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Early prediction of adult police dog efficiency—a longitudinal study

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Abstract

The problem at the South African Police Service Dog Breeding Centre was that most of their progenies were unsuitable as police dogs. Behaviour tests were developed specifically for police dogs to predict their efficiency as adults. Puppies from the age of 8 weeks were exposed to situations that they probably would encounter in their work as police dogs. These experiences included crossing of obstacles, retrieval of objects, startle stimuli and aggression. In the longitudinal study of 2 years it was found that all the tests had statistical significance to a greater or lesser extent, except the gunshot test. The most significant tests were retrieval at 8 weeks and aggression at 9 months. These tests thus enable selection for suitable dogs as early as 8 weeks of age, but not later than 9 months. The conclusion is that reliable tests can predict adult police dog efficiency and in doing so, save unnecessary training and other costs on unsuccessful dogs. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

Up to 70% of dogs that were bred at the South African Police Service Dog Breeding Centre (SAPSDBC) were not suitable for use. This was not because most of those that failed lacked trainability, but because the standard set for qualifying as a police dog was of such a nature that only a few could be allowed to enter into advanced training. Rejected police dogs were frequently utilised as watch dogs for security companies.

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Since the cost of training a police dog is high, it will be readily understood that no time could be wasted in attempting to train doubtful cases. To allow a police dog on the street that was unsafe or out of control would be irresponsible. It could lead to civil claims by people being bitten unnecessarily or injury to the policeman who was supposed to be protected by his dog.

Thus, the importance of being able to reliably predict the dog's adult behaviour at an early age was obvious. The earlier it could be done, the lower the costs involved. The only way in which this objective could be achieved, was through the use of so called 'puppy tests'. None of the documented 'puppy tests', however, were reliable (repeatable) in predicting whether a puppy would become a successful police dog (Schaffer and Phillips, 1993; Bondarenko, 1995). It was therefore suggested that a set of tests be developed for the South African Police Service (SAPS), which would be more reliable than the existing ones.

Pfaffenberger (1963), during his studies on dogs for the blind, felt the need for testing puppies at an early age, during a sensitive period of learning, between 6 and 16 weeks. His results showed a high correlation between dogs that performed well at an early age and those that became guide dogs. Later, Michael Fox's work on canine behaviour popularised the notion of predictability in puppy behaviour and by the 1970s 'puppy tests' became familiar and a frequently recommended technique for selecting suitable dogs (Fox, 1970). Puppy aptitude tests (PAT) are usually carried out on puppies at around 8 weeks of age, out of sight and sound of the mother, litter mates, other dogs or other distractions. Each puppy is taken individually to the test area and handled gently at all times (Fogle, 1990).

Most of the documented studies are aimed at selecting the right puppy for the right family in an attempt to prevent problem behaviour (Campbell, 1975; Fogle, 1990; Van Den Borg et al., 1991; Bondarenko, 1995; Coren, 1995), selecting dogs suitable as guide dogs for the blind or therapy dogs for the aged or disabled (Pfaffenberger, 1963; Schaffer and Phillips, 1993; Murphy, 1995), determining the genetic influence on dog behaviour (Reuterwall and Ryman, 1973; Greyvenstein, 1982), to assess the temperament of dogs in rescue shelters (Ledger and Baxter, 1997), to measure adaptive behaviour in dogs (Coren, 1995) and to investigate whether behaviour tests could be used to select service dogs for different kinds of work and breeding (Wilsson and Sundgren, 1997). Other studies on behavioural tests for the purpose of predicting the success of police and military dogs have also been carried out (Reuterwall and Ryman, 1973; Fält et al., 1982; Mackenzie et al., 1985). None of the documented studies, however, tested puppies in order to predict whether they would become successful police dogs.

2. Materials and methods

The puppies ($n = 167$) used in the prediction of adult police dog behaviour were bred at the SAPSDBC between January 1994 and March 1996. The sample consisted of 49 different litters from 34 stud dogs and 54 brood bitches. A total of 11 stud dogs had

been mated to more than one bitch and five bitches produced more than one litter. No bitches were mated to the same male twice. All dogs were German Shepherd dogs and puppy tests started at 8 weeks.

One week after the mating, bitches were dewormed against roundworm such as *Toxocara canis* and *Ancylostoma*. At 28 days after mating each bitch was taken to the local Veterinary Hospital for a pregnancy test, by abdominal palpation. Once pregnancy had beenconfirmed bitches were dewormed at 35 days of pregnancy (using a broad spectrum dewormer which also controls tape worms such as *Dipylidium caninum*). During late pregnancy and lactation two meals of one kilogram (kg) of a premium commercial dog food were given per day, instead of the single meal of one kg for non-pregnant bitches. This feeding process lasted until puppies had been weaned. The bitches were placed in the whelping kennel approximately 14 days before parturition.

The whelping kennels measured 5.30 m × 2.10 m and consisted of a concrete floor, surrounded by 1.80 m brick or asbestos walls on the sides and 1.8 m of welded mesh at the front and back. Entrance to the kennel was gained by a gate, measuring 1.8 m × 0.5 m. The roof consisted of corrugated iron and was insulated with asbestos sheets with an insulating material in between. It also contained a built-in whelping area measuring 2.04 m × 1 m which was surrounded by a plastered brick wall on the sides and welded mesh in front. This area contained an overhead infra red heating lamp for use during winter months and a mat which covered the concrete floor.

The litter remained with their mother in the whelping kennel during the period, birth to 6 weeks. Each morning, while kennels were being cleaned, bitches were allowed into socialization camps of which the smallest measured approximately 10 m × 5 m and the bigger areas 20 m × 15 m. It consisted of grass and was enclosed with 2-m high diamond mesh fence. Ample amounts of shade was provided by trees in these camps. Puppies were either held in the arms of someone or placed in playpens for the duration of the cleaning process. Puppies were weighed weekly, on an electronic scale, from the first to the 12th week of age and graphs drawn up of its weight gain/week. Weighing took place in the morning, before pups had eaten. At the age of 3 weeks, puppies were introduced to commercial puppy pellets softened with warm water, and the addition of cow milk. From the age of 4 weeks, the handlers spent at least 2 h per day with the puppies, playing with them and allowing them into their office building where they were allowed to lie where they wanted to, or were left to explore the rest of the building. Play and exercise are known stress release activities for dogs (Holden, 1989). According to Pfaffenberger (1963) boredom, resulting from a lack of something to do, prevents dogs from achieving their greatest potential. Five people were responsible for the feeding and general care of pups during this time. These people represented different sexes and ethnic groups as far as possible. Puppies were dewormed with *Nemex* at 3 weeks and 6 weeks of age and also vaccinated at 4 weeks and 6 weeks. No puppy tests were carried out during this period. Gunshots were, however, fired at the age of 6 weeks to start familiarising the pups to loud noises. A 9 mm pistol was used and blanks were fired from a distance of 40 m. Puppies were also taken for short rides on the premises in a police vehicle. These drives lasted for approximately 10 min at a time.

Pups were not separated from their mothers after weaning at 6 to 7 weeks of age as was suggested in early literature (Pfaffenberger and Scott, 1959; Scott and Fuller, 1965;

Scott et al., 1974). This is, however, still a standard procedure amongst commercial dog breeders. Prior to the year 1990 it was also done by the SAP (during 1996 the name South African Police (SAP) was changed to the South African Police Service/SAPS). The separation of puppies from their mother at the age of 6 to 7 weeks was, according to Scott et al. (1974), implemented to facilitate human/pup socialization. Slabbert and Rasa (1993), however, showed that bonding between the handler and pup could be just as successful even if pups were subjected to prolonged maternal contact. The main reasons for leaving the pups with their mothers for an extended period were:

   - for the pups to observe their mothers behaviour when subjected to police work and
   - to reduce the effect of separation stress, which could cause a higher rate of disease susceptibility and mortality (Slabbert and Rasa, 1997).

   The bitch and her litter were kept in the socialization camps until the age of 12 weeks, when the mother was finally separated from her litter.

   Puppy walks: Each litter was taken for walks outside the breeding units once a week. At the age of 8 and 9 weeks the mother was taken with the puppies. She was kept on a leash and the puppies allowed to follow the handler and mother. The route followed led through a building with slippery (polished) floors and a flight of stairs, a workshop where workers were hammering and grinding and a narrow path through bush. The route was approximately 500 m and lasted for 30 min. At the age of 10–12 weeks the litter made the same journey without the mother along with the handler once a week and at the age of 13–16 weeks each pup was taken individually once a week along the same route and also to shopping centres where they would come across crowds of people and other activities typical of a shopping centre.

   Vehicle drives: The idea here was to expose the puppies to vehicle drives as soon as possible, to prevent car sickness in adult police dogs. During this period each litter was taken for a 30 min drive at least once a week which included a trip through town where heavy traffic could be experienced. The police vehicles used were light delivery vehicles fitted with a canopy and six dog kennels big enough for an adult German Shepherd to sit or lie comfortably. Depending on the age of the puppies two or three were placed in one kennel. The kennels had welded mesh sides and gates which allowed the dogs to observe the surroundings while travelling.

   Swimming: The mother and her pups were regularly taken for a swim in a dam on the premises of the SAPSDBC. Seeing that the mother usually loved playing in water, puppies were left to observe her behaviour, but never forced into the water by the handler. They could enter at own free will, which they normally did after the first introduction, or stayed on the banks until they gained enough courage to enter. Most of the time, the handlers swam with their dogs. Swimming, as a form of relaxation for the handler and his dog, was practised far beyond the socialization period.

   Humans, other than the handlers: Contact with humans, other than police dog handlers was brought about by taking the puppies to nearby schools and allowing children to play with them. Care was, however, taken to ensure that puppies were not overwhelmed by the large numbers of children. These visits took place from the 10th week of age to the 16th and at least once every 2 weeks. Dogs were also exposed to other people visiting the Dog Breeding Centre, under supervision and control of the handlers.

Aggression: At the age of 10–12 weeks puppies were allowed to observe their mothers being provoked into aggressive behaviour by a person who was playing the role of an 'assailant'. This was done by placing the litter and their mother into the socialization kennels. The 'assailant' who is a police dog handler specially trained for provoking police dogs, then ran up and down the outside of the fence enticing the bitch to bark and display typical aggressive behaviour. This exercise was never aimed directly at the puppies and was carried out once a week.

Gunshots: Gunshots were first fired from a distance of 40 m away from the puppies, at the age of 8 weeks and then the distance was gradually decreased to 10 m, at the age of 16 weeks. Blank shots were fired at least once a week while puppies were playing with littermates or the handler. It was never carried out during a routine exercise like walking or swimming.

Retrieval: If the mother was a good retriever of objects she was used in this socialization session. An object (stick or ball) was thrown away from the bitch so that she could retrieve it. Pups were allowed to observe their mother's action and join in if they wanted to. The litter alone was also encouraged to retrieve objects that had been thrown short distances by the handler. At the age of 16 weeks pups were socialized individually. This was done at least twice a week.

At the age of 16 weeks pups were transferred from the breeding section to the socialization section where they remained until the age of 9 months. The socialization unit only started its work at the beginning of 1995. Prior to this date 16 week old puppies were placed directly from the breeding units to the forming units. Handlers at these units would thus have to work with dogs ranging in age from 16 weeks to 2 years. After the realization of the fact that the younger dogs, who needed the most attention, were getting the least, the socialization unit was started in an effort to raise the success rate of dogs bred at the SAPSDBC. At this unit, very little pressure is placed on the dogs when taught to do certain routines.

The following programme is followed.

Basic obedience: From the age of 16 weeks puppies were taught to walk on a leash and encouraged to stay on the left hand side of the handler when walking. This is standard practice for all dog handlers all over the world and is called heeling. Puppies were further taught to sit and stay.

Aggression (6 to 9 months): Once the dogs were familiar with the slip collar and leash the first agitation session commenced at 6 months of age. The dogs and their handlers formed two opposite rows of approximately eight to ten dogs with a space of 6 m between rows and 2 m gaps between each dog. The 'assailant' would then run between the two rows of dogs, provoking each one individually by waving his arms, whistling and shouting. As the weeks progressed and dogs became more used to this form of provocation the 'assailant' would take a rag and swing it at each dog and allow them to bite onto it. At the age of 9 months it was expected of every dog to bite onto a soft arm guard which was worn by the assailant. During the agitation sessions, gunshots were fired from a distance of 10 m from the dogs.

Shopping malls: Dogs were regularly taken in police vehicles to shopping malls where the handlers would walk their dogs on a leash. Their course through the mall had to include escalators, lifts, slippery floors and stairs. If a handler found that the dog was

not completely comfortable with any of the mentioned obstacles it would be repeated at least three times. This exercise was done at least once a month.

Searches: This was done by using play methods. The dog would be held by a person while the handler of that specific dog would go and hide in a bush at a distance of not more than 20 m from where the dog was being held. When he was out of sight of the dog he would call the dog's name and the dog would start searching for the handler by using its natural tracking ability. The same was done where the handler hid in a room of a vacant house. Without placing any pressure on the young dogs they were thus taught to search for hidden persons.

At the age of 9 months dogs were transferred from the socialization unit to the forming unit where they remained until they were ready to be trained as police dogs. The task of this unit was to start teaching the dogs to:

- do proper building searches with an assailant hiding in difficult places e.g., the ceiling or in a cupboard;
- do difficult searches in a bush where the assailant would hide in a tree or a cave; and
- execute a proper attack by setting after an assailant, biting onto his protective suit and holding on until the handler arrived.

It was from this unit that dogs were selected for training as police dogs or discarded. All tests were carried out at the SAPSDBC between 1100 and 1300 h. If a test was scheduled for a specific day when the weather was not fair, e.g., very cold, very hot or raining, that test was postponed and completed soon afterwards when the weather was moderate. The same four evaluators were used throughout, for all the tests. They were trained police dog handlers, each having at least ten years experience in the training and breeding of police dogs. The researcher was not involved in scoring the puppies' performance, but observed all the tests. Scoring was done on a ten-point scale and the points achieved by each puppy were documented on a data sheet. The final scores of each evaluator did not differ by more than two points from each other. After scoring had been completed, a mean score was calculated for each puppy for the eight tests. Handlers were not allowed to score their own dogs. This approach ensured high inter-rater reliability. These scores were then used for the prediction of adult dog behaviour. The following tests were carried out at 8 weeks, 12 weeks, 16 weeks, 6 months and 9 months of age.

2.1. Obstacle test (8 weeks)

The test consisted of the puppy's ability to manage obstacles to reach the handler or its food. The puppies were tested individually at the age of 8 weeks on an obstacle course consisting of a fenced area of approximately 15 m long. The puppy was placed over the fence by the handler. The latter then moved to a position at the end of the obstacle course, from where the dog was called towards him. To reach the handler, the puppy would have to pass through a 1.5 m long tunnel with a diameter of 0.75 m, up a stairway of 1 m long × 40 cm high and consisting of two steps on either side and over an A-frame of 1 m × 40 cm. The course was designed in such a way that it was not possible for the puppies to pass around the obstacles since these were fenced on both

sides. None of the puppies had prior experience of the course at the time of testing. Three points were awarded for each of the three obstacles which was crossed success-fully and one point if the course was completed within 2 min.

2.2. Retrieval test (8 and 12 weeks)

At the age of 8 weeks and 12 weeks puppies were tested individually for their ability to retrieve objects, a favourite toy, small enough for the puppy to retrieve. The handler would take a walk with the puppy and carry out the test away from other distractions such as dogs, people or vehicles. The evaluators would stand close enough to observe the puppies' performance without disturbing them. The chosen area would be one where the puppy could easily see where the object had landed after it has been thrown by the handler (e.g., relatively flat surface and short grass). When scoring the dog's perfor-mance the following criteria were considered:

  - the dog's interest in its handler's instruction to retrieve the object (e.g., was it easily distracted or was its attention focussed on the task);
  - the manner in which it approached the object;
  - the way in which it found the object;
  - how, if found, it retrieved the object; and
  - whether the puppy carried the object straight back to the handler.

 Each criterium counted two points.

2.3. Startle test for temperament (12 weeks and 16 weeks)

Temperament can be defined as the internal constitution with respect to balance or mixture of qualities or parts. Thus, in this general application, temperament embraces expected character, sensitivity, discrimination, spirit and intellect (Goldbecker and Hart, 1967).

The following behavioural scale was used for temperament evaluation.

The handler would walk with his dog, off-leash, along a trail through dense bush. A stranger to the dog then suddenly jumped from behind a bush or wall in front of the dog. When awarding a point out of ten, the dog's immediate reaction was important. If the puppy ran away and stayed away, it scored zero. If the dog was frightened, ran away, but returned after reconsidering the situation, it was scored 5. On the other hand, if the puppy barked at the stranger or even tried to attack and made no effort to run away, it scored 10. Any reaction of the dog between the mentioned criteria was scored accord-ingly.

2.4. Gunshot test (12 weeks)

At the age of 12 weeks each puppy was tested individually for its ability to tolerate loud noises caused by gun shots. A puppy and its handler were playing in the

socialization camp. Three shots were fired from a 9 mm blank pistol, with an interval of 2 s between shots from a distance of approximately 20 m. The person firing the shots was not visible to the puppy. When scoring the puppy's performance the evaluators would rely on its body language as described by Schaffer and Phillips (1993), e.g., the position of the ears and tail, total body posture, whether hair was raised or not and whether the dog tried to escape. If the dog stood to listen where shots were coming from, but showed no typical signs of fear and immediately carried on with what it was doing prior to the shots being fired, it passed the test. A dog which showed typical signs of fear and tried to escape, failed the test. No points were awarded for in between behaviour as a dog would either be gun-shy or not. On the data sheet, in the appropriate column, each dog was thus marked as having passed (P) or failed (F).

2.5. Aggression test (6 months and 9 months)

This test was carried out at 6 and 9 months of age. The dogs were provoked into aggressive behaviour 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 five 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. This method is a standard and accepted way of testing aggression in police dogs (Slabbert, 1990).

2.6. Measurement of success

After the scoring had been completed for all eight tests, the score sheets were kept by the researcher until a decision was made on whether each dog had turned out to be a successful police patrol dog. The decision on whether a dog was successful could only be made at the age of 18 to 24 months. For a dog to be accepted as a successful police dog it had to pass the prescribed patrol dog course of 103 days. The course is held at the SAPS Dog School Training Centre and the pass mark is an average of 80%. Once this was decided, a 'Y' (yes) or 'N' (no) was marked on the data sheet.

The work of a police patrol dog is threefold.

(i) Patrolling, which includes searching, arresting, and controlling crowds. The dog's obedience is evaluated on its ability to heel, stay, sit, lie down, stand and come on command. On command, the dogs attacks an 'assailant' (pseudo-criminal) over a distance of at least 50 m, and holds him until he is arrested by the handler. The dog also has to release on command. While this exercise is carried out, three shots from a blank pistol are fired by the 'assailant' to test the dog's courage and gun-sureness. An 'assailant' hides in a building and then in a bush; the dog has to locate the person, and alert the handler of his whereabouts, by barking and remaining at the spot;

(ii) Tracking criminals or lost persons. A track of a person of at least 400 m long, with a 90° turn is prepared for each dog. The track has to be one hour old, and three small objects are left on the track for the dog to find. A square, measuring approximately 30 m^2, is marked in long grass. Four small objects, e.g., keys, knives, shoes,

purse, or a matchbox, are then thrown into the square for the dog to locate and retrieve to its handler.

(iii) Recovering stolen or lost property. An object is thrown a distance of at least 15 m and the dog is given the command to retrieve it. The dog has to search for the object and return it to the handler.

3. Results

The dog's performance in the eight tests and whether it became a successful police dog were determined. Statistical analysis of the data was carried out by the University of Pretoria's Bureau for Statistical and Survey Methodology (STATOMET). The Wilcoxon 2-sample Test (Normal approximation, with continuity correction of 0.5), T-test and Kruskal–Wallis Test (Chi-square approximation) were used for all the test scores except the gunshot test. Because the gunshot test was the only test not scored out of ten but by 'pass' or 'fail'.

4. Obstacle test (8 weeks)

A high percentage of puppies which had low scores for the obstacle test, did not become police dogs ($n = 96$; $p < 0.005$). On the other hand, a moderate percentage of puppies which achieved high scores for this test became successful police dogs ($n = 71$). A comparison was made between the percentage of puppies which achieved high scores
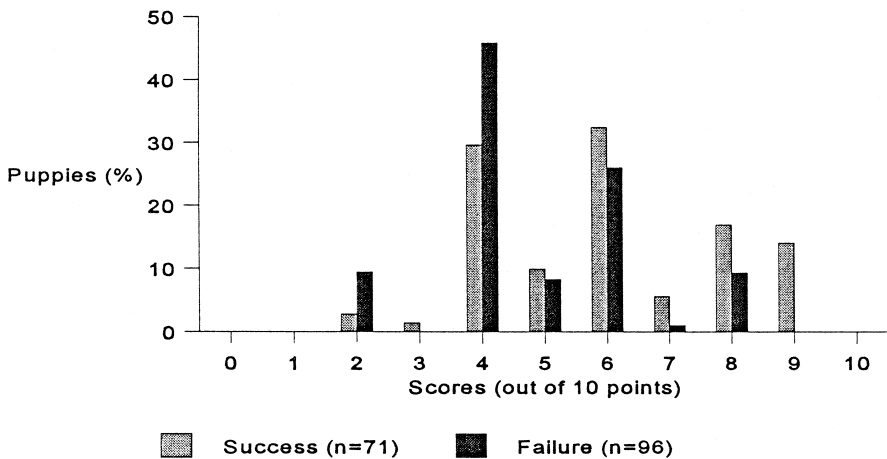

Fig. 1. Comparative obstacle test scores of 8-week old puppies ($n = 167$).

and became police dogs in adulthood, and those which achieved low scores and failed to become police dogs (Fig. 1).

5. Retrieval test (8 weeks)

Retrieval test scores of 8-week old puppies which became police dogs in adulthood were significantly higher than those which did not become police dogs ($p < 0.001$). A comparison was made between the percentage of puppies which could be trained as police dogs in adulthood, and those which failed to be chosen as police dogs (Fig. 2).

6. Retrieval test (twelve weeks)

The statistical analysis of data showed that a highly significant number of dogs which became successful police dogs during adulthood, achieved better scores than those dogs which failed to become police dogs $p < 0.001$ (Fig. 3).

7. Startle test (12 weeks)

A significant percentage of puppies which achieved low scores for the startle test, did not become successful police dogs during adulthood, while those which achieved higher
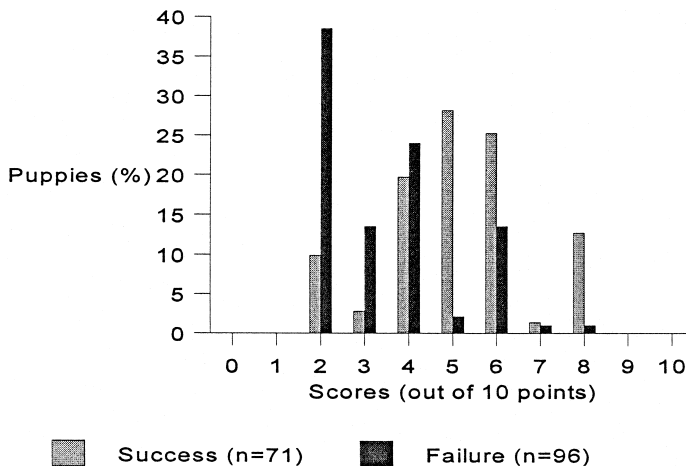

Fig. 2. A comparison between the retrieval test scores of 8-week old puppies ($n = 167$).
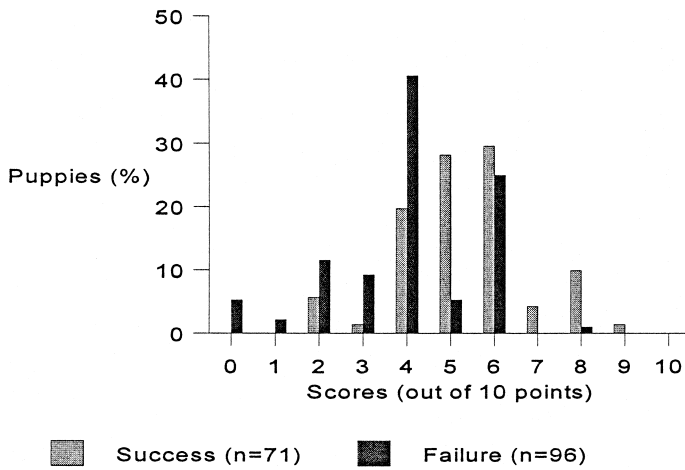
Fig. 3. Comparative retrieval test scores of individual 12-week old puppies ($n = 167$).

scores for the startle test had a better chance of becoming police dogs during adulthood ($p < 0.005$) (Fig. 4).

8. Gunshot test (12 weeks)

Of the total number of puppies tested for gun-shyness ($n = 167$), the majority passed the test ($n = 158$). Only one of the dogs which failed this test, went on to become a
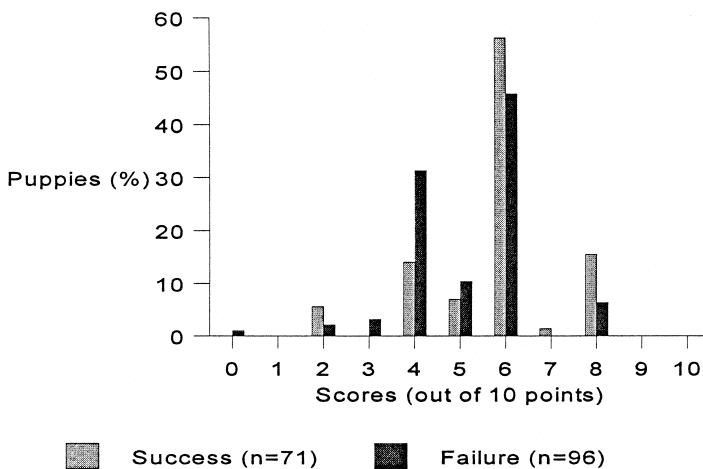

Fig. 4. Comparative startle test scores of individual 12-week old puppies ($n = 167$).

Table 1
Comparison of individual 12 week old puppies' ($n = 167$) performance in the gunshot test as a determinant of whether this test could be used as a predictor of adult dog behaviour ($n = 167$)

Successful police dog	Gunshots			
	% Pass	(n)	% Fail	(n)
Yes ($n = 71$)	41.9	70	0.6	1
No ($n = 96$)	52.7	88	4.8	8
Total ($n = 167$)	94.6	158	5.4	9

successful police dog during adulthood. No significant difference was found between the two different groups of dogs ($p > 0.05$) (Table 1).

9. Startle test (16 weeks)

Startle test scores of 16 week old puppies which became police dogs in adulthood ($n = 71$) were significantly higher than those which did not become police dogs ($n = 96$) ($p < 0.01$). A comparison was made between the scores of puppies which could be trained as police dogs during adulthood, and those which could not (Fig. 5).

10. Aggression test (6 months)

A high percentage (78.1%) of puppies which achieved low scores at the aggression test did not become police dogs ($p < 0.001$), while a fairly high percentage (69%) of those which achieved high scores went on to become police dogs during adulthood. A
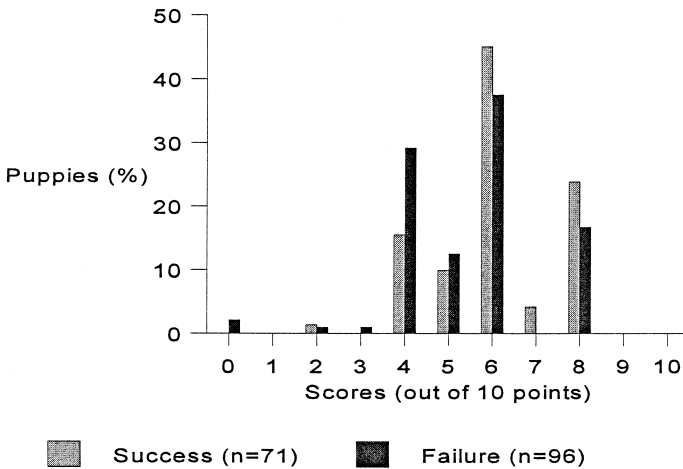

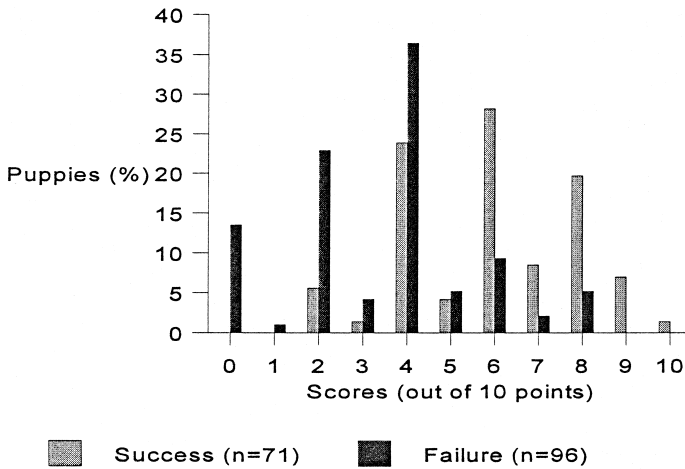Fig. 5. Startle test scores of individual 16-week old puppies ($n = 167$).

Fig. 6. Comparative aggression test scores of individual 6-month old juveniles ($n = 167$).

comparison was made between the percentage of juveniles which achieved high scores and went on to become police dogs in adulthood, and those which achieved low scores and failed to become police dogs (Fig. 6).

11. Aggression test (9 months)

A high percentage of 82.2% of juvenile dogs, aged 9 months, which achieved low scores at the aggression test, did not become police dogs, while a moderate percentage (54.9%; Table 3) of those which achieved high scores, went on to become police dogs
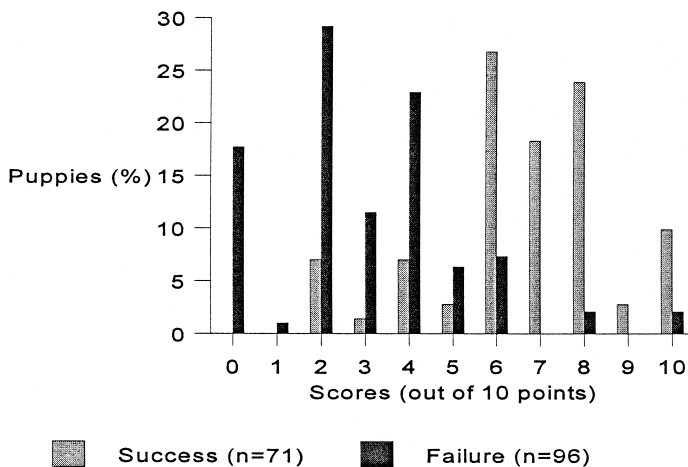

Fig. 7. A comparison between the individual aggression test scores of 9-month old juvenile dogs ($n = 167$).

Table 2
Summary of results of all eight tests used as predictors of adult police dog efficiency to compare which tests were most likely to predict adult police dog efficiency ($n = 167$)

Test	P	Mean	Std. Dev.	Std. Error of Mean (SEM)	Odds ratio
Obstacle (8 weeks)	< 0.005	5.149	1.623	0.125	1.092
Retrieve (8 weeks)	< 0.001	4.018	1.918	0.148	1.708
Retrieve (12 weeks)	< 0.001	4.568	1.733	0.134	1.277
Startle (12 weeks)	< 0.005	5.407	1.440	0.111	0.694
Gun (12 weeks)	> 0.05	0.946	0.236	0.017	1.234
Startle (16 weeks)	< 0.01	5.694	1.566	0.121	1.248
Aggression (6 months)	< 0.001	4.509	2.384	0.184	1.478
Aggression (9 months)	< 0.001	4.538	2.780	0.215	1.660

during adulthood ($p < 0.001$). A comparison was made between the percentage of puppies which achieved high scores and became police dogs in adulthood, and those which achieved low scores and failed to become police dogs (Fig. 7).

12. Comparison between the eight different tests

The four tests, aggression (6 and 9 months) and retrieve (8 and 12 weeks) were most likely to predict police dog efficiency ($p < 0.001$). The other three tests, obstacle (8 weeks); startle (12 weeks) and startle (16 weeks) were, however, also significant in predicting adult police dog efficiency. Significance in predicting adult police dog efficiency could not be proved for the gunshot test ($p > 0.05$) (Table 2).

Table 3 compares the puppy scores of the seven tests which turned out to be significant in predicting adult police dog efficiency of the successful dogs. It is evident from this table that successful dogs achieved better scores, the second time they were tested. Compare retrieve at 8 and 12 weeks, startle at 12 and 16 weeks and aggression at 6 and 9 months.

Table 3
A comparison between the successful puppies' scores for seven of the eight tests used to determine adult police dog efficiency ($n = 71$)

Test	% Scores out of ten points					
	0–4 (low)	(n)	5–6 (average)	(n)	7–10 (high)	(n)
Obstacle	33.8	24	42.2	30	24.0	17
Retrieve (8 weeks)	32.4	23	53.5	38	14.1	10
Retrieve (12 weeks)	26.8	19	57.7	41	15.5	11
Startle (12 weeks)	19.7	14	63.4	45	16.9	12
Startle (16 weeks)	16.9	12	54.9	39	28.2	20
Aggression (6 months)	31.0	22	32.4	23	36.6	26
Aggression (9 months)	15.5	11	29.6	21	54.9	39

Table 4
A comparison between the unsuccessful puppies' scores for seven of the eight tests used to predict adult police dog efficiency ($n = 96$)

Test	% Scores out of ten points					
	0–4 (low)	(n)	5–6 (average)	(n)	7–10 (high)	(n)
Obstacle	55.2	53	34.4	33	10.4	10
Retrieve (8 weeks)	82.3	79	15.6	15	2.1	2
Retrieve (12 weeks)	68.7	66	30.2	29	1.1	1
Startle (12 weeks)	37.5	36	56.3	54	6.2	6
Startle (16 weeks)	33.3	32	50.0	48	16.7	16
Aggression (6 months)	78.1	75	14.6	14	7.3	7
Aggression (9 months)	82.3	79	13.5	13	4.2	4

Table 4 compares puppy scores of seven tests which turned out to be significant in predicting adult police dog efficiency of the unsuccessful dogs. This table shows that unsuccessful puppies achieved better scores during the second test, for the retrieve and startle tests, but achieved lower scores for the aggression tests. A score of 0–4 points on a 10-point scale was regarded as being low, 5–6 points as average and 7–10 points as being high.

13. Discussion

This study has indicated that a significant number of police dogs' adult behaviour can be predicted by their performance as puppies and juveniles through the use of specific aptitude tests. With the exception of the gunshot test, all the other tests used for this particular study showed significant values for predicting adult police dog efficiency (Table 2). However, the three tests 'retrieve (8 weeks)'; 'aggression (9 months)' and 'aggression (6 months)' proved to be the most effective predictors when used together. These three tests accounted for the accurate prediction of 81.7% of unsuccessful dogs and 91.7% successful police dogs. The objective of this study was not necessarily to find a single test for the prediction of adult police dog efficiency, but a variety of tests which could be used together. Bondarenko's article (Bondarenko, 1995) supported this statement by saying that no single test can reliably evaluate all aspects of a dog's future behaviour.

Results as shown in Figs. 2 and 3 and Tables 3 and 4 revealed that puppies bred at the SAPSDBC did not possess a high retrieval drive. Only 14.1% of 8 week old puppies which were successfully trained as police dogs achieved high scores while 2.1% of unsuccessful police dogs achieved high scores. The retrieval test at 12 weeks showed a slight improvement but was still, unacceptably low. Of these dogs 15.5% ($n = 11$) of the successful ones achieved high scores while only 1.1% ($n = 1$) of the unsuccessful police dogs achieved these scores (Tables 3 and 4). This slight improvement in the 12 week tests scores was due to the fact that socialization had taken place during the period 8 to 12 weeks of age. Pfaffenberger (1963) explained that a puppy could be taught to retrieve

without much difficulty, but found that these puppies would not be willing workers. Fält et al. (1982) found that fetch tests carried out on 8-week old German Shepherd army dogs proved significant for the heritability of this trait. Stud dogs and brood bitches used for breeding SAPS dogs are not selected for their ability to retrieve. This could be one of the most important explanations for the high percentage of failures amongst dogs bred at the SAPSDBC. The inability of a potential police dog to retrieve, accounts for the most failures other than lack of aggression.

The testing of puppies for fearfulness was more significant at 12 weeks of age than at 16 weeks of age for the prediction of adult police dog efficiency. Puppies achieved higher scores for this test at 16 weeks compared to 12 weeks (Fig. 4; Tables 2–4). Goddard and Beilharz (1984) demonstrated that behaviour of adult dogs could be predicted, to some degree, for fearfulness at 12 weeks of age, but that the accuracy of this prediction increased with age. Bondarenko (1995) cautioned, however, that a startle test should be handled with care and set up so that each puppy was relaxed and comfortable in an open space where it could escape from and return to investigate the stimulus. Masking reduces the number of circumstances which are likely to trigger flight, but it does not eliminate them. What assessment of puppies can do is to predict which puppies are most likely to tend to respond in a particular way to a general environmental stimulus or stress and how readily any puppy is able to recover and return to physiological status quo (Bondarenko, 1995).

The fact that the gunshot test was not significant in predicting adult police dog efficiency came as no surprise as puppies were exposed to gunshots prior to their testing at 12 weeks of age. This type of exposure is known as gunfire desensitization. This test is, however, still regarded as a very useful test in eliminating dogs before they are trained as police dogs. A gun-shy dog can never be allowed to work as a police dog as gunshots will most definitely be encountered during its work as a police dog. Gun-sure dogs will continue to function effectively during exchanges of gunfire, regardless of the origin of these gunshots. Gun-shyness was reported by Kock (1984) in German Pointers but the heritability derived for this trait was not significant. At the SAPSDBC no gun-shy dogs are used for breeding purposes.

The results of the aggression tests at 6 months and 9 months of age proved to be highly significant for predicting adult police dog efficiency (Tables 2–4). The lack of aggression accounted for the biggest reason for failing to qualify as police patrol dogs in the SAPS. This problem was documented as early as 1934 when Humphry and Warner (1934), working in Switzerland, found that teaching German Shepherds to bite was the most difficult task in their police dog course. Wilsson and Sundgren (1997), however, used the word 'sharpness' for the tendency of the dog to react with aggression. They also stated that the characteristics most used in training of German Shepherds were defence drive, sharpness and, above all, prey drive. These were all scored separately. Although stud males and brood bitches used by the SAPS were all selected for their appropriate temperament, which included high levels of aggression, a high percentage of their progenies still scored poorly in the aggression test. The results of the 6 month test as shown in Table 3 show 31.0% ($n = 22$) of puppies which eventually passed as police dogs and 78.1% ($n = 75$) of failures achieved low scores. Results of the 9 month test, as shown in Table 3, revealed that 15.5% ($n = 11$) of successful police dogs and 82.3%

($n = 79$) of unsuccessful police dogs achieved low scores. These results support the findings of Willis (1989) that aggression was not necessarily inherited. Wilsson and Sundgren (1997) also found that German Shepherd dogs, selected as police and protection dogs, had higher than average partial index values for defence drive and prey drive. The reason for the high percentage of poor scores at this age could also be attributed to the statement by Lithgrow (1991) that juvenile dogs, at the age of 6 to 9 months of age, may become 'skittish' or act differently. He went on to say that at this age a dog realizes, for the first time, that it could get hurt. This fear is necessary for self preservation. Before this age, a young puppy has no sense of caution and may run in front of a car or horse not knowing the consequences. Lithgrow's advice was to give the dog of this age a chance to recover and not to force it into activities it feared. This may well be the reason for the lack of development of aggression in puppies that are excessively 'stimulated' between 6 and 9 months. Although the aggression test at 9 months was highly significant in predicting adult police dog efficiency, it does not reduce the age of prediction by very much. Previously a decision would be made at the age of 12 to 18 months, without the use of puppy tests. The aggression test at 6 months would therefore be more useful because of the saving of 3 months. This may however, not be the best time, because it is the time when puppies are most fearful (Lithgrow, 1991). The nature of temperament is difficult to define and studies on its heritability are not readily available (Serpell, 1995). Mackenzie et al. (1985) obtained significant results to indicate heritability of temperament. This suggests that selection for this feature would be successful. Puppy aptitude tests can be defined as attempts to classify a puppy's reaction to a broad range of situations to allow the breeder to judge each puppies temperament type (Wilkes, 1997). Ideally puppies are subjected to these tests between 7 and sixteen weeks of age. The tests are designed to tell the breeder or buyer the behaviour they can expect when the puppies grow up (Pfaffenberger, 1963; Campbell, 1975; Bondarenko, 1995; Diederich, 1995). The advantage of a good set of puppy tests was best summed up by Pfaffenberger (1963) when he stated that if a person could learn to rely on his test for his specific breeding, a year or more could be saved in unnecessary time and money. This saving was attributed to the fact that a person would not have to wait until a litter was grown to see what a specific breeding produced. Bondarenko (1995) agreed with this statement and explained that puppy assessment has a role in purpose breeding of dogs for specific functions or roles, seeing that it could be used for reducing the number of dogs in a programme which were unlikely to qualify or were likely to be very cost and time intensive in order to qualify.

During 1960, however, John Scott was quoted by Pfaffenberger (1963) as saying that he doubted if anyone had yet arrived at a solution of how to predict, with any degree of accuracy, what the behaviour of an adult dog would be by a test given to puppies. One of the biggest advantages of puppy tests is that even if no positive predictability is achieved, the socialization puppies receive while being tested, would probably improve the trainability and the percentage of dogs available for training, to justify the time spent on each puppy (Pfaffenberger, 1963).

Very little research has been done on longitudinal studies assessing puppy behaviour as a predictor of adult dog behaviour. It seems, however, that not only dog behaviour, but research on dogs in general, has been neglected by researchers. Serpell (1995)

confirmed this statement when he commented that a general shortage exists of objective and reliable scientific information about the domestic dog. When considering how long dogs have been an integral part of human society, let alone the practical and emotional impact they have had on countless human lives, it is surprising how little is known about *Canis familiaris*.

The behaviour of wolves, coyotes, jackals and most other wild canids have been studied in meticulous detail, but, with a few notable exceptions (e.g., Lorenz, 1954; Scott and Fuller, 1965; Fox, 1975) the domestic dog has been largely ignored by scientists, except when it has become a problem, or when it has been used as a substitute for humans in biomedical and psychological research. Most modern biologists and behavioural scientists seem to regard domestic animals as unnatural and therefore unworthy or unsuitable as subjects for serious scientific investigation (Clutton-Brock, 1994). It is still believed by many people that the domestic dog is essentially a degraded wolf, abnormal and therefore an uninteresting artifact of human design, rather than a unique biological species in its own right, with its own complex and fascinating evolutionary history. So much of the existing canine literature contains anecdotal observations, subjective impressions and unsubstantiated theories (Serpell, 1995).

Although Clarence Pfaffenberger developed his tests as early as 1946, they are still today one of the best studies in this field. This statement is supported by the fact that these tests were designed specifically for the screening of puppies, produced in a closed breeding programme at the GDBA, for the use as guide dogs. By using these tests a significant prediction could be made whether puppies had the ability to become successful guide dogs during adulthood. (Pfaffenberger et al., 1976). Pfaffenberger's study is one of only a few documented longitudinal studies on puppy testing apart from this one on police dogs.

Most of the documented puppy tests involve lifting the puppy off the ground, rolling it on its back and pinching its ear or toes (e.g., Campbell, 1975; Volhard and Fisher, 1983; Coren, 1995). According to Wilkes (1997) puppy testing assumes that:

- resistance to dominance at an early age will translate into resistance to human control as an adult;
- physically holding a dog down on the ground or in the air imitates the way dogs dominate each other; and
- puppies display dominance consistently as they mature.

Critics of such temperament testing suggest these assumptions are not yet proven. The tests are not representative of natural behaviours seeing that wolves or wild dogs do not usually lift each other off the ground. Being suspended in the air is completely alien to natural dog behaviour. This, assuming that a struggling puppy is displaying dominance, is unrealistic. The test that requires rolling a puppy on its back and holding it for 30 s is also unlike real dog behaviour. In nature, dogs do not roll their opponents to the ground. Most often, the subordinate dog voluntarily gives up and lies on its back (Wilkes, 1997).

In cases where testing is used as a game, breeders will often obtain the services of a friend or colleague with little or no experience of puppy assessment and development. They follow a written test found in a dog magazine or book and open umbrellas, bang pots and call the puppies with great enthusiasm. The end result is a pronouncement that

the puppy is of good temperament and an assurance to the buyer that they can pay their money in good faith. The usual outcome of this way of testing is that the buyer finds that he has no comeback if the puppy demonstrates extremes of nervousness, aggression, over activity or any other behaviour which is disruptive and difficult to control. The breeder simply points out the fact that the puppy did have a good temperament when it left their premises and the buyer must therefore be at fault (Bondarenko, 1995). Wilkes (1997) said that developing a test to predict a puppy's future behaviour was obviously a desirable goal. Many pitfalls could be avoided by dog breeders if they could accurately determine which puppies would make quality pets and which would be better suited to working or showing. He, however, warned that as long as current testing methods remained unproved, this goal would not be reached. Continuing the quest toward effective puppy testing would require an open mind and objective study.

The use of the specific puppy tests for police dogs provides a reliable tool which enables dog handlers to distinguish between puppies that would succeed as efficient police dogs and those which would not be suitable. This promotes cost-effective dog breeding and training as no unnecessary time is wasted on doubtful cases.

Acknowledgements

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