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Foster Owner Factors Influence Temperament Test Results of Military Dogs and Their Suitability for Service

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militärhundens testresultat och dess lämplighet för tjänst*

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Animal Science, Masters's Programme

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Summary

Military dogs in Sweden spend their first 18 months after weaning with a foster owner that has volunteered to care for its upbringing. The foster owner is advised by a consultant and offered three opportunities to train the dog together with other foster owners. There is a positive correlation between the number of attended training opportunities with the consultant, or other professional dog trainers, and the results of the dog in the temperament test at the end of the 18 months. The test results are in turn positively correlated with the likelihood of the dog to enter service. This thesis aims to investigate why the number of training opportunities is important for the dog's chance to enter service by identifying foster owner factors that influence the success of the dog and which temperament test items the factors have the strongest impact on. There were records of 797 German shepherd military dogs with temperament test results and a known number of training opportunities, of which 263 had questionnaires filled in by the foster owners. Questions included e.g. demographics and previous experience. Analysis revealed that dogs that went into service more often came from foster owners with previous experience of dogs and dog training, living in an apartment rather than a house. Foster homes with horses, farm animals, small pets and many children decreased the likelihood of the dog to enter service. Temperament test items that were related to play e.g. prey drive, retrieving and tug of war, and items related to confidence had the strongest correlation with the number of training opportunities and the foster owner factors. In conclusion, the most important factor appeared to be time spent on activities such as playing or training with the dog. Therefore, foster owners should be encouraged to engage in training and play-like activities with their dogs, to produce trainable and confident dogs.

Sammanfattning

Försvarsmaktens hundar tillbringar sina första 18 månader efter avvänjning hos fodervärdar som frivillig åtagit sig att uppfostra dem. Fodervärden får stöd av en fodervärdskonsulent och erbjuds tre träningstillfällen tillsammans med hunden. Antalet träningstillfällen är positivt korrelerat med de resultat som hunden får i ett lämplighetstest som alla hundar genomgår vid 18 månaders ålder. Testresultaten är i sin tur korrelerade med sannolikheten att hunden går i tjänst. Examensarbetet syftar till att utröna varför antalet träningstillfällen påverkar hundens sannolikhet att gå i tjänst, genom att identifiera vilka fodervärdsfaktorer som påverkar sannolikheten att gå i tjänst, samt vilka delar av lämplighetstestet som påverkas av fodervärdsfaktorerna. Av 797 Schäfrar med testresultat från lämplighetstestet och ett känt antal träningstillfällen hade 263 hundar ifyllda ansökningsblanketter för fodervärdsskap. Blanketterna tillhandahöll information om till exempel demografi och tidigare erfarenhet. Statistisk analys visade att en större andel av de hundar som gått i tjänst kom från fodervärdar med tidigare erfarenhet av hundar och unghundsträning och som bodde i lägenhet i stället för hus eller på en gård. Om fosterfamiljen även hade hästar, lantbruksdjur, små sällskapsdjur och/eller många barn minskade sannolikheten för att hunden skulle gå i tjänst. Lekrelaterade delar av lämplighetstestet, som föremålsintresse, hantering av föremål och traskamp, samt några som är kopplade till självsäkerhet hade starkast korrelation med antalet träningstillfällen och fodervärdsfaktorerna. Sammanfattningsvis verkade den viktigaste faktorn vara hur mycket tid som lades på lek och träningsaktiviteter tillsammans med hunden. För att producera så lätttränade och självsäkra hundar som möjligt bör fodervärdarna således uppmuntras att träna och leka med sina hundar.

Background

Introduction

The Swedish Armed Forces Dog Instruction Centre (SAFDIC) has its own breeding programme for German shepherd dogs. The dogs are intended to become arms and explosives sniffer dogs, surveillance dogs, guard dogs or working dogs with the police or home guard (Swedish Armed Forces 2013). Although nearly 250 young dogs are tested for suitability each year, barely a third of these enter service later in life (Försvarsmakten 2013).

The puppies are born at a breeding kennel in Sollefteå in northern Sweden, where they stay until eight weeks of age. They are then placed with foster families all over the country. Anyone can apply to offer a foster home to a military dog at the SAFDIC webpage (questions with collected responses are presented in Appendix I.). Applications are then reviewed by local foster owner consultants employed by SAFDIC. Applicants are interviewed and the eligible foster owner signs a contract with SAFDIC to eventually receive a puppy. Litter mates are ideally placed with families within the same region and are therefore under the same consultant.

Besides an introduction at the time of the adoption, consultants arrange three foster owner training opportunities. It is a way for the consultant to see how the foster owners and puppies interact and to give pointers on how to handle the puppy to build their relationship. During the first meeting, when the dog is around four months of age, they engage in tug of war, sniffing out toys and other play-like activities. In an email on 29th October 2013 M. Pounu, who is responsible for the foster home system and the consultants, described that observing the behaviour of the puppy at the first training opportunity reveals a lot about the personality of the puppy and gives important information on the type and amount of obedience training that it is going to need. The second training opportunity is also very important, because the dogs are then around eight months of age and are maturing to adulthood, which causes behavioural changes (Diederich & Giffroy 2006). The exercises are more advanced and the consultant can advise on how to address troublesome behaviours. At the final meeting, when the dogs are around 12 months, the consultant helps the foster owners along the same lines as the previous times, but also prepares the owners for the upcoming temperament test (M. Pounu, email 29 October 2013).

The dog will stay with the foster owner until it is approximately one and a half years old, when it is time for the temperament test. During the test, the test leader notes how many instructor-led training opportunities the dog has attended – here it is termed "education level" with a value of one, two or three. In essence it is a measurement of how active the foster owner has been to bring the dog to the training opportunities. Other instructor led training opportunities, such as with the Working Dog Club, are also taken into account. The test is extensively described by Wilsson and Sinn (2012) and comprises an objective behavioural ratings part (26 items), where the dog's behaviour in different test situations is recorded, and a subjective ratings part (15 items) where the test leader scores different behavioural traits displayed during the test. The results from the two types of measurements are strongly correlated, but still give slightly different information on the reactions of the dog (Wilsson & Sinn 2012). The same test leader has rated all dogs from 2005 to 2013. There are three traits that are deemed more important for training the military dogs than all others; defence drive (a tendency to defend itself or its handler), sharpness (acting agonistic or aggressive) and most importantly prey drive (an interest in

objects; to search for, bite and carry them) (Wilsson & Sundgren 1997; Wilsson & Sinn 2012).

The ratings of all items of a tested dog are compared to the ratings of all previously tested dogs. The different items are of varying importance based on the actual outcome of previously tested dogs. When all factors have been weighted in, the dog receives a score that gives an estimate of its probability to enter service – the so called 'index'. A high index indicates a high probability of success, which is to enter service and/or to be included in the breeding programme.

The index in the analysed data ranges from -129 to 135, where a value of 0 indicates a 50 % chance of success. However, because the index is based on previous tests and the outcome of a growing number of dogs, that will change over time. Based on the tests from the former Swedish Dog Training Centre the index has a heritability of about 0.25 according to E. Wilsson in a conversation on 2nd March 2013. Because there is a positive correlation between the education level and the index, it is clear that the education level is important for the success of the dog.

Literature Review

There has been much research done on the postnatal period up until eight weeks of age of dogs, regarding their development (e.g. Foyer et al. 2013; Fox & Stelzner 1966), but the SAFDIC dogs are all raised under the same conditions during that period. This study focuses more on the development of the juvenile and young dogs. The interaction between dog and human and the management regime seem to be important factors in how the dog develops, as described below.

In Taiwan, dogs that grew up in large families and had access to a yard were rated as more aggressive by their owners. Aggression towards strangers was rated higher for dogs in rural areas and aggression towards family members higher where the dogs were kept solely indoors or outdoors (Hsu & Sun 2010). However, there was no correlation between obedience training and dominance-related aggression (Podberscek & Serpell 1997).

Several external factors have been found to influence the temperament test results of Swiss military dogs (German shepherds) during their juvenile period (Fuchs et al. 2005). Dogs that frequently had contact with school-age children and adults had higher scores on defence drive. They also got more desired total scores in the temperament test the more contact they had with school-age children. Those that had attended puppy/young dog training got higher scores for nerve stability. However, puppies that received obedience and social training when they were between 6 and 16 weeks old did not differ in their reactions towards novel stimuli, compared to puppies that did not participate in any extra training, although the puppies became more obedient after receiving training (Seksel et al. 1999).

The dog's obedience level also seems to be affected by how the dog is housed. The proportion of obedient Belgian military dogs (Belgian/German shepherds) was larger among those that lived with their handler, than among those who stayed at the military kennel (Lefebvre et al. 2007). A dog was considered obedient when it released its bite on the "loose" command after a maximum of three commands. The proportion of obedient dogs was also larger for military dogs that practiced sports (e.g. agility, protection or obedience) compared to those who had not. Military dogs that were considered to be

sociable by their owners were also more obedient. Sociable and obedient dogs were more likely to let an unknown person pet them. The authors ascribed the difference to the additional time the handlers spent with their dogs in the home, creating a stronger bond between dog and handler. However, in a test situation with protection work and obedience exercises (heel, down, recall etc.), dogs that lived with their handler and those who stayed at the military kennel performed equally well (Haverbeke et al. 2008).

Training is a factor that seems to influence several aspects of the relationship. Untrained pet dogs in Colorado, that were 3-36 months old, showed improvement in the pet-human relationship, including less separation anxiety and better obedience, when their owners were given training opportunities as well as canine behaviour counselling (Clark & Boyer 1993). Interestingly, the relationship was improved even for owners who were advised to simply interact actively with their dog for 20 minutes per day. Owners that got no specific instructions did not improve on neither obedience nor the relationship. The more time a pet dog owner spent with its dog, the calmer the dog became, as rated by the owners (Kubinyi et al. 2009). Additionally, owners that played with their dog daily had calmer dogs. Owners who had owned two or more dogs previously had calmer dogs than more inexperienced owners did. Playing with the dog also increased its trainability and sociability. Trainability was however mostly influenced by the number of types of training opportunities (e.g. agility, protection work, obedience etc.) and time spent together with the dog on a daily basis. Trained dogs were also calmer, bolder and more sociable than untrained dogs. A larger number of people in the household led to calmer female dogs, but also to bolder and less trainable, less dog-sociable dogs. Conversely, the more dogs in the household the more trainable and less bold were the dogs. Dogs from multiple-dog households were also calmer than dogs from single-dog households. Similarly, an earlier study could link the dog's "responsiveness to training" to its playfulness (Jones & Gosling 2005).

Pet dogs that have had any kind of previous training experience were more often successful at manipulating a treat-dispenser to receive a treat, than dogs with no previous training experience (Marshall-Pescini et al. 2008). The trained dogs spent more time manipulating the dispenser and were more proactive towards novel objects in general, while untrained dogs spent more time looking back at their handlers. Even though trained dogs were more successful with the treat dispenser, there was no difference in trainability between the trained and the untrained dogs, as rated by their owners (Canine Behavioural Assessment & Research Questionnaire). Trainable dogs however, showed much less fear of strangers. Svartberg (2005) suggest that playfulness can influence problem solving talent since it is positively correlated with trainability. Even though untrained dogs looked back more at their handler during the test, Range et al. (2009) found that dogs with training experience of any kind were better observers of a demonstrating human than were untrained dogs.

Pet dogs in the United Kingdom that showed a clear preference to socialise with their owner rather than with an unfamiliar person, played for a longer time (duration of a bout) with their owner (Rooney & Bradshaw 2003). Whether the dog showed a preference for its owner or an unfamiliar person was, surprisingly, neither influenced by the time the owner spent with its dog every day, nor the time they spent interacting. Dogs that played tug of war and fetching games were also more confident in their interactions with the handler, whereas those who played rough-and-tumble were more amenable. Regular games of fetch even increased confidence in Labrador retrievers (Rooney, 1999, cited in Rooney & Bradshaw 2003). Confident dogs also showed longer duration of play bouts (Rooney & Bradshaw 2003). Dogs that often initiated play, as reported by their owners, were scored as

more aggressive. The authors suggested that play behaviour reflects relationship patterns in dogs, rather than the other way around. Play can also be used as a primary reinforcer as it is pleasurable for the dog (Held & Špinka 2011). It can replace food treats, for example, as a reward when the dog has performed a wanted behaviour, in order to increase the occurrence of the behaviour.

Temperament and heritability

Temperament can be defined as individual (or breed) differences in behaviour that can be observed when testing animals, and are relatively stable over time and consistent in different situations (Diederich & Giffroy 2006). Similarly, personality is defined as a pattern of behaviour, distinctive to an individual that is consistent in different situations and across time (Pervin and John, 1997, cited in Kubinyi et al. 2009). The terms temperament and personality are often used interchangeably. Even though temperament is relatively stable over time it can still be influenced by a number of external factors, e.g. early experiences and learning (Diederich & Giffroy 2006). In human psychology there is a widely accepted five-factor model (FFM) of personality structures. The FFM encompasses the five dimensions Neuroticism/Emotional stability, Agreeableness/Antagonism, Extraversion/Introversion, Openness to experience/Closeness to experience and Conscientiousness/Impulsiveness. Several behavioural traits in dogs can be placed within one of these dimensions, although not yet for Conscientiousness (Gosling & John 1999).

Heritability is the estimated proportion of the phenotypic variance of a trait (in the population) that is inherited, rather than affected by environmental factors (Simm 1998). The heritability for several temperament traits have been calculated previously for German shepherd dogs in Sweden, and are of moderately large magnitudes (Table 1.).

Table 1. Heritabilities for a number of simple and complex temperament traits, after van der Waaij et al. (2008), heritabilites marked with * after Wilsson and Sundgren (1997)

Trait	Heritability	Heritability	Complex trait
Courage	0.19 ± 0.04		
Nerve Stability	0.16 ± 0.04	0.25 ± 0.06*	Mental Stability
Hardness	0.14 ± 0.03		
Temperament/Liveliness	0.18 ± 0.04	0.24 ± 0.06*	Willingness to please
Cooperation	0.17 ± 0.04		
Affability	0.38 ± 0.06	0.32 ± 0.07*	Affability
Sharpness	0.19 ± 0.04		
Prey Drive	0.23 ± 0.05	0.17 ± 0.06*	Ardour
Defence Drive	0.14 ± 0.03		
Gun Shyness	0.22 ± 0.09		

The larger the heritability of a trait is, the smaller the chance of influencing the dog with different management practices. However, by identifying environmental factors that influence a trait the heritability estimates can be made with greater accuracy.

Aim

The study aims to investigate why the education level of the dog has such a big impact on whether the dog enters service or not. This will be achieved by:

1. Analysing the influence of the value "education level" (i.e. training engagement) on the success (going into service or not) of military dogs
2. Identifying foster owner factors that influence the success of the dog
3. Identifying foster owner factors that influence the education level
4. Analysing which foster owner factors influence which items in the temperament test

Hypotheses

Housing generally influences the way the dog and foster owner interact and possibly favours dogs without access to a garden/yard, because it leads to more interactions between the dog and the human. Therefore, dogs from apartments are expected to have a higher success rate.

Because military dogs living with other dogs were more trainable, I expect dogs living with other animals to also be more trainable and therefore have a higher chance of success than single-animal-household dogs.

Foster owners with previous dog training experience are probably more likely to take their foster dog to training. Hence, I expect dogs of experienced owners to have a higher education level and thus a higher chance of success.

Foster families with children are expected to play more (children playing with the dog) and therefore should have more confident dogs, resulting in milder reactions to startle test items, which would give them higher scores on those items.

Material and methods

Foster owner application forms from between 2005 and 2010, filled out by would-be foster owners, were collected. Questions included gender, other animals in the household, previous experiences of dog training, current living conditions, number of children and more. The answers from the open-ended questions "reasons for fostering" and "previous dog training experience" were grouped into 15 and 7 categories respectively (Appendix I.).

The SAFDIC temperament test record on dogs tested between 2006 and 2012 was provided in a spreadsheet. The test results comprised 26 items with behavioural rating and 15 items with subjective rating (Wilsson & Sinn 2012). Most test items had scores ranging from one to five, but a few items had a maximum score of three, four or six. The highest score is most often preferred, but in some instances the second highest score is the most desired one. For example in the subjectively rated "ability to cooperate", five is described as "overly eager to cooperate" and four is "eager to cooperate", and the latter score is preferred. The record also contained education level, test dates, index and the outcome for each dog. The outcome had eight categories, of which "police dog", "sniffer" or

"breeding", for example, were grouped as "in service". Three categories; "rejected due to health reasons", "rejected due to mental reasons" and "euthanized" were grouped as "not in service" for the analysis. The index was originally produced by first calculating a partial index for each test item (Wilsson & Sundgren 1997). The partial index is based on the proportion of dogs with a particular rating that previously succeeded to enter service. The partial indexes are then summed up per dog to form the index score for each individual (Wilsson & Sundgren 1997).

A total of 900 dogs had been tested and had a known outcome. Only dogs with a known outcome and a recorded education level could be used for the analysis. If a dog had been re-homed during its foster period it was excluded because of the uncertainty regarding the number of education opportunities. Additionally, only dogs with foster owner applications could be used to analyse foster owner factors. Dogs that were rejected for health reasons were counted as "not in service" regardless of index, as there was only a 28 % chance to enter service, based on the proportion of successful dogs.

Statistical Analysis

Differences in success rate between the three education levels were tested for significance using the Chi square test, as were the categories of foster owner factors. Pearson's correlation coefficients were used to identify which temperament test items correlated with "education level", "index", "in service or not" and with each other. To determine which foster owner factors had most influence on whether the dog went into service or not, a stepwise logistic regression was used. Finally, an ordinal logistic regression analysis was used on the temperament test items to determine which items were most influenced by education level (Figure 1.).
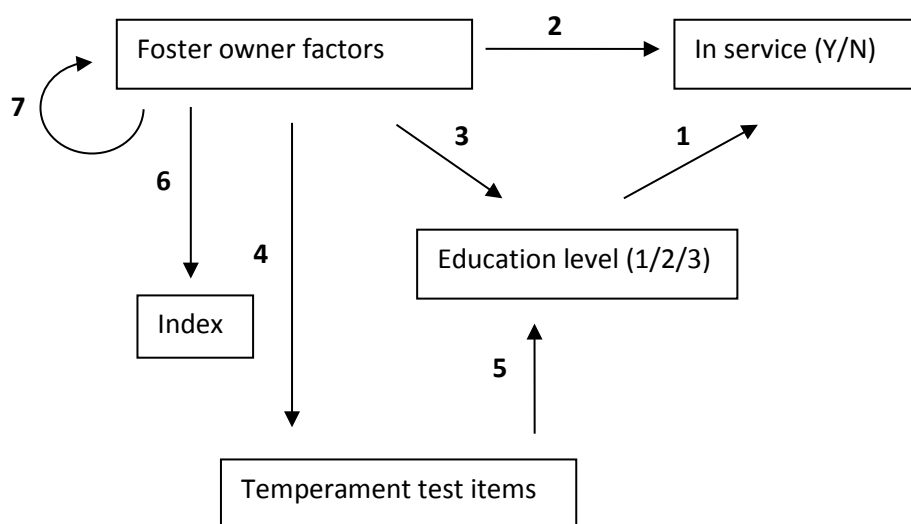
Figure 1. Overview of comparisons. 1: Relationship between education level and chance of entering service. 2: Foster owner factors affecting whether the dog entered service. 3: Foster owner factors affecting education level. 4: Correlations between foster owner factors and the temperament test. 5: Relationship between education level and the temperament test. 6: Relationship between foster owner factors and the index. 7: Additional correlations among the foster owner factors.

Correlations, ordinal logistic regression and Chi-square tests were performed using Minitab® 16 Statistical Software. Stepwise logistic regression was performed with SAS 9.3. P ≤ 0.05 was considered the level of significance.

Results

The SAFDIC data contained 797 dogs with known education level (Table 2.). Of those, 565 had a known outcome (in service/not in service). Out of 433 dogs that also had a foster owner application, only 263 dogs had never been re-homed during their foster time.

Table 2. The number of dogs in each education level category. "All Dogs" include those that were rejected for various reasons after the temperament test. The "%" column shows the percentage of dogs that went into service from each education level.

Education level	All Dogs	In service	%	Rejected Health	Foster Owner Application	In service	%
1	252	59	23	40	128	25	20
2	169	56	33	38	79	21	27
3	144	67	47	36	56	20	36
TOTAL	565	182	32	114	263	66	25

Distribution of dogs that had been rejected due to poor health

Fourteen percent of the 797 dogs had been rejected for physical health reasons. They had an even distribution of index scores and were equally represented in all education levels ($\chi^2 = 3.319$, P = 0.190) (Table 2.).

1. Relationship between education level and chance of entering service

Out of 900 tested dogs with a known outcome (but some with unknown education level), 255 dogs, or 28 %, entered service.

The chance of entering service if the dog had education level one, two or three was tested for all dogs with known education level and outcome (n = 565, $\chi^2 = 22.5$, P < 0.001). The chance increased significantly with every increase in education level, with adjustment for multiple comparisons with Bonferroni's method.

There was a positive correlation between education level and the index (n = 797, Pearson r = 0.37, P < 0.001).

2. Foster owner factors affecting whether the dog entered service

Foster owner factors, extracted from the application, that increased the chance of the dog entering service included previously attending dog training opportunities, stating that the dog will be left on its own for more than four hours per day and a reported interest in dog-training.

Factors that seemed to decrease the likelihood of entering service were: owning small pets such as rabbits or guinea pigs, living in a house or on a farm as opposed to an apartment and having children, also depending on how many children with fewer seeming better (Table 3.).

Table 3. Influence of foster owner factors on dogs entering service, as stated in the application form

Factors that increase the chance of success	Pearson r	P-value	Factors that decrease the chance of success	Pearson r	P-value
Previously attended instructor led puppy class	0.19	0.002	Also keep small pets	-0.15	0.015
States dog will be left alone for more than 4 hours/day	0.14	0.024	Lives in a house/farm	-0.14	0.020
Reports an interest in dog training	0.12	0.051	Children in the household	-0.13	0.039
			Number of children	-0.12	0.053

The foster owner factors in Table 3 were also tested with Chi-square. The factors with positive correlations to entering service are shown in Figure 2, and the factors with a negative correlation to entering service can be seen in Figure 3, with the exception of the number of children. There were no significant differences between having no children, one child or two or more children.
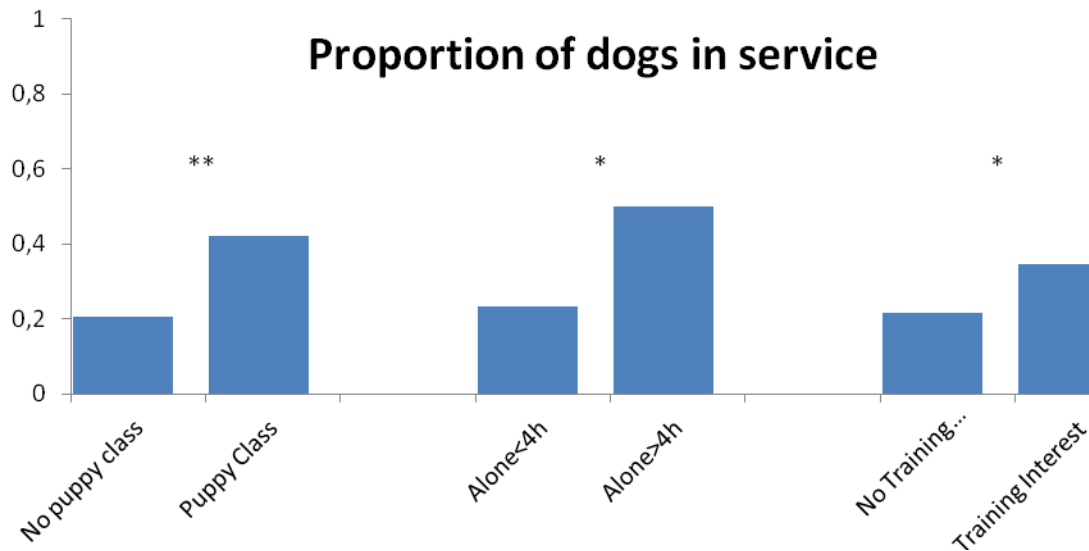
Figure 2. Differences in proportion of dogs in service between responses that are positively correlated to entering in service. ** = $P < 0.01$, * = $P < 0.05$. Having previously attended puppy class: $\chi^2 = 9.66$, $P < 0.002$, $n = 265$. Stating the dog will be left alone for more than four hours: $\chi^2 = 5.08$, $P < 0.024$, $n = 263$. Reporting an interest in dog training: $\chi^2 = 3.82$, $P < 0.051$, $n = 273$.
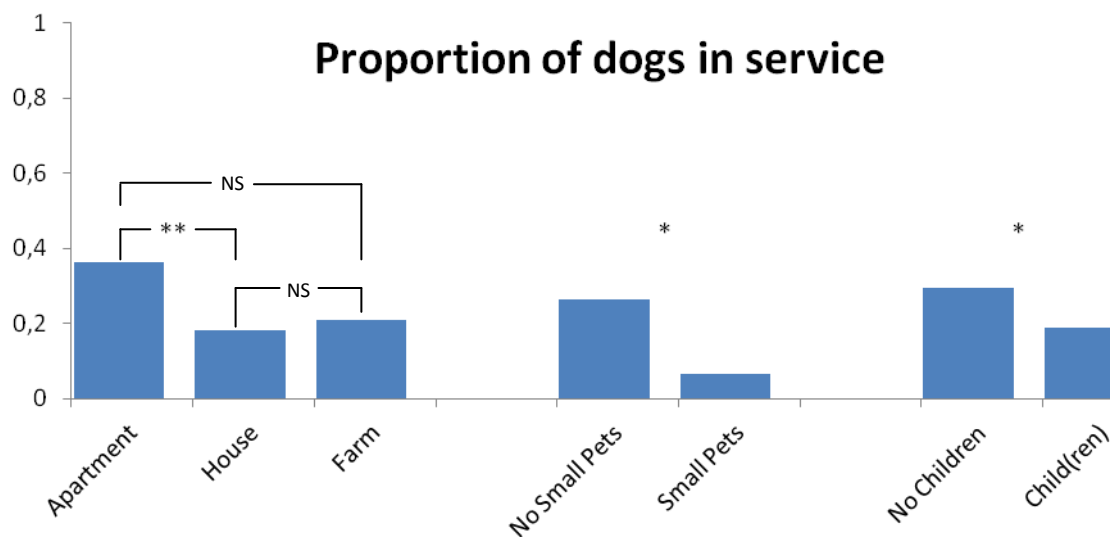

Figure 3. Differences in proportion of dogs in service between responses that are negatively correlated to entering service. ** = $P < 0.01$, * = $P < 0.05$. Living in a house compared to an apartment: $\chi^2 = 8.78$, $P < 0.003$, $n = 210$. Having small pets: $\chi^2 = 5.95$, $P < 0.015$, $n = 270$. Having children: $\chi^2 = 4.26$, $P < 0.039$, $n = 268$.

Stepwise binary logistic regression of the foster owner factors showed which factors were the best predictors of the dog entering service. Those who had owned a dog before had a 7.6 times higher odds ratio (OR, point estimate) of getting a dog into service than first-time owners (P = 0.035). Foster owners with a reported interest in dog training had 3.24 times higher OR (P = 0.021) and those that lived in apartments a 2.10 times higher OR than farm or house residents (P = 0.020).

3. Foster owner factors affecting education level

Dogs of foster owners that also kept other animals had lower education levels if the other animal was a small pet ($\chi^2 = 6.85$, P = 0.009, n = 259), a horse ($\chi^2 = 5.33$, P = 0.021, n = 259) or another farm animal (e.g. sheep or chickens) ($\chi^2 = 4.13$, P = 0.042, n = 259). Dogs living on farms had lower education levels than those living in apartments ($\chi^2 = 6.79$, P = 0.034, n = 252). There was no significant difference in education level if the other animal was another dog, cat or cold blooded pet (e.g. fish or reptile).

4. Correlations between foster owner factors and the temperament test

Because the index value is a better predictor of success (Pearson's r = 0.61, P < 0.001, n = 646) than the education level (Pearson's r = 0.20, P < 0.001, n = 566), I also tested the correlation between the temperament test items with the most weight in the index with the foster owner data using Pearson's correlation coefficients. There were no correlations above 0.3, but a few were above 0.2. Significant correlations with coefficients < 0.2 are not listed here. Foster owners that also owned a horse had dogs with lower scores on Search persistence (r = -0.22, P < 0,001) and Search intensity (r = -0.21, P = 0.001). Additionally, dogs from apartments generally got higher scores on the test items Search persistence, Competitiveness, Prey drive, Search intensity (r = -0.26, P < 0.001), Tug of war (r = -0.24, P < 0.001) and Hunting drive (r = -0.21, P < 0.001), compared to dogs from houses or farms.

5. Relationship between education level and the temperament test

As the SAFDIC were already aware of a positive correlation between the education level and the index, this study further investigated whether or not it was the same items that influenced the index that was important in relation to the education level.

Correlations between the education level and all test items revealed which test items were most influenced by the education level (Table 4.). Only items with a correlation > 0.3 are listed here. Additionally, correlations between all test items and the index made it possible to rank which items had the strongest influence on the index. Since the index calculation is already based on test item scores, correlations would naturally be very strong between the two and because of that the value of those coefficients are not interesting other than to rank the most influential test items. Some of the items that have the strongest correlation to the index are also significantly influenced by the education level.

Table 4. Correlations (p < 0.001) between test items and education level and index (* = subjective rating, black = important for both)

Test Item vs Education Level	r	Test Item vs Index Score	r
Competitiveness*	0.39	Competitiveness*	0.72
Prey Drive*	0.39	Prey Drive*	0.71
Tug of war	0.35	Hunting Drive/grip*	0.67
Retrieving/Chasing	0.35	Hardness*	0.66
Retrieving/Obj. Interest	0.35	Search/Intensity	0.64
Unstable Table Reaction	0.35	Search/Persistence	0.61
Search/Intensity	0.35	Courage*	0.61
Search/Persistence	0.34	Curiosity*	0.60
Hunting Drive/grip*	0.33	Tug of war	0.58
Ability to cooperate*	0.31	Gradual Visual Startle/Lasting effect	0.58
Curiosity*	0.30	Retrieving/Chasing	0.56

Ordinal logistic regression was used to determine which test items would best predict the education level. Five behavioural test items fit the model (P ≤ 0.001) and were all positive; Retrieving – interest in object (OR = 1.82), Unstable table reaction (OR = 1.46), Metal stair (OR = 1.40), Tug of war (OR = 1.34) and Gradual visual startle – secondary response (OR = 1.25). The model of the subjectively rated test items consisted of four items (P ≤ 0.001): Prey drive (OR = 1.65), Ability to cooperate (OR = 1.60), Competitiveness (OR = 1.26) and Curiosity (OR = 1.44, P = 0.007).

To visualize how the different test items were correlated to each other and to the education level, a dendrogram was produced (Appendix II.). The education level of the dogs ended up in the same cluster as all test items related to the play-like activities with the ball and the rag, but also with items concerning challenging footing, curiosity and liveliness (green cluster).

6. Relationship between foster owner factors and the index

To see which foster owner factors had the greatest influence on the index, a correlation matrix was produced. Only one foster owner factor was significantly correlated and had r > 0.2: Accommodation (Pearson's r = -0.26, P < 0.001).

7. Additional correlations among the foster owner factors

Foster owners who had larger accommodations were more likely to have other animals (Pearson's r = 0.29, P < 0.001), especially cats (Pearson's r = 0.32), farm animals (Pearson's r = 0.27), dogs (Pearson's r = 0.26) and horses (Pearson's r = 0.24). Families with children more often had other animals, positively but weakly correlated with number of children (Pearson's r = 0.15, P = 0.016), especially small pets (Pearson's r = 0.28, P < 0.001), which was also positively correlated with number of children (r = 0.29, P < 0.001). Additionally there was a weak positive correlation between number of children and the size of accommodation (Pearson's r = 0.19, P = 0.002). In summary, it was more

common for farm owners to have many children and animals, than it was for house owners, who in turn had more children and animals than apartment owners. Female respondents stating that they were the main caretaker of the dog were more likely to have other animals than male caretakers ($r = 0.29$ and -0.28 respectively, $P < 0.001$).

Discussion

This study aimed to investigate why the education level of the Swedish military dogs influenced whether they went into service or not, by analysing foster owner factors and their relationship with the education level and items in the temperament test.

As expected, dogs from apartments generally had higher education levels than those who lived in houses or farms and were also more likely to enter service. Additionally, apartment owners were less likely to have other animals and many children than house/farm owners. Dogs from apartments generally had a higher index, but specifically achieved higher scores for the test items search persistence, search intensity, prey drive, hunting drive, competitiveness and tug of war. The dendrogram in Appendix II showed that these items were related and also relatively closely correlated with the education level.

In the temperament test, these items are all parts or aspects of how the dog engages in games with a ball or a rag (see description in Wilsson & Sinn 2012). Prey drive is part of the complex trait called "Ardour", which also includes sharpness and defence drive (Table 1). Ardour is in turn correlated with the complex trait Mental stability, which comprises the test items courage, nerve stability and hardness (Wilsson & Sundgren 1997). Nerve stability and hardness seems to be the same type of traits as calmness in the study by Kubinyi et al. (2009), judging by their common grouping under the personality dimension Neuroticism/Emotional stability (Gosling & John 1999). They are increased by training, playing, time spent with the dog, previous experience with dogs and having more than one dog in the household, whereas courage seem to be more related to boldness (Extraversion/Introversion) (Gosling & John 1999).

Boldness is increased by training and having more people in the household (Kubinyi et al. 2009). The complex trait Mental stability also has a lot in common with confidence, as described by Rooney and Bradshaw (2003), which was increased by playing tug of war and fetch with the dog. Playing also increased the dog's trainability, but so did training, time spent with the dog and a larger number of people and/or dogs in the household (Svartberg 2005; Kubinyi et al. 2009; Jones & Gosling 2005). However, in an email on 11th December 2013 E. Wilsson points out that the test items involving tug of war and fetch would not necessarily be classified as play, as they could have another motivational background than being just for fun. Regardless what we call it, it seems like the activites of interacting with the dog with a ball and/or a rug can have positive effects on the behaviour later on. Fetch/tug of war and training the dog crops out as management factors that are relatively easy to change in order to enhance wanted traits such as prey drive and confidence.

Contrary to expectations it did not prove beneficial for the dog's chance of success to have children in the household. However, this study did not divide children into different age categories, as was done by Fuchs et al. (2005), who found that dogs that had frequent contact with school-age children performed better in the temperament test. This study only took the number of children in the household into account.

Education level was correlated to several items in the temperament test that related to playing games; retrieving - interest in object, tug of war, prey drive and competitiveness. But it was also predicted by the reactions to an unstable table and a metal stair, the perceived curiosity of the dog, its willingness to cooperate with the handler and its approach reaction towards a previously threatening stimulus. One could speculate that dogs that are used to playing a lot with their handlers would pay more attention to the handler (expecting something positive from them) and have better confidence in general, which would manifest on strange footing and generate more exploratory behaviour. Confident dogs that pay attention to their handler would probably investigate a strange "threat" sooner, when they see that their handler is neutral towards it.

It seems like playing games could be the key to many of the desirable behaviours in military dogs, and it is selected for by including dogs that do well on several game-like test items. Since prey drive has a moderately high heritability (Table 1) and is deemed one of the most important traits (Wilsson & Sundgren 1997), it should be a prominent trait in all Swedish military dogs. Even so, based on the results of this study, dogs from apartments were generally "better at playing" than those from larger accommodations. Kubinyi et al. (2009) suggested this higher level of play was because a dog in an apartment naturally interact more with its owner than a dog left in a yard. Additionally, higher scores on the play-like test items were correlated to higher education level, which also indicates that owners that spend more time with their dogs and engage in training activities get more playful dogs that are more successful. I suspect that sharing a smaller living area makes obedience more important. Supposedly a dog that is actively being exercised (going on walks, as opposed to being let out in the garden) gets played with more in order to get rid of excess energy that otherwise could be spent on destructive behaviour in the apartment. It is also possible that dogs get used to several different environments while being walked, compared to perhaps only seeing the inside of a garden. However, it could also be the reverse; dogs in apartments get to play less, whereas dogs in a yard can fulfil their need for searching and hunting, which could be why the apartment dog puts in more effort when it finally gets the chance to search and play. That kind of rebound effect is known from several species (Held & Špinka 2011).

In contradiction to the rebound effect in the above explanation, Rooney and Bradshaw (2003) showed that dogs with strong bonds to their owners were more confident and played longer (duration of a bout), which makes it unlikely that search persistence and competitiveness would be more pronounced in dogs from apartments if it only were to stem from frustration. The test item "ability to cooperate", which was positively correlated with high education level, could also be influenced positively by a playful relationship between handler and dog. This was suggested by Haverbeke et al. (2008), where dogs that were rewarded with play as a reinforcer were all placed high in an obstacle course competition. More trainable dogs are also more playful (Svartberg 2005) and are better able to focus on a task (Marshall-Pescini et al. 2008), which could be reflect in the higher scores on the important test items that involve play and prey games and persistence that are listed in Table 4.

Unlike the results by Kubinyi et al. (2009) I found no evidence that dogs from households with multiple dogs or other animals and horses, as I hypothesised, would be more trainable and therefore more successful. On the contrary, the opposite was true for farm animals, especially horses, but also for households with small pets. Other correlations between the different foster owner factors suggested that it might not be the presence of the animals in

themselves that influence the temperament of the dog, but rather more complex associations. For instance, owners of farm animals were more likely to live on a farm, which was shown to negatively influence the dog's education level. A foster owner that has to care for a horse might not have enough spare time to engage with the dog too. Similarly, foster owners with small pets often also had a lot of children, which could influence the dog in many ways. It could be a matter of simply not having enough time for the dog because of the children, but it could also have to do with a reluctance to let the dog engage in tug of war and other rough games that have the potential to get a young active dog excited and unintentionally hurting a child. There was no indication that dogs from households with children would be more confident, as if they had played more. However, simply spending time with the dog does not seem to be enough, since military dogs that were left in the kennel performed equally well as those that were taken home (Haverbeke et al. 2008). This is also supported by the result that foster owners who report the dog will be left alone for more than four hours per day have more successful dogs than those stating it will be left for a shorter time. Perhaps it has more to do with the quality of the interaction, rather than the quantity. Additionally, foster owners that reported an interest in dog training and those that had attended puppy class before, had more successful dogs, even though there was no difference in education level. It seems that even if current dogs in the household have no influence, historical dogs can have some impact.

This study was based on a questionnaire that the foster owners had filled out before they knew if they were going to get a dog. Some questions would probably be better answered during the foster period, such as "hours left alone" for instance. The question "have you had a dog before" was ambiguous as it could include dogs owned in early childhood as well as more recent dogs. The category was kept in the analysis anyway, to get information about experience. A question about which breed had been owned before received so many breeds in the responses that it was removed because the sample sizes became too small to achieve statistical significance. A more relevant question would perhaps be the purpose of the previous dog; whether it was a companion, for sports, hunting or something else. Unfortunately I had no access to information about which consultant was involved with each dog. The consultants could be an important factor, which would be interesting to include in future analyses.

The correlations in this study were not very strong, despite the large sample size and high levels of significance, which makes me think the demographic aspects are too broad to have good predictive value. Ideally, a standardized personality test, like the FFM (Gosling & John 1999), could be used to investigate the personality of potential foster owners and single out which traits are most likely to make a good foster owner. The clearest picture would probably be that of both personality and demographics together. I suspect, however, that it would be a daunting task for prospective foster owners to fill in such an extensive application form. I would instead recommend focusing on the benefits of play and training activities – offer more training opportunities with the consultants, give incentive to participate in different kinds of instructor-led courses and inform foster owners about the benefits of playing with the dog. Since trainability increases with more training, one should not have to worry that the dog learns the wrong things, but instead encourage it to learn to learn.

Conclusion

Foster owners that engaged in training and play-like activities with their dogs were more likely to contribute to their dog being selected as suitable for military service. The foster owner can develop a bond with the young dog through play, which makes the dog more confident. Foster owner factors such as type of accommodation and having children and/or other animals in the household seemed to influence the success of the dog mainly through allowing the foster owner to spend more or less time interacting actively together. It follows that foster owners should be encouraged to spend more time on activities with their dogs, training and playing with them.

Acknowledgements

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Unpublished/Personal Communication

Pounu, M. 2013. Email to H. Jones 29 October.
Wilsson, E. 2013. Conversation with H. Jones 2 March.

Foster owner application questions and the resulting answer categories with response frequencies

Why do you want to become a foster owner?

Open-ended/multiple:

Try it out	36	Want company	27
Interested in German shepherds	23	Finds foster ownership suitable/flexible	22
Interested in dogs	139	Fostered before	15
Interested in animals	21	Wants to serve the community	62
Interested in nature	17	Retired/plenty of time	2
Interested in dog-training	52	For the kids	5
Want exercise	12	Protection	3
Economy	10	RESPONDENTS	274

Who will be responsible for the dog?

Open-ended:

Male	141	(Both	50)
Female	182	Child	4

Are there other animals in the family – which?

Yes	177
No	95

Open-ended/multiple:

Dog	104	Small pet	31
Cat	96	Farm animal	10
Horse	24	Cold-blooded	10

Will the puppy be left alone for more than four hours during the day?

Yes	14
No	250

Have you had a dog before? (What breed? - Removed)

Yes	241
No	30

Do you have any previous dog-training experience – what kind?

Yes	166
No	105

Open-ended/multiple:

Puppy class	45	Agility/freestyle/clicker	18
Obedience	75	Hunting	5
Working	55	Military	31
Instructor	6		

Can you bring the dog to work?

Yes	132
No	80
Home based	35

Current living conditions/accomodation?

Apartment	78
House/townhouse	133
Farm	53

Do you have children?

Yes	139
No	130

How many children?

1	27
2	61
3	38
4	11
5	1
6	1

Dendrogram

Single Linkage; Correlation Coefficient Distance
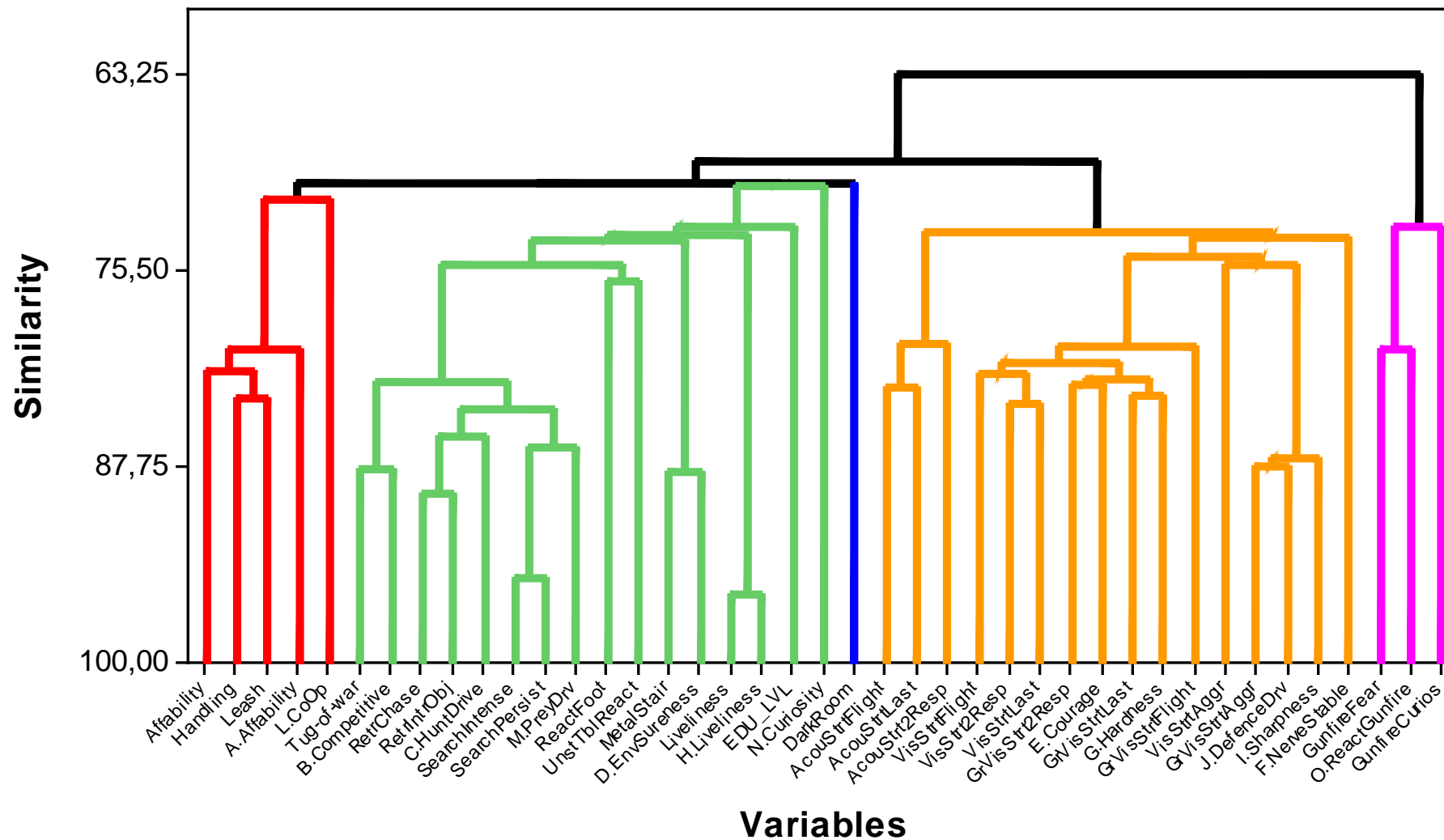
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