a common local training method using tennis ball as a reward. It was found previously that fetch tests carried out on 8-week-old German shepherd army dogs had high heritability estimates (Fält et al., 1982). Rewarding the dog with a tennis ball in the Czech Republic may be the reason of the difference between this study and that of Slabbert and
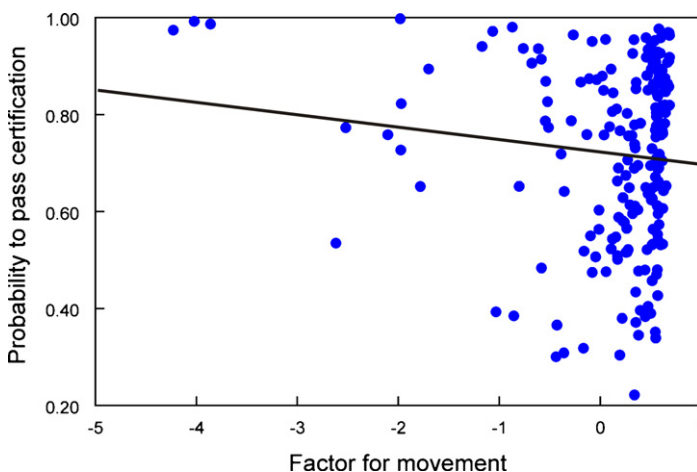

Fig. 4. Predicted values of the probability that the puppy will pass the certification plotted against the Factor for movement.

Odendaal (1999). In their study puppies bred at the SAPSDBC did not possess a high retrieval drive. Also Pfaffenberger (1963) argued that a puppy usually could be taught to retrieve, but found that these puppies would not be willing workers as guide dogs. Differences in methodology are a likely reason for a lack of consensus among various studies (Diederich and Giffroy, 2006). It may also be, however, that what Slabbert and Odendaal (1999) called an ''aggression'', was in fact a characteristic close to our ''attitude to predation''. During bite-work police or Schutzhund canines usually do not display any features that are typical of aggressive interactions (e.g., Barwig and Hilliard, 1991; Raiser, 1996) like bared teeth, wrinkled and swollen forehead or growling (e.g., Abrantes, 2001). The dog attacking a helper, wearing protective sleeve, behaves more or less the same as a wolf attacking its prey (Mech, 2003). Slabbert and Odendaal (1999) described their test as follows ''the dogs were provoked into aggressive behavior by a stranger striking at them with an old rag. If the dog tried to hide behind the handler, it scored zero. If the dog showed no fear, but did not attack, it scored 5 and if the dog moved forward and bit the rag and held on, it is scored 10 points. Any aggression in between was scored accordingly.'' Slabbert and Odendaal were measuring this later in the ontogeny (6 and 9 months of age). Therefore, we do not have any data to compare with our suggestion.

Low responsiveness to a distracting noise, affirmatively used as a predictor by Slabbert and Odendaal (1999), may reflect general calm dispositions of the puppy which may be beneficial for training. In guide dogs Goddard and Beilharz (1984a,b, 1986) also reported that adult fearfulness could be predicted to some degree from fearfulness at early age.

The third group of tests in our study, i.e., our ''Factor for movement'' (loading independent movement and interactions with the tester, response to distracting stimuli caused by a shovel, entering a room, behavior toward a person, and behavior in new environments) appeared negatively related to the probability that the puppy will pass the certification. Validity of this factor as a useful predictor remains somewhat questionable, however. Distribution of the factor's values in Fig. 4 is not balanced. The negative relation to the probability that the puppy will pass the certification differs from that of Slabbert and Odendaal (1999) and some others (cited by them) who reported that all the other comparable tests used in their study showed positive significant values for predicting adult police dog efficiency. Nevertheless, they analyzed each of these behaviors separately taking no notice of possible interrelations among the characteristics. Thus, an adequate comparison between this study and theirs is rather difficult. The results of the factor analysis applied in this study suggest that it might be worth to simplify the original tests and to design fewer tasks reflecting the meaning of our three factors.

5. Conclusion

Contrary to skeptical assumptions expressed by various authors (e.g., Beaudet et al., 1994; Wilsson and Sundgren, 1998; Rooney et al., 2003; Jones and Gosling, 2005), the specific puppy tests for police dogs may provide a reliable tool for predicting future service ability of a puppy as expected by Pfaffenberger (1963) already and more recently proved also by Slabbert and Odendaal (1999).

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