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Traits of drug and explosives detection in dogs of two breeds as evaluated by their handlers and trainers*

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Police dogs handlers' and trainers' opinions on Labrador retrievers (n=87) and German shepherds (n=96) trained for drugs *vs*. explosives detection have been compared. As most important traits in both specialties the responders indicated: (1) willingness to sniff objects, (2) concentration (focusing) ability, (3) acuity of smell and (4) willingness to bring an object back to a person. Only trainers but not handlers rated boldness in novel surroundings, and fear of specific things and of sudden loud noises, high in importance. Taking all traits together 43.7% and 44.4% of dogs showed an "ideal" level of the traits according to handlers' and trainers' opinion, respectively. Correlations coefficients between handlers' and trainers' ratings for the traits of real dogs did not exceed $r = 0.33$. Significant breed and specialty differences were found for the percentage of dogs that demonstrated too low, too high and "ideal" levels of the trait. Both handlers and trainers were consistent in their opinion that Labrador retrievers as service dogs of both specialties are too highly motivated to obtain food ($P<0.05$) and as drug detection dogs are overly friendly to people ($P<0.01$). The overall satisfaction rate did not differ significantly between breeds, specialties and sexes. This report shows a rather low consistency of opinions of dog trainers with those of dog handlers as to 28 behavioral and physical traits of drug and explosives detection dogs of both breeds and reveals no special preference for either breed in performing narcotics or explosives detection.

KEY WORDS: detection dogs / dogs' handlers / dogs' trainers / drugs

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The most common use of specialist detection dogs in law enforcement forces is for explosives and drug detection [Gazit *et al*. 2005, Rooney *et al*. 2004, Sinn *et al*. 2010]. Performance of detection dogs is mostly evaluated subjectively by handlers and trainers without employing scientific experiments. It is not known how consistent are the subjective evaluations of dogs by their handlers and trainers. The observed differences in detection performance between individual dogs are related to behavioral differences [Slabbert and Odendaal 1999, Svartberg and Forkman 2002, Rooney *et al*. 2007, Sinn *et al*. 2010]. Due to differences in genetic selection and current breeding trends in particular breeds, their suitability for explosives and drug detection may differ and change over the long term. Breeding for show purposes may be reducing the effectiveness of animals of some breeds in performing traditional functions [Svartberg 2006]. Therefore, ranking of breeds as to their suitability for particular kinds of detection is of importance.

Opinions of police canine experts on particular dog breeds affect breeders in the criteria by which they select and prepare dogs before offering them for purchase by the police, at which point they are committed to specialist training. Behavioral questionnaires are considered a useful research tool [Bradshaw *et al*. 1996, Serpell and Hsu 200, Rooney *et al*. 2004, Rooney *et al*. 2007, Lefebvre *et al*. 2007, Kubinyi *et al*. 2009] as these allow a preliminary evaluation of a large group of dogs in a short period of time. However, the validity of such an evaluation is quesionable since it may depend on experience of the evaluator, his/her preferences or differences in focusing on particular traits, and even on the evaluator's attitude to particular breeds or individual dogs. Up to now there have been no scientific studies comparing opinions of police canine specialists on the two main dog breeds *i.e*. German shepherds and Labrador retrievers used by many countries' law enforcement forces for drug and explosives detection. Also, no international standards or criteria officially designate specific breeds as optimally suitable for drug and explosives detection.

The aim of this paper was to compare two the most popular dog breeds used for drug and explosives detection – German Shepherds and Labrador retrievers – on the basis of handlers' and trainers' opinions. As there is a gap in multi-trait evaluation of sniffer dogs, the procurement process of dogs for specialist detection training and evaluation of training progress may benefit from the results of this research.

Material and methods

Animals

Questionnaires concerning 57 drug detecting Labrador retrievers (DL) of both sexes, 46 drug detecting German shepherds (DG), 30 explosives detecting Labradors (EL) and 50 explosives detecting German shepherds (EG) were collected. The dogs were trained or underwent periodical testing at the Canine Department of the Police Training Centre in Sułkowice, Poland from 2009 to 2011. All dogs were procured for training at the age of 1-3 years. Preliminary tests involved the ability to retrieve a

thrown object, searching for a hidden object, persistence in searching, ability to retrieve different objects, indoor behavior (fear reaction), behavior on slippery surfaces, fear reaction to noise, and interest in treats. Purchased dogs were allocated to particular handlers for ultimate specialization in either narcotics or explosives detection. Each dog handler trained one dog or, in a few instances, two dogs. Specialist training lasted 5 months and was conducted under the supervision of experienced dog trainers. Two trainers were in charge of drug detection training of DG and DL dogs and two other trainers were in charge of explosives detection training of EG and EL dogs. Training programs for both dog specialties were basically similar, but differed as to the reaction dogs were taught to give when indicating a site where target material was hidden. Whereas the D dogs were trained to scratch at the site, E dogs were taught to sit or lie down cautiously in front of the site where the material was hidden.

Questionnaries

A questionnaire contained 28 traits and was generally based on that described by Rooney *et al*. [2004] and Rooney and Bradshaw [2004], modified for Polish conditions . Before filling in the questionnaires, the handlers and trainers were asked to give frank opinions on their dogs without this having any consequence on the further fate of their dogs or on any evaluation of responder's qualifications. Questionnaires were filled in by the same handlers evaluating the same dogs for the second time after a 3-week period.

Each of the 28 traits was scored using a scale of 1-5, where 5 was given for the highest magnitude of the trait. The responders were also asked to give scores (1-5) for each trait which they deem to be "ideal" or "desirable", and scores (1-5) for the weight (importance) of each trait for given specialty. The 28 traits were ranked according to their weight for assigned specialty and deviations between scores for real vs. "ideal" dogs were calculated.

In order to calculate the overall indexes of deviation (OID) of individual dogs from "ideal", the sum of products (deviation from ideal x weight) of each trait was obtained. The lower OID the better a dog fulfilled overall expectations of its handler or trainer.

Statistical

The internal consistency of questionnaires was assessed by calculating the Cronbach's alpha coefficient. As there was no normal distribution of the scores given in questionnaires, the non-parametric Spearman's rank correlation coefficients were calculated to assess relationships between ratings of trainers and handlers. The differences in percentages of dogs with "ideal", too low and too high a level of the traits were evaluated using the Chi-square test.

As the OID showed a normal distribution, a multi-factorial ANOVA was applied with breed, specialty and sex of dogs as main factors and with interaction effects between main factors.

Results and discussion

The four most important characteristics (mean importance score >4.5) were: willingness to sniff objects, concentration (focusing) ability, acuity of sense of smell and willingness to bring an object back to a person. For the trainers, traits of the highest importance (score 5) also included boldness in novel surroundings, fear of specific things and fear of loud sounds.

Table 1. Internal consistency and test – re-test reliability of particular traits

Traits ordered according to their importance	Internal consistency (Cronbach's alpha)		Inter-rater agreement (rank correlations coefficients between scores given by handlers and trainers)	Test – re-test rank correlation coefficient
	interrater	test-retest		
Willingness to sniff objects	0.464	0.547	0.299***	0.328**
Concentration (focusing) ability	0.504	0.354	0.306***	0.190
Acuity of sense of smell	0.556	0.565	0.332***	0.373**
Willingness to bring an object back to a person	0.546	0.692	0.332***	0.450***
Stamina	0.500	0.756	0.325***	0.625***
Tendency to hunt by smell alone	0.435	0.634	0.214**	0.513***
Ability to learn from being rewarded	0.362	0.785	0.225**	0.608***
Motivation to chase an object	0.433	0.825	0.263***	0.690***
Health	0.366	0.838	0.239**	0.700***
Tendency to be distracted when searching	0.229	0.703	0.145*	0.582***
Boldness in novel surroundings	0.387	0.712	0.245**	0.555***
Travel ability	0.299	0.540	0.082	0.308*
Intelligence – ability to act on own initiative	0.058	0.125	0.021	0.086
Playfulness	0.152	0.425	0.018	0.213
Motivation to retain possession of an object	0.419	0.593	0.212**	0.404**
Consistency of behavior from day to day	0.223	0.185	0.089	0.112
Independence - working without guidance	0.449	0.754	0.307***	0.592***
Fear of specific things	0.174	0.737	0.056	0.656***
Obedience to human commands	0.150	0.766	0.096	0.602***
Ease of adaptation to kennel environment	0.018	0.443	0.003	0.369**
Fear of sudden loud noises	-0.297	0.431	-0.123	0.373**
Friendliness to people	0.194	0.691	0.140	0.474***
Level of aggression towards humans	-0.105	0.316	-0.088	0.235
Excitability	0.407	0.619	0.281***	0.444***
Motivation to obtain food	-0.022	0.831	-0.029	0.719***
Level of aggression towards dogs	0.354	0.765	0.213**	0.621***
Agility	0.415	0.708	0.262***	0.546***
Body sensitivity - reactivity to touch	0.198	0.682	0.092	0.453***

***P<0.001, **P<0.01, *P<0.05.

Traits listed in Tables 1-3 have been ranked according to their mean importance score.

The internal consistency of the questionnaires was acceptable (Cronbach's alpha, considering that all items on the questionnaires were 0.75 for trainers and 0.74 for handlers).

Table 2. Percentage of drug detecting dogs of both breeds with traits too low, too high or "ideal" according to handlers' and trainers' opinion

Traits ordered according to their importance		DL dogs according to handlers' (H) and trainers' (T) opinions (n = 46)			DG dogs according to handlers'(H) and trainers' (T) opinions (n = 36)		
		% dogs trait too low	% dogs trait too high	% dogs trait "ideal"	% dogs trait too low	% dogs trait too high	% dogs trait "ideal"
Willingness to sniff objects	H	50.0	4.3	45.7	66.7	2.8	30.6
	T	46.7	0	53.3	40.0	0	60.0
Concentration (focusing) ability	**H +++**	**52.2**	**0**	**47.8**	**91.7**	**2.8**	**5.6**
	T	64.4	0	35.6	65.7	0	34.3
Acuity of sense of smell	H	41.3	6.5	52.3	44.4	5.6	50.0
	T ++	**37.8**	**0**	**62.2***	**68.6**	**0**	**31.4**
Willingness to bring an object back to a person	H	23.9	6.5	69.6	22.2	5.6	72.2
	T	40.0	0	60.0	42.9	0	57.1
Stamina	**H ++**	**54.3**	**8.7**	**37.0**	**86.1**	**5.6**	**8.3****
	T	71.1	0	28.9	68.6	0	31.4
Tendency to hunt by smell alone	H	50.0	6.5	43.5	50.0	0	50.0
	T	4.4	68.9	26.7***	5.7	48.6	45.7
Ability to learn from being rewarded	H	52.2	8.7	39.1	69.4	5.6	25.0
	T	37.8	0	62.2***	51.4	0	48.6***
Motivation to chase an object	H	21.7	6.5	71.7	22.2	5.6	72.2
	T	44.4	0	55.6	45.7	0	54.3
Health	H	50.0	4.3	45.7	61.1	2.8	36.1
	T	37.8	0	62.2	60.0	0	40.0
Tendency to be distracted when searching	H	23.9	50.0	26.1	27.8	58.3	13.9
	T	37.8	28.9	33.7***	40.0	22.9	37.1***
Boldness in novel surroundings	H	47.8	8.7	43.5	63.9	5.6	30.6
	T	40.0	0	60.0	57.1	0	42.9
Travel ability	H	26.1	23.9	50.0*	22.2	13.9	63.9
	T	15.6	37.8	46.7***	5.7	48.6	45.7***
Intelligence – ability to act on own initiative	H	45.7	28.3	26.1	52.8	16.7	30.6
	T	20.0	13.3	66.7**	17.1	20.0	62.9 ***
Playfulness	H	30.4	19.6	50.0	25.0	25.0	50.0
	T	2.2	42.2	55.6	2.9	51.4	45.7
Motivation to retain possession of an object	H	37.0	17.4	45.7	16.7	19.4	63.9
	T	57.8	0	42.2***	51.4	0	48.6***
Consistency of behavior from day to day	H	50.0	19.6	30.4	48.7	12.8	38.5
	T ++	**93.3**	**0**	**6.7*****	**68.6**	**0**	**31.4*****
Independence - working without guidance	H	45.7	6.5	47.8	66.7	0	33.3
	T	22.2	35.6	42.2	14.3	28.6	57.1
Fear of specific things	H	13.0	50.0	37.0	19.4	47.2	33.3
	T	0	37.8	62.2	0	51.4	48.6***
Obedience to human commands	H	52.2	10.9	37.0	63.9	5.6	30.6
	T	4.4	68.9	26.7***	0	65.7	34.3***
Ease of adaptation to kennel environment	H	41.3	15.2	43.5	44.4	5.6	50.0
	T	20.0	44.4	35.6	5.7	45.7	48.6
Fear of sudden loud noises	H	19.6	32.6	47.8	22.2	36.1	41.7
	T	0	24.4	75.6	0	37.1	62.9**
Friendliness to people	**H ++**	**10.9**	**32.4**	**58.7**	**25.0**	**5.6**	**69.4**
	T +++	**6.7**	**86.7**	**6.7**	**11.4**	**45.7**	**42.9**
Level of aggression towards humans	H	37.0	26.1	37.0	38.8	27.8	33.3
	T	0	46.7	53.3***	0	51.4	48.6**
Excitability	H	19.6	34.8	45.7	16.7	41.7	41.7
	T	2.2	93.3	4.4***	5.7	91.4	2.9**
Motivation to obtain food	H	19.6	43.5	37.0	19.4	44.4	36.1
	T +++	**11.1**	**57.8**	**31.1**	**40.0**	**17.1**	**42.9*****
Level of aggression towards dogs	H	8.6	45.7	45.7	8.3	63.9	27.8
	T	0	68.9	31.1***	0	68.6	31.4***
Agility	H	21.7	34.8	43.5	19.4	38.9	41.7
	T	28.9	31.1	40.0	31.4	28.6	40.0
Body sensitivity - reactivity to touch	H	26.1	34.8	39.1	22.2	41.7	36.1
	T	40.0	28.9	31.1***	31.4	28.6	40.0***

Significance of differences between breeds within specialty, test Chi-square: +++ P<0.001, ++ P<0.01, + P<0.05
Significance of differences between specialties within breed, test Chi-square: ***P<0.001, **P<0.01, *P<0.05.

Rank correlation coefficients between scores given by handlers and trainers (inter-rater agreement) for particular traits of the same dogs, occurred surprisingly low, although due to a relatively large number of animals they were significant for 16 traits (Tab. 1). These correlations calculated for more important traits tended to be higher than those for the less important traits for which some very low and negative correlation coefficients were found (Tab. 1).

The Pearson correlation between mean scores for an "ideal" dog as given by trainers and handlers for 28 particular traits was $r = 0.955$ and correlation between mean scores for trait importance given by trainers and handlers for particular traits was $r = 0.710$.

Taking all traits together, handlers were of the opinion that 43.7% of dogs of both breeds and specialties showed an "ideal" level of the traits, 37.9% demonstrated traits below and 18,5% of dogs demonstrated traits that were above an "ideal" level. According to the opinions of trainers, 44.4% of dogs were "ideal", while 28.3% and 27.3% showed levels too low or too high, respectively. The difference between handlers and trainers was significant ($Chi^2 = 134.9$ d.f.=2, $P<0.001$). The percentage of dogs with ratings for particular traits lower and higher than the "ideal" level and equal to the "ideal", in handlers' and trainers' opinions are given in Tables 2 and 3.

Both in handlers' and trainers' opinions, DL dogs were too friendly to people compared to DG dogs (handlers $P<0.01$, trainers $P<0.001$, Tab. 2), but the difference was not significant between EL and EG dogs (Tab. 3). In handlers' but not in trainers' opinions, significantly more DG dogs showed too low concentration ability ($P<0.001$) and stamina ($P<0.01$) compared to DL dogs (Tab. 2). Handlers of EL dogs believed that their animals were significantly more healthy ($P<0.05$) than EG dogs and demonstrated significantly lower motivation to retain possession of an object ($P<0.05$), did not adapt as well to the kennel environment ($P<0.05$) and also demonstrated a lower level of aggression towards other dogs ($P<0.05$, Tab 3).

Dog trainers' opinions on the differences between the two breeds were not significant for most traits (Tab. 2 and 3). Trainers evaluated the acuity of sense of smell higher in Labrador retrievers than in German shepherds, but the difference was significant only in drug detection dogs ($P<0.01$). Trainers believed that DG dogs showed higher consistency in behavior from day to day compared to DL dogs, but found DL dogs too highly motivated to obtain food ($P<0.001$). Trainers also found EG dogs too highly motivated to retain possession of an object compared to EL dogs ($P<0.05$). EL dogs were rated as being overly fearful of specific things compared to EG dogs ($P<0.01$, Tab. 3).

There were some inconsistencies in handlers' and trainers' opinions as to the deviations from the "ideal" in dogs of both breeds and specialties (Tab. 2 and 3). The greatest discrepancies between handlers and trainers concerned the percentage of drug detection dogs that demonstrated a level of a trait which was too low or too high. Traits for which this disagreement was most pronounced were: the tendency to hunt by smell alone, playfulness, independence (working without guidance), obedience, level

Table 3. Percentage of explosives detecting dogs of both breeds with traits too low, too high or "ideal" according to handlers' and trainers' opinion

Traits ordered according to their importance		EL dogs according to handlers' (H) and trainers' (T) opinions (n = 29)			EG dogs according to handlers'(H) and trainers' (T) opinions (n = 47)		
		% dogs trait too low	% dogs trait too high	% dogs trait „ideal"	% dogs trait too low	% dogs trait too high	% dogs trait "ideal"
Willingness to sniff objects	H	62.1	0	37.9	53.2	6.4	40.4
	T	57.1	0	42.9	56.8	0	43.2
Concentration (focusing) ability	H	65.5	0	34.5	72.3	2.1	25.5
	T	82.1	0	17.9	75.0	0	25.0
Acuity of sense of smell	H	51.7	0	48.3	61.7	2.1	36.2
	T	63.3	0	36.7*	76.1	0	23.9
Willingness to bring an object back to a person	H	44.8	3.4	51.7	27.7	4.3	68.1
	T	56.7	0	43.3	54.3	0	45.7
Stamina	H	72.4	0	27.6	59.6	2.1	38.3 **
	T	66.7	0	33.3	60.9	0	39.1
Tendency to hunt by smell alone	H	58.6	3.4	37.9	59.6	0	40.4
	T	26.7	16.7	56.7 ***	21.7	28.3	50.0
Ability to learn from being rewarded	H	51.7	3.4	44.8	53.2	2.1	44.7
	T	30.0	33.3	36.7 ***	15.2	30.4	54.3 ***
Motivation to chase an object	H	31.0	0	69.0	21.3	6.4	72.3
	T	56.7	0	43.3	56.5	0	43.5
Health	**H +**	**51.7**	**0**	**48.3**	**74.5**	**4.3**	**21.3**
	T	25.0	0	75.0	38.9	0	61.1
Tendency to be distracted when searching	H	24.1	37.9	37.9	14.9	51.1	34.0
	T	0	70.0	30.0 ***	0	50.0	50.0 ***
Boldness in novel surroundings	H	62.1	3.4	34.5	59.6	6.4	34.0
	T	56.7	0	43.3	60.9	0	39.1
Travel ability	H	10.3	10.3	79.3 *	25.5	14.9	59.6
	T	0	93.3	6.7 ***	2.2	89.1	8.7 ***
Intelligence – ability to act on own initiative	H	37.9	27.6	34.5	44.7	14.9	40.4
	T	50.0	0	50.0 **	63.0	0	37.0 ***
Playfulness	H	17.2	31.0	51.7	34.0	23.4	42.6
	T	6.7	53.3	40.0	4.3	45.7	50.0
Motivation to retain possession of an object	**H +**	**55.2**	**13.8**	**31.0**	**25.5**	**14.9**	**59.6**
	T +	**26.7**	**30.0**	**43.3** ***	**6.5**	**43.5**	**50.0** ***
Consistency of behavior from day to day	H	44.8	13.8	41.4	34.0	12.8	53.2
	T	10.0	50.0	40.0 ***	23.9	32.6	43.5 ***
Independence - working without guidance	H	69.0	0	31.0	61.7	8.5	29.8
	T	43.3	16.7	40.0	26.1	26.1	47.8
Fear of specific things	H	13.8	41.4	44.8	6.4	48.9	44.7
	T ++	**0**	**40.0**	**60.0**	**0**	**13.0**	**87.0** ***
Obedience to human commands	H	51.7	3.4	44.8	63.8	2.1	34.0
	T	86.7	0	13.3 ***	82.6	0	17.4 ***
Ease of adaptation to kennel environment	**H +**	**62.1**	**10.3**	**27.6**	**40.4**	**2.1**	**57.4**
	T	26.7	43.3	30.0	13.0	41.3	45.7
Fear of sudden loud noises	H	13.8	20.7	65.5	10.6	34.0	55.3
	T	0	30.0	70.0	0	10.9	89.1 **
Friendliness to people	H	24.1	17.2	58.6	29.8	10.6	59.6
	T	0	80.0	20.0	8.7	67.4	23.9
Level of aggression towards humans	H	24.1	24.1	51.7	27.7	27.7	44.7
	T	0	3.3	96.7 ***	0	17.4	82.6 **
Excitability	H	27.6	34.5	37.9	25.5	25.5	48.9
	T	3.3	53.3	43.3 ***	4.3	71.7	23.9 **
Motivation to obtain food	H	20.7	41.4	37.9	29.8	25.5	44.7
	T	0	83.3	16.7	0	76.1	23.9 ***
Level of aggression towards dogs	**H +**	**17.2**	**37.9**	**44.8**	**2.1**	**63.8**	**34.0**
	T	0	16.7	83.3 ***	0	17.4	82.6 ***
Agility	H	17.2	31.0	51.7	17.0	25.5	57.4
	T	30.0	16.7	53.3	23.9	17.4	58.7
Body sensitivity – reactivity to touch	H	27.6	27.6	44.8	21.3	34.0	44.7
	T	0	23.3	76.7 ***	0	15.2	84.8***

Significance of differences between breeds within specialty, test Chi-square: +++ P<0.001, ++ P<0.01, + P<0.05
Significance of differences between specialties within breed, test Chi-square: ***P<0.001, **P<0.01, *P<0.05 (see Tab. 2).

of aggression towards humans and excitability (Tab. 2). In explosives detection dogs, handlers and trainers disagreed most on the ability to learn from being rewarded, the tendency to be distracted, friendship to people and excitability (Tab. 3).

In handlers' opinions, significant differences between specialties within breeds concerned only travel ability (a higher percentage of "ideal" EL dogs and a lower percentage of EL dogs with travel ability that was too low compared to DL dogs, ($P<0.05$), and higher stamina in EG than in DG dogs($P<0.01$). The trainers believed that there are more traits in which the percentage of dogs with an "ideal", and deviating from "ideal" level of the trait differ significantly between specialties within breeds (Tab. 2 and 3). For example, according to the trainers, more DL than EL dogs show an "ideal" level of acuity of smell ($P<0.05$), too high tendency to hunt by smell alone ($P<0.001$), an "ideal" ability to learn from being rewarded ($P<0.001$), less tendency to be distracted ($P<0.001$), and "ideal" travel ability ($P<0.001$). Further significant differences in deviations from "ideal" level of the traits between breeds within specialties and between specialties within breeds are given in Tables 2 and 3.

Overall index of deviations (OID) of real from "ideal" dogs

The OID evaluated general satisfaction of handlers and trainers with their dogs taking into account all traits and respective weights (importance) of each trait. The ANOVA revealed no significant effect of breed, specialty and sex of the dogs as well as of interactions between these factors on the OID based on handlers' and trainers' opinions.

The answers in questionnaires reflect a subjective assessment of the responders. Therefore, the reliability and internal consistency of questionnaire items may be questioned. As a parameter of internal consistency, the Cronbach's alpha has been used by some authors. In the present study, the Cronbach's alpha considering all items of the questionnaires did not deviate significantly from those reported by other authors for different traits [Lit *et al*. 2010, Vas *et al*. 2007, Kubinyi *et al*. 2009, Serpell and Hsu 2001]. The Cronbach's alpha may be calculated for each trait separately [e.g. Svartberg *et al*. 2005, Kubinyi *et al*. 2009] or for all traits together [e.g. Lit *et al*. 2010].

In the present survey the highest internal consistency in test – re-test (alpha > 0.82) was found for motivation to chase an object, health and motivation to obtain food, which means that either these traits did not change in time or were easier to assess. A low internal consistency and reliability in terms of rank correlation coefficients for test – re-test and inter-rater agreement was found for intelligence, consistency of behavior from day to day, travel ability, playfulness, ease of adaptation to kennel environment and level of aggression towards humans. In our study there was generally a low handler-trainer agreement, as Cronbach's alpha and rank correlations for particular traits were low, and for some traits negative. This means that handlers and trainers evaluated the same dog differently.

Methods used for extraction and labelling of groups of traits revealed different numbers of underlying dimensions that were differently named. For example Sinn *et al*. [2010] using Principal Component Analysis found four aggregate behavioral traits: object focus, sharpness, human focus and search focus. Factor analysis used by Svartberg and Forkman [2002] revealed five narrow traits: playfulness, curiosity/

fearlessness, chase proneness, sociability and aggressiveness, while Jones and Gosling [2005] demonstrated that an expert sorting can usefully classify temperament traits into seven broad dimensions: reactivity/excitability-stability, fearfulness-courage/confidence, aggression-agreeableness, sociability/friendliness-lack of interest in others, openness-non-openness, dominance-submission and activity level. Our questionnaire comprised some items that correspond to some dimensions labelled by Sinn *et al*. [2010, Jones and Gosling [2005] and Svartberg and Forkman [2002]. As our goal was not to add another analysis of dogs' temperament and personality to the existing papers, but to find differences in suitability of two dog breeds for two detection specialties, taking into account the importance of particular traits, we did not employ principal component analysis to extract broader dimensions, but we considered all traits separately.

According to dog specialists in the UK questioned by Rooney *et al*. [2004], the four most important traits (score > 4.4) were: acuity of sense of smell, incentive to find an object which is out of sight, health and tendency to hunt by smell alone. For our responders the "acuity of smell" was the third most important trait. It should be mentioned that acuity of smell is difficult to assess without special experiments, or should be described by several parameters. Willingness to sniff objects, according to our responders, was the most important trait of search dogs, followed by concentration ability. Health was, according to our responders, only in the 9th position of importance. As the fourth most important trait for search dogs, our responders considered willingness to bring an object back to a person. This trait is one of the traits evaluated during the test at the procurement of police search dogs for the training and is relatively easy to assess. Moreover, willingness to bring back an object is important during all stages of the training since rewarding of search dogs is based on retrieval of favorite objects by the dogs. Interestingly, this trait was rated very low for its importance in the survey by Rooney *et al*. [2004].

The differences in rating the importance of the traits by Polish and UK specialist may either reflect the differences in quality of service dogs or differences in approach to the dog training by specialists in these countries.

The correlation coefficient between ratings for importance of 26 corresponding traits given by Polish handlers and UK specialists [Rooney *et al*. 2004] was $r = 0.695$. More agreement between Polish and UK specialists was ascertained as to the ratings of particular traits in "ideal" dogs (Pearson correlation coefficient between mean ratings = 0,913). In the two latter correlations, only those 26 traits were considered which were evaluated both by Polish and UK specialists.

None of the traits surveyed by Rooney *et al*. [2004] and rated by dog handlers in present study achieved for its importance a maximum mean rating of 5. Body sensitivity, motivation to obtain food, excitability and level of aggression towards dogs were rated low (mean<3.7) for their importance both in Rooney *et al*. [2004] and in our survey.

In contrast to surveys by Rooney *et al*. [2004] and Rooney and Bradshaw 2004], we distinguished opinions of dog handlers and trainers. It may be expected that handlers' and trainers' opinions would differ in some aspects. Handlers generally spent much more time with their animals than did trainers, and their opinions of their dogs were based on longer observations and might be more reliable. Some traits, as for instance consistency of behavior from day to day, fear of specific things, adaptation to kennel environment and body sensitivity can be more exactly assessed by handlers than by trainers. On the other hand, a handler's opinion on his/her dog can be biased due to human-animal bond and/or personal attitude of a handler to the dog. Usually handlers have fewer opportunities to compare more dogs or dog breeds than do trainers who conduct or supervise training of more individual dogs of different breeds. Moreover, trainers are usually more experienced and qualified specialists not only in dog training but also in teaching dog handlers. Kaleta *et al*. [2011] found that the personal profile and emotional intelligence of Polish police dog handlers differ significantly from those of general population, showing a very low neuroticism, above average extraversion, agreeableness, very high conscientiousness and slightly below average openess to experience.

The responders were not asked to explain why they gave specific scores for an "ideal" dog, nor were they given any hints how to rate particular traits. Although the handlers were asked to give their frank opinion without any consequences for the fate of their dogs and their professional careers, a bias resulting from fear of consequences of low or high scoring of dogs could not be excluded. We eliminated some questionnaires which seemed to be questionable (too low variability between scores, high correlation between scores for "ideal" dog and for weight of traits) from statistical analyses.

The ratings of an "ideal" level of some traits by some handlers and trainers remains puzzling or illogical. The "ideal" level of traits which are definitely desirable, e.g. health or definitely undesirable, e.g. fear or tendency to be distracted when searching — logically should be scored as a maximum and a minimum, respectively. Scoring other than a maximum or minimum for an "ideal" level of such traits may result in classifying some dogs as demonstrating health or ability to learn or acuity of smell better than "ideal", which seems illogical and difficult to explain. A possible explanation for such cases could be that some responders had a more holistic approach to the traits of their dogs and would accept a definitely desirable trait below the top level if other traits are at a sufficient level. Other explanations for what the responders meant are possible. For example, too high a tendency to hunt by smell alone could mean that the responders expected "ideal" dogs would also use sight for choosing suspicious objects as parcels or suitcases for more exact sniffing. Too low a tendency to be distracted could mean that the responders would wish an "ideal" dog should not be totally concentrated on sniffing but should also respond to commands when searching. Too high a travel ability could mean that an "ideal" dog should not become excited on seeing a car as some dogs that love travelling do. Too high an obedience

to human commands could mean that the responder wished more independence at work of an "ideal" search dog. However, it is difficult to explain what some of the responders meant when assessing that a dog demonstrated too high an ease of adaptation to kennel environment or too low a fear of sudden loud noises. Probably they would accept a moderate level of the ease of adaptation to kennel and a moderate fear of loud noises in an "ideal" dog but they rated their real dogs higher for those traits. Too low a body sensitivity could be explained by wishing an "ideal" dog would be moderately sensitive to touch applying as a reward.

One of the most important problems in procurement of police dogs for specialist training is that it is difficult to predict actual suitability of the dog for the search work on the basis of preliminary tests and opinions. This results in trainers and handlers not being satisfied with their dogs. According to Slabbert and Odendaal [1999], up to 70% of dogs bred at the South African Police Service Dog Breeding Centre were not suitable for use. This opinion was confirmed by Maejima *et al*.[2007], who stated that approximately 30% of dogs that enter training programs to become drug detection dogs successfully complete training. Our work provides information as to which particular traits are not satisfactory.

The behavior of some dog breeds used by law enforcement forces has been analyzed in many studies [Scott and Fuller 1965, Wilsson and Sundgren 1997a,b, Ruefenacht *et al*. 2002, Rooney *et al*. 2004, Kobelt *et al*. 2007, Jakovcevic *et al*. 2010, Lit *et al*. 2010]. Behavioral differences between breeds can be explained by the way in which they were originally used. German shepherds were used for herding and guarding livestock, but also as protection dogs [Scott and Fuller 1965, Willson and Sundgren 1997a,b]. Labrador retrievers were bred as hunting dogs for retrieving prey. For this task a low level of aggression and low predatory motivation were desirable [Vas *et al*. 2005]. Both breeds were bred to cooperate with humans, but German shepherds were required to work more independently [Jakovcevic *et al*. 2010]. Also, German shepherds are believed to be more aggressive and less friendly than Labradors to alien people. On the other hand, Svartberg [2006] found no relationships between breed-characteristic behavior and function in the breed's origin which suggest that it was rather the selection in the recent past that affected breed-typical behavior. In this study the German shepherds were evaluated, however, as more aggressive towards humans only by handlers of explosives detection dogs. Labrador retrievers are commonly known for their high food motivation. Although in our study both handlers and trainers were of an opinion that most Labradors have too high a food motivation but only trainers of drug detection dogs were of the opinion that Labradors have significantly higher food motivation than German shepherds ($P<0.001$). Too high a motivation for food is undesirable in working dogs since it may distract dogs when searching. Only trainers, but not handlers of explosives detection dogs believed that Labradors show a significant tendency to be distracted during searching.

As expected, German shepherds were scored higher than Labradors for motivation to retain possession of an object, which can be a trait that promotes motivation for a

reward during training. Labrador retrievers are known to be very friendly to people. In our study only drug detection Labradors were significantly more friendly to people than German shepherds of this specialty. Although trainers of explosives detection dogs indicated that 80% of Labradors were too friendly to people, the difference from German shepherds was not significant.

As the explosives detection dogs have to move during searching and to indicate more cautiously, more calm and less agile dogs may be more suitable for this specialty. To our knowledge, there have been no previous studies analysing breed differences in this respect.

Search dogs should be highly motivated to chase an object, which is used for rewarding dogs. Dogs predisposed to fearful behavior are more likely to feel anxiety in the presence of loud noises but also their ability to work is lower due to the variety of stimuli in the environment. Dogs with poor concentration are often more anxious [Murphy 1998]. Also, Svartberg [2002] indicated that to reach high level of performance in working, dogs should have a certain level of boldness.

This survey revealed that handlers' and trainers' opinions on two main dog breeds used for drug and explosives detection by Polish police, *i.e*. Labrador retrievers and German shepherds, are only partly consistent. Although both breeds differ in some particular traits and in handlers' and trainers' satisfaction as to the "ideal" level of these traits, it could not be definitely ascertained which breed is more suitable for specialized training for drug and explosives detection. The differences in particular traits revealed preferences of dog trainers and handlers and can be used by breeders and by specialists in charge of procurement of dogs for the training to chose dogs that would better fulfill the expectations.

REFERENCES

1. BRADSHAW J.W.S., GOODWIN D., LEA A.M., WHITHEAD S.L., 1996 – A survey of the behavioral characteristics of pure-bred dogs in the United Kingdom. ***Veterinary Record*** 138, 465-468.
2. GAZIT I., GOLDBLATT A., TERKEL J., 2005 – The role of context specificity in learning: the effects of training context on explosives detection in dogs. ***Animal Cognition*** 8, 143-150.
3. JAKOVCEVIC A., ELGIER A. M., MUSTACA A. E., BENTOSELA M., 2010 – Breed differences in dogs' (Canis familiaris) gaze to the human face. ***Behavioral Processes*** 84, 602-607.
4. JONES A.C., GOSLING S.D., 2005 – Temperament and personality in dogs (Canis familiaris): A review and evaluation of past research. ***Applied Animal Behaviour Science*** 95, 1- 53.
5. KALETA T., PISULA W., FISZDON K., KONDRAKIEWICZ P., 2011 – Individual differences in police dog handlers. ***Polish Psychological Bulletin*** 42, 52-55.
6. KOBELT A. J., HEMSWORTH P.H., BARNETT J. L., COLEMAN G.J., BUTLER K.L., 2007 – The behavior of Labrador retrievers in suburban backyards: The relationships between the backyard environment and dog behavior. ***Applied Animal Behaviour Science*** 106, 70-84.
7. KUBINYI E., TURCSAN B., MIKLOSI A., 2009 – Dog and owner demographic characteristics and dog personality. ***Behavioral Processes*** 81, 392-401.
8. LEFEBVRE D., DIEDERICH C., DELCOURT M., GIFFROY J.M., 2007 – The quality of the relation between handler and military dogs influences efficiency and welfare of dogs. ***Applied Animal Behaviour Science*** 104, 46-60.

9. LIT L., SCHWEITZER J. B., OBERBAUER A. M., 2010 – Characterization of human – dog social interaction using owner report. ***Behavioral Processes*** 84, 721-725.
10. MAEJIMA M., INOUE – MURAYAMA M., TONOSAKI K., MATSUURA N., KATO S., SAITO Y., WEISS A., MURAYAMA Y., ITO S., 2007 – Traits and genotypes may predict the successful training of drug detection dogs. ***Applied Animal Behaviour Science*** 107, 287-298.
11. MURPHY J.A., 1998 – Describing categories of temperament in potential guide dogs for the blind. ***Applied Animal Behaviour Science*** 58, 163-178.
12. ROONEY N.J., BRADSHAW J.W.S., ALMEY H., 2004 – Attributes of specialist search dogs – a questionnaire survey of UK dog handlers and trainers. ***Journal of Forensic Science*** 49, 296-302.
13. ROONEY N.J., BRADSHAW J.W.S., 2004 – Breed and sex differences in the behavioral attributes of specialist search dogs – a questionnaire survey of trainers and handlers. ***Applied Animal Behaviour Science*** 86, 123-135.
14. ROONEY N.J., GAINES S. A., BRADSHAW J.W.S., PENMAN S., 2007 – Validation of a method for assessing the ability of trainee specialist search dogs. ***Applied Animal Behaviour Science*** 103, 90-104.
15. RUEFENACHT S., GEBHARDT-HENRICH S., MIYAKE T., GAILLARD C., 2002 – A behavior test on German Shepherd dogs: heritability of seven different traits. ***Applied Animal Behaviour Science*** 79, 113-132.
16. SCOTT J.P., FULLER J.L. eds., 1965 – Genetics and the Social Behavior of the Dog. The University of Chicago Press, Chicago.
17. SERPELL J.A., HSU Y., 2001 – Development and validation of a novel method for evaluating behavior and temperament in guide dogs. ***Applied Animal Behaviour Science*** 72, 347-364.
18. SINN D.I., GOSLING S.D., HILLARD S., 2010 – Personality and performance in military working dogs: Reability and predictive validity of behavioral tests. ***Applied Animal Behaviour Science*** 127, 51-65.
19. SLABBERT J. M., ODENDAAL J.S.J., 1999 – Early prediction of adult police dog efficiency – a longitudinal study. ***Applied Animal Behaviour Science*** 64, 269-288.
20. SVARTBERG K., 2002 – Shyness-boldness predicts performance in working dogs. ***Applied Animal Behaviour Science*** 79, 157-174.
21. SVARTBERG K., 2006 – Breed-typical behaviour in dogs – Historical remnants or recent constructs? ***Applied Animal Behaviour Science*** 96, 293-313.
22. SVARTBERG K., FORKMAN B., 2002 – Personality traits in the domestic dog (Canis familiaris). ***Applied Animal Behaviour Science*** 79, 133-155.
23. SVARTBERG K., TAPPER I., TEMRIN H., RADESATER T., THORMAN S., 2005 – Consistency of personality traits in dogs. ***Animal Behavior*** 69, 283-291.
24. VAS J., TOPAL J., GACSI M., MIKLOSI A., CSANYI V., 2005 – A friend or an enemy? Dogs' reaction to an unfamiliar person showing behavioral cues of threat and friendliness at different times. ***Applied Animal Behaviour Science*** 94, 99-115.
25. VAS J., TOPAL J., PECH E., MIKLOSI A., 2007 – Measuring attention deficit and activity in dogs: A new application and validation of a human ADHD questionnaire. ***Applied Animal Behaviour Science*** 103, 105-117.
26. WILSSON E., SUNDGREN P.E., 1997a – The use of behavior test for selection of dogs for service and breeding. I. Method of testing and evaluating test results in the adult dog, demands on different kinds of service dogs, sex and breed differences. ***Applied Animal Behaviour Science*** 53, 279-295.
27. WILSSON E., SUNDGREN P.E., 1997b – The use of behavior test for selection of dogs for service and breeding. II. Heritability for tested parameters and effect of selection based on service dog characteristics. ***Applied Animal Behaviour Science*** 54, 235-241.