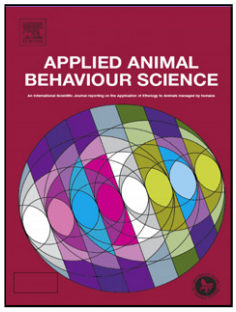

Title: Evaluation of the predictive validity of the behavioural assessment for re-homing K9's (B.A.R.K.) protocol and owner satisfaction with adopted dogs

Author: Kate M. Mornement Grahame J. Coleman Samia R. Toukhsati Pauleen C. Bennett

PII: S0168-1591(15)00099-4
DOI: http://dx.doi.org/doi:10.1016/j.applanim.2015.03.013
Reference: APPLAN 4057

To appear in: *APPLAN*

Received date: 30-9-2014
Revised date: 22-3-2015
Accepted date: 28-3-2015

Please cite this article as: Mornement, K.M., Coleman, G.J., Toukhsati, S.R., Bennett, P.C.,Evaluation of the predictive validity of the behavioural assessment for re-homing K9's (B.A.R.K.) protocol and owner satisfaction with adopted dogs., *Applied Animal Behaviour Science* (2015), http://dx.doi.org/10.1016/j.applanim.2015.03.013

Highlights

- We examine the predictive validity of the B.A.R.K. protocol
- B.A.R.K. predicted fearful and friendly behaviour post adoption
- Problem behaviour and aggression post adoption were not predicted by B.A.R.K.
- About 25% of adopted dogs assessed by B.A.R.K. and existing tests showed aggression
- Shelters should review standard practices when assessing shelter dog behaviour

Evaluation of the predictive validity of the behavioural assessment for re-homing K9's (B.A.R.K.) protocol and owner satisfaction with adopted dogs.

Kate M. Mornement[a], Grahame J. Coleman[b], Samia R. Toukhsati[c] & Pauleen C. Bennett[d]

[a]School of Psychological Sciences, Building 17, Clayton Campus, Wellington Rd, Monash University, VIC, 3800, Australia

[b]Animal Welfare Science Centre, School of Land and Environment, Building 162, The University of Melbourne, Parkville VIC 3010, Australia

[c]Department of Animal Sciences, The Ohio State University, Columbus, OH 43210, United States

[d]Anthrozoology Research Group, School of Psychological Science, La Trobe University, PO Box 199, Bendigo, VIC, 3552, Australia

Requests for reprints should be sent to Pauleen Bennett, Anthrozoology Research Group, School of Psychological Science, La Trobe University, PO Box 199, Bendigo, VIC, 3552, Australia

Phone: +61 3 5444 7460

Fax: +61 3 5444 7850

E-mail: Pauleen.Bennett@latrobe.edu.au

Abstract

It is common practice for animal shelters and rescue organisations to conduct behaviour assessments on the dogs in their care. The information obtained is used to identify dogs suitable for rehoming and also assist with matching dogs to appropriate homes. Although the aim of these assessments is to provide a snapshot of the behavioural characteristics of individual dogs, research to determine whether such tools are effective and accurate in predicting the behaviour of dogs post adoption is currently lacking. In the present study, we investigated the predictive validity of a standardised protocol called the Behavioural Assessment for Re-homing K9's (B.A.R.K.). We used the B.A.R.K. protocol to assess 74 dogs housed in an animal shelter, prior to their adoption. All dogs were at least 1 year of age (mean= 2.86 years, SD = 2.02). New owners of these dogs took part in a post adoption survey 2 to 8 months (Mean = 4) after they adopted their dog. The survey aimed to establish the degree to which the behavioural tendencies identified by the B.A.R.K. protocol carried through to the adoptive home. The predictive validity of the B.A.R.K. protocol was relatively poor. Multiple regression analyses revealed that Fear, measured by the B.A.R.K. protocol, significantly predicted 'fearful/inappropriate toileting' behaviours post adoption ($\beta = 0.36$, $p < 0.05$), as did Anxiety ($\beta = -0.31$, $P < 0.05$). However problem behaviours more generally and aggression post adoption were not predicted by the B.A.R.K. protocol. Almost 25% of adopters reported that their new dog had 'growled, snapped at, or attempted to bite a person' and nearly 75% indicated that their dog exhibited behaviour they would change if they could. Despite this, just over half (56.8%) of the new owners said they were very satisfied with the behaviour of their newly adopted dog and 71.2% said their adopted dog had met their expectations. Our results suggest that additional research is urgently needed to evaluate the predictive validity of in-field behaviour assessments and whether a more holistic, or alternative, approach to assessing shelter dog behaviour, such as longer-term foster care programs, is required to safeguard the welfare of dogs in the shelter system and the community at large.

Keywords: Shelter dogs; Behaviour assessment; Temperament test; Welfare; Predictive validity

1. Introduction

Animal welfare shelters, the world over, take in millions of unwanted and stray dogs every year (Bollen and Horowitz, 2008). It is common practice for shelters to assess the behaviour of the dogs in their care, prior to re-homing them, to determine whether or not they are suitable for adoption. These assessments are thought to provide a profile of the behavioural characteristics of dogs (van der Borg et al., 1991) and are used to assist in matching adopters with appropriate dogs (Bollen and Horowitz, 2008). Information collected during the assessment, in which dogs are exposed to a series of stimuli intended to replicate real world situations, is used to identify stable behavioural tendencies in order to predict future behaviour that may be expressed in similar circumstances (Dowling-Guyer et al., 2011). The purpose of the assessment is to determine whether a dog will make a suitable companion for potential adopters (Christensen et al., 2007) and to optimise the match between adopter and dog (Bollen and Horowitz, 2008).

The quality of a behavioural test, whether a test is a good measure, the right measure and a useful measure, is determined by three characteristics: reliability; validity; and feasibility (Martin and Bateson, 1993). While these characteristics can only be assessed empirically, these tests are seldom validated (Taylor and Mills, 2006). This is an important oversight because it is widely recognised that deficiencies in assessment have the potential to be a significant welfare concern if dogs are wrongly euthanased or placed in homes for which they are unsuited, and they may also place adoptive families at risk if potentially dangerous dogs are sold as adoptable pets (Mornement et al., 2010). Available National statistics for Australia show that 21.5% of all dogs admitted to shelters are euthanased (Royal Society for the Prevention of Cruelty to Animals Australia National Statistics 2012-2013). The most common reasons cited for euthanasia are 'behavioural' (66%) followed by 'medical' (23%). Although, encouragingly, fewer dogs are

being euthanised for behavioural reasons than was the case a decade ago, this still represents many thousands of dogs. It is therefore imperative that shelter dog behavioural assessments are valid.

Validity in this context cannot be assumed because accurate assessment of the behaviour of dogs while in a shelter environment, even when utilising standardised protocols, remains problematic. Shelter admission is highly stressful and traumatic for most dogs (Mornement et al., 2014). Contributing factors include capture and confinement during transport, loss of familiar social companions, extremely novel surroundings, contagious and aggressive barking and loss of control over environmental contingencies (Shiverdecker et al., 2013). Other evidence demonstrates that chronic stress can affect cognitive functioning (Marina et al., 2011) and behaviour (Beerda et al., 1997; Beerda et al., 1999; Grønli et al., 2005). Behaviour displayed by dogs during a behaviour assessment, which typically occurs in the first few days following admission, may therefore not be indicative of dogs' usual behaviour under more normal circumstances, such as in the home environment. This could render any assessment of behaviour conducted within a shelter, particularly within close proximity of time of admission, inadequate. Although few studies have examined this possibility recent research has found that, of 77 dogs that did not display food-related aggression during a shelter behaviour assessment, 22% did display the behaviour post adoption. Conversely, 45% of the 20 dogs that did display food-related aggression during the behaviour evaluation did not display the behaviour in their new homes (Marder et al., 2013). Another study by Kis et al,. (2014) found that food related aggression changed over time with dogs showing more aggression having spent two weeks in the shelter compared to one to two days after admission. In addition, pet dogs showed more food aggression in the presence of their owner (Kis et al., 2014). This suggests that behaviour assessment protocols for shelter dogs may not be efficient in identifying and predicting all behavioural tendencies, including aggression.

The Behavioural Assessment for Re-homing K9's (B.A.R.K.) protocol, a standardised shelter dog behaviour assessment, was developed following a review of shelter dog assessment protocols used in Australia (Mornement et al., 2010). The review revealed that, although shelters are to be commended for attempting to ensure that only appropriate dogs are adopted, standardisation in content and methodology, and empirical evidence to support the reliability, validity and feasibility of such assessment protocols, was lacking. Preliminary evaluation of aspects of the reliability of the B.A.R.K. protocol revealed a good degree of inter-rater reliability, when two experienced raters simultaneously scored dog behaviour, but limited test-retest reliability, when dogs were retested 24 h later (Mornement et al., 2014). It may be inevitable that individual dogs' responses will vary over time, as the shelter environment is dynamic and cannot be completely standardised. If so, however, this would significantly limit the validity and utility of shelter-based behavioural tests.

In a previous study we also followed up dogs, assessed in-shelter using the B.A.R.K. protocol, that were subsequently adopted using a post adoption questionnaire. We reported one general measure of the predictive validity of the B.A.R.K. which showed that two behavioural traits, measured by the instrument in the shelter, were observed by new owners. Mean Fear and Friendliness scores obtained during the B.A.R.K. assessment were significantly correlated with new owner ratings of their dogs, overall, for the same behavioural traits (Mornement et al., 2014). In this paper we report the predictive validity of the B.A.R.K. protocol in greater detail by investigating the tools ability to predict a range of specific post adoption behaviours, in a variety of contexts. The questionnaire probs various aspects of the behaviour of adopted dogs in their new homes, adopter satisfaction with their dog and the adoption process, and the process adopters used to select their new dog.

2. Method

2.1 *Subjects*

2.1.1 B.A.R.K Assessments

A sample of 102 dogs were assessed using the B.A.R.K. protocol while temporarily housed in five Australian animal shelters over a 12 month period. Due to University risk management and ethics requirements all dogs had already passed the shelters' existing behaviour assessments. Each was also given at least 3 days to acclimatise to the shelter environment before the assessment took place. After the dogs were rehomed, their new owners were invited to participate in a follow up phone interview. Data for 28 dogs were unavailable either because the dogs were not made available for adoption (n = 9) or their new owners did not consent to participate (n = 13) or could not be contacted for the post adoption survey (n = 6). The final sample comprised 74 adopted dogs (55.4% male, 44.6% female, 100% desexed prior to rehoming). All were estimated to be at least 1 year of age (mean= 2.86 years, SD = 2.02). The most common breeds/breed types were Jack Russell Terrier cross (n = 9, 12.2%), Maltese cross (n = 7, 9.5%), Australian Cattle Dog cross (n = 5, 6.8%), Staffordshire Bull Terrier cross (n = 5, 6.8%) and Cavalier King Charles Spaniel (n = 5, 6.8%). The remaining dogs in this study consisted of a wide variety of small to large pure breeds (n = 16, 21.6%) and cross breeds (n = 27, 36.4%).

2.1.2 Questionnaire Participants

Data were collected over a 12 month period. Women represented the large majority of survey participants (77%) compared to men (23%). The majority of households contained two adults (63.5%), followed by one adult (24.3%), three adults (9.5%) and four or six adults (2.8%). The most common age of the person most responsible for caring for the newly adopted dog was 26-55 years (58.1%), followed by 66 years and over (18.9%) and 56-65 years (14.9%). The highest level of education attained by participants was a Bachelor degree (36.5%), followed by Year 10 (17.6%), Trade certificate or vocation (16.2%), Year 12 or equivalent (14.9%), Post graduate degree (12.2%) and less than Year 10 (2.7%).

164

165 *2.2 Materials*

166 *2.2.1 B.A.R.K Assessments*

167 Each dog was assessed using the B.A.R.K. protocol, with its performance being recorded on the
168 B.A.R.K scoring matrix (see Morenement et al., 2014) with a cover sheet attached to record
169 specific characteristics (age, breed/breed type, sex, ID number) of each dog and the date and time
170 the assessment took place.

171

172 *2.2.2 Post adoption questionnaire*

173 The B.A.R.K. Protocol Post Adoption Questionnaire was developed on the basis of the B.A.R.K.
174 protocol and informed by a focus group of canine experts. The focus group consisted of an animal
175 behaviourist, dog trainer, a veterinary nurse, shelter worker and several academics within the
176 anthrozoology and psychology disciplines. The questions were designed to obtain information
177 about the dog selection process, the adopted dog's behaviour in the new home, the new owner's
178 satisfaction with the dog they adopted, and the adoption experience.
179 The post adoption questionnaire comprised 69 questions divided into 5 sections. Five questions in
180 Section 1 and eight questions in Section 2 related to details about the dog that participants
181 adopted and questions about the selection process. Questions such as 'Do you still have the dog
182 you adopted?', 'How old is the dog you adopted?', 'What was the main reason you decided to get
183 a dog', 'How much planning (and research) went into your decision to adopt your dog'?, and;
184 How important were certain factors, such as size, coat type, general appearance and the behaviour
185 of the dog, in influencing your selection of your dog?.' Section 3 asked participants 40 questions
186 about the post-adoption behaviour of their new dog. Adopters were asked to rate how often, on a
187 5 point Likert-type scale (Never, Rarely, Sometimes, Often, and Very often), their dog had
188 displayed a number of behaviours since the adoption. Examples include being destructive,
189 hyperactive, too noisy, toileting in the house and growling or snapping at a person whilst eating.

Participants were also asked where the dog slept, if they had taken the dog to obedience training, how often the dog was exercised and how well the dog had adjusted to its new home. Lastly, participants were asked to rate overall, on a 5 point Likert-type scale (Not at all, Somewhat, Moderately, Very or Extremely) how anxious, fearful, friendly, active and compliant their new dog was. Eight questions in Section 4 of the questionnaire asked participants about their satisfaction with the dog they adopted and the adoption process and a further eight questions in Section 5 related to demographic information.

2.3 Procedure

The project was approved by the Monash University Standing Committee for Ethics for Research involving Humans and Animal Ethics Committee.

Nine Australian animal shelters were invited to participate in the B.A.R.K. validation study. Shelter managers, who volunteered their shelter to participate in the research, contacted the researchers to indicate their interest. In total, five animal shelters agreed to participate. Workshops, run by one of the investigators, were conducted at the five Australian animal shelters during which at least two staff members were trained in administration and scoring of the B.A.R.K. protocol. Instructions and scoring sheets were provided and staff members observed assessing and scoring several dogs using the protocol until the investigator was satisfied they were competent. At the completion of each workshop, each shelter agreed to: assess as many dogs as possible (and at least n = 20) using the B.A.R.K. protocol, as well as their usual assessment protocol; invite owners of newly adopted dogs included in the study to participate in a post adoption survey, and; send completed assessments and new adopter consent forms to the investigators (Mornement, et al., 2014).

After several months it was evident that data collection from the participating shelters was extremely poor. Two shelters did not collect any data after the work shop, one assessed one dog and another assessed two dogs. The highest data collection rate from a participating shelter over six months was 13 dogs. Subsequently, one of the investigators worked on a voluntary basis at one of the participating shelters, where she personally administered and scored the B.A.R.K. Issues concerning poor data collection on behalf of participating shelters are discussed in detail in the discussion section of this paper.

New owners of dogs that were subsequently adopted from the participating shelters (n = 89) were invited to participate in a post adoption survey at the time they adopted their dog. Those who agreed to participate, and were contactable (n = 74), were telephoned between 2 and 8 months (Mean = 4 months) after the adoption of their new dog and the post adoption survey was completed over the telephone at a time convenient for participants (Mornement et al., 2014).

2.4 Statistical analysis

Data from the completed surveys were entered into SPSS for Windows (Version 19) for analysis. Descriptive data analyses were conducted for the majority of the post adoption questionnaire variables. Principal components analyses (PCA), using Direct Oblimin rotation, were performed to explore emergent components in variables from Section 3 of the questionnaire. Only data that met the recommendations for Kaiser-Meyer-Oklin value (0.6 or above) and Bartlett's Test of Sphericity (reaching statistical significance; $P < 0.001$) were used in the PCAs. Multiple regressions, using the Enter method, were performed to identify which components best predict shelter dog behaviour post adoption. Mahalanobis distance was employed to identify multivariate outliers, which were subsequently deleted from the model (Tabachnick and Fiddell, 2007). Relationships between behaviour assessed in dogs while temporarily housed in animals shelters and new owner reported behaviour 4 to 8 months post adoption were examined.

241

242 **3. Results**

243 *3.1 Post adoption questionnaire*

244 *3.1.1 Sections 1 and 2 – Details about the adopted dog and the selection process*

245 Only one participant no longer had the dog that they had adopted and this person indicated that
246 they had given it away to a friend. The remaining 73 participants still had their dog. Using a 5-
247 point Likert-type scale (1 = none to 5 = a great deal), new dog owners were asked to rate how
248 much planning went into their decision to adopt their dog. Half (50%) indicated they did 'a lot' of
249 research, followed by 'some' (18.9%), 'a great deal', 'a little' (12.2%) and 6.5% said they did no
250 planning. Participants were also asked to rate, using the same scale, how much research they did
251 into dog ownership and dog behaviour prior to adopting their dog. Over one third (39.2%)
252 indicated they did no research prior to adopting their dog while the remaining 60.8% did some
253 level of research. Participants cited various reasons for adopting their dog, the most common of
254 which were as a companion for themselves (51.4%), as a companion for another dog (16.2%),
255 because their previous dog had died (10.8%), as a companion for their child/children (9.5%) and
256 for exercise (4.1%). When asked why they decided to adopt a dog from a shelter the most
257 common responses were that they wanted to rescue a dog/save a life (60.8%), they wanted an
258 adult dog (14.9%) and that they didn't like pet shops (10.8%). In most cases, the person who
259 adopted the dog (58.1%) or the whole family (23%) wanted to get a new dog.
260 On a 5-point Likert-type scale (1 = extremely unimportant to 5 = extremely important),
261 participants were asked to rate the importance of a range of factors in their decision to adopt their
262 particular dog. Table 1 shows the frequency of their responses.

263 ----------

264 Insert Table 1 here

265 ----------

266

As can be seen from Table 1, 87.7% of participants rated the fact that the dog needed a home as important or extremely important. Participants also considered the behaviour of the dog (87.7%), the size of the dog (82.2%), the personality of the dog (87.6%), the appearance of the dog (46.6%) and the coat type (38.4%) as important or extremely important in their decision to adopt their dog. Interestingly, opinions varied on some factors with many participants stating that coat type (39.7%) and the appearance of the dog (31.5%) were unimportant or extremely unimportant. The gender of the dog (64.3%) was the factor considered least important, rated frequently as unimportant or extremely unimportant, by participants.

3.1.2 Section 3 – Behaviour in the new home

Participants rated the frequency, on a 5 point scale (never, rarely, sometimes, often, very often), with which their newly adopted dog displayed 19 different behaviours (Table 2). Behaviours most frequently rated as occurring very often included greeting visitors in a friendly manner, jumping up on people and pulling hard on the lead. Behaviours most frequently rated as never occurring included: fear of strangers (60.8%); fear of strange noises/objects (27%); being overly active (24.3%); mouthing or chewing people in play (54.1%); chasing small animals (40.5%); aggression towards other animals (47.3%); escaping (62.2%); growling or snapping while eating a treat/bone (93.2%), meal (93.2%), and playing with a toy (93.2%); growling or snapping at or attempting to bite a person (75.7%); being destructive (41.9%); being too noisy (54.1%), and; being anxious/stressed when home alone (44.6%). Alarmingly, 24.3% of participants reported their adopted dog had growled, snapped at or attempted to bite a person.

Insert Table 2 here

The 19 behaviours were subjected to PCA, which revealed three behavioural scales (Table 3). The 'Fearful/inappropriate toileting' subscale consisted of 5 items ($\alpha = 0.73$); the 'Problem

behaviours' subscale consisted of 7 items (α = 0.65), and; the 'Aggression' subscale consisted of 4 items (α = 0.66), explaining 15.1%, 13.2% and 11.0% of the variance, respectively. When dealing with psychological constructs, values below or in the region of 0.70 are expected because of the diversity of the constructs being measured and the small number of items in the 'Aggression' subscale (Klein, 1999; Field, 2005).

Insert Table 3 here

3.1.3 Section 4 – Satisfaction with the adopted dog and the adoption experience

When asked whether their dog had any behaviours they would change if they could, almost three quarters (71.6%) answered affirmatively. When asked to indicate what behaviour they would like to change, the most common responses included destructive behaviour (11.2%), fearful behaviour (8.4%), excessive barking and pulling on the lead (7.0%), separation anxiety, escaping, aggression towards other dogs and inappropriate toileting (4.2%).

Most adopters reported that their dog had adjusted to its new home extremely well (60.8%) or very well (35.1%) and all agreed (24.3%) or strongly agreed (75.7%) that their new dog was a member of the family. The majority strongly agreed (70.3%) that the adoption process was a positive experience, that they would adopt again in the future (75.7%) and that their dog had met their expectations (71.2%). The majority of participants neither agreed nor disagreed that the time (60.8%) and work (66.2%) involved in caring for their new dog was more or less than expected. For some participants it was less time (25.7%) and work (21.6%) looking after their dog than expected. Overall, the majority of participants were very satisfied both with the behaviour of the dog they adopted (56.8%) and with the adoption process (71.6%).

3.2 Predictive validity of the B.A.R.K protocol

3.2.1 B.A.R.K. Protocol predictors of post adoption behaviour in the new home

Three multiple regression analyses were conducted to determine whether means scores derived from the five behavioural traits scored in the B.A.R.K. protocol could predict behaviour in the new home using the three behavioural subscales ('Fearful/inappropriate toileting', 'Problem behaviour' and 'Aggression') as dependent variables. The results of the first regression analysis indicated the model explained 30.6% of the variance (R^2=0.31, F (5, 61) = 5.38, P < 0.001). It was found that Fear (scored in the B.A.R.K. protocol) significantly predicted 'Fearful/inappropriate toileting' behaviour post adoption (β = 0.36, P < 0.05), as did Anxiety (β = -0.31, P < 0.05). The other behavioural subscales derived from PCA, 'Problem behaviour' and 'Aggression', were not predicted by B.A.R.K.

We also investigated whether the mean scores for the five behavioural traits scored in B.A.R.K. could predict specific post adoption behaviours (See Table 2). It was found that mean Fear scores significantly predicted how often new owners reported that their dog had shown fear of strangers (β = 0.34, P < 0.05), as did mean Anxiety scores (β = -0.26, P < 0.05). These two variables accounted for 34.5% of the variance in fear of strangers (R^2=0.35, F (5, 61) = 6.42, P < 0.001). How often the dog greeted visitors in a friendly manner was also predicted by B.A.R.K with mean Friendliness scores (β = -0.45, P < 0.05) accounting for 28.2% of the variance (R^2=0.28, F (5, 61) = 4.78, P < 0.01). The remaining post adoption behaviours were not predicted by the B.A.R.K. protocol.

4. Discussion

The aims in this paper were to evaluate, more specifically, the predictive validity of the B.A.R.K. protocol by investigating, via a questionnaire, a range of behaviour exhibited by adopted dogs and how satisfied owners were with their new dogs and the adoption process. Preliminary evaluation

of a general measure of the predictive validity of the instrument had previously shown that overall mean scores for Fear and Friendliness obtained from the B.A.R.K. protocol correlated with ratings given by new owners, for the same behaviours, post adoption (Mornement et al, 2014). Upon investigation of the ability of the B.A.R.K. protocol to predict more specific behaviours post adoption, the results were somewhat disappointing. While it appears that the B.A.R.K. protocol may be an effective tool to predict a general measure of friendliness and fearful behaviour exhibited in a number of contexts post adoption, the protocol does not appear to be a good predictor of problem behaviours, such as aggressive and destructive behaviour, in shelter dogs.

Several possibilities exist when considering how to interpret these data. The first is that the B.A.R.K. may simply be inadequate as an instrument with which to assess canine behaviour, either because the instrument itself, or its administration in this study, were flawed. We do not think that the instrument is inadequate because it was developed based on a comprehensive review of shelter dog behaviour assessment protocols and input from experts (Mornement et al., 2010). The reliability of the B.A.R.K. protocol has also been investigated and the instrument exhibits strong inter-rater reliability however the test-retest reliability was reduced (Mornement et al., 2014). We also feel that poor administration is unlikely to have resulted in the negative findings we obtained. While a small proportion of the dogs were assessed by 'trained' shelter staff at four shelter establishments, the majority of dogs in our sample were assessed by one of the researchers at one of the participating shelters, an expert in dog behaviour assessment.

A second possibility is that, despite research supporting the stability of personality and behavioural traits in dogs (Diederich and Giffroy, 2006; Taylor and Mills, 2006), some aspects of canine behaviour may not be predictable. Consistent with this possibility was the relatively high number of new adopters who reported their dog had growled at, snapped at or attempted to bite a

person (see Table 2). This is alarming considering that all of the dogs in this study had been assessed using the B.A.R.K. protocol and the standard assessment already used within each shelter, and they had been observed by shelter staff for at least 3 days prior to assessment, and did not display aggressive behaviour. In Australia, shelter dogs that display any form of aggression, either during an assessment or during their stay in the shelter, are typically not made available for adoption. Indeed, a limitation of this study, as with similar studies in this area, is that only those dogs that did not show any signs of aggression, either during the shelters' routine assessment or at any time prior to this assessment taking place, were included in the sample for safety reasons.

This, then, suggests the possibility of a high number of false negatives in the initial assessment and the B.A.R.K protocol, potentially meaning that shelter dog assessments overall do not offer a valid index of aggression, and that they may be poor predictors of future aggressive behaviour. Aggression, it seems, is particularly difficult to assess reliably as it occurs infrequently and may be context specific. In a study that assessed the behaviour of privately owned dogs using the Dutch Socially Acceptable Behaviour (SAB)-test, it was found that a considerable proportion of aggressive dogs remained undetected and the test was deemed suboptimal for assessing types of aggression unrelated to fear (van der Borg et al., 2010). In contrast, fear may be a more robust and stable behavioural trait than aggression, and also when compared to anxiety, compliance and activity level. Indeed, recent research in epigenetics revealed fearful behaviour may be heritable, without prior learning taking place (Dias and Ressler, 2013).

A third possible explanation for our results is that canine behaviour may be reasonably predictable and the B.A.R.K. may be adequate as a measure of canine behaviour, but assessment of dogs in the first few days following admission to a shelter may produce misleading results. Despite shelters' best efforts to maintain excellent animal welfare, dogs may be suffering from disease, sleep deprivation, noise pollution, social and emotional stress. These stressors, inherent

in shelters, may inhibit some dogs with aggressive tendencies from exhibiting them during an assessment (Christensen et al., 2007). This may be particularly true in the first few days following admission, with the admission process itself likely to be stressful and traumatic for most dogs due to capture and confinement, loss of familiar social companions, novel surroundings, contagious and aggressive barking and loss of control over environmental contingencies (Shiverdecker et al., 2013). Indeed, recent research has shown that shelter dogs show more aggression when tested two weeks after entering a shelter compared to one to two days after admission and that aggression was more probable in the presence, than in the absence, of a passive owner (Kis et al., 2014). Evidence suggests stress can affect cognitive functioning (Marina et al., 2011) and behaviour (Beerda et al., 1997; Beerda et al., 1999; Grønlia et al., 2005).

This implies that all standardised shelter dog assessment protocols, used soon after admission to inform decisions about which dogs are made available for adoption, rehabilitation or euthanased, may fail to provide shelter staff with accurate information upon which these decisions can be based. Other factors are also likely to influence the results. For example, it is possible that shelter staff, as experienced and more confident dog handlers, are less likely to elicit aggressive behaviours in dogs during testing than are new owners once the dog is rehomed. There are also many possible situational factors that could undermine the predictive validity of the protocol, such as the absence of the dog-owner relationship (van der Borg et al., 1991) novelty or stressors in the environment. Indeed, a recent study by Marder et al., (2013) demonstrated that many shelter dogs that exhibited food aggression during a behaviour assessment did not exhibit the behaviour post adoption. The situations simulated within any given behaviour assessment may not stimulate a dog's triggers for aggressive behaviour (Christensen et al., 2007). In addition, certain types of aggression, such as territorial aggression, are very difficult to assess in a shelter because the dog does not have a home territory other than its kennel (van der Borg et al., 1991).

This is a serious issue and it may mean that a new approach to rehoming shelter dogs, which does not rely on the outcome of behaviour assessments to make decisions about which dogs are suitable for adoption, warrants further consideration. Foster programs in which dogs are temporarily housed with competent and experienced foster carers until they are adopted provide dogs with an opportunity to live and learn in a home environment and gain skills that are necessary for their role as a companion animal. It would also allow foster carers to observe, assess and address any problematic behaviour that arises in a home environment that may not be observed in shelter environment. Future research could investigate whether foster care programs produce better behaved dogs post adoption compared with dogs adopted from shelters, or at least whether assessment of those dogs is more predictive of behaviour in the new home. New owners adopting dogs may be complete novices when it comes to their understanding of canine body language and behaviour. This lack of knowledge could result in dogs being placed in situations in which they resort to aggression such as growling or snapping. The development of a shelter dog manual, which provides new adopters with a basic level of understanding of canine behaviour, body language, appropriate interaction and correct training methodology, could be a cost effective way of reducing post adoption aggression due to improper management, interaction or interpretation of behaviour.

In addition to the main findings that arose from this study, one further issue requires discussion. It quickly became apparent during the study that the development and ongoing improvement of scientifically valid shelter dog behaviour assessment protocols is extremely challenging. Despite our best efforts we were unable to gain an adequate level of assistance from existing shelters in Australia. Shelter managers and staff were enthusiastic about the project, but they work with enormously varied available resources and capabilities associated with individual shelter establishments and rescue organisations. Our findings are consistent with Haverbeke et al. (2014) where a clear discrepancy between the field reality and current scientific knowledge was evident.

Financial restrictions and lack of time prevented shelters in the European Union from utilising scientifically validated protocols for assessing adoption suitability in dogs, despite there being a demand for such a tool. Furthermore, it is understood that no behavioural evaluation can predict, with absolute certainty, the future behaviour of dogs and so a more holistic approach to adoption is required. A broad picture evaluation which takes into account pre-shelter, in shelter and post-shelter behaviour assessment and a follow up interview with new owners is warranted (Haverbeke et al., 2014). This, together with efforts to improve shelter dog behaviour and adoptability by minimising in-shelter stress, providing enrichment and ultilising rehabilitation training may help increase adoption success. To achieve this, however, further research is required.

Conclusion

Findings from this study suggest that the B.A.R.K. protocol may be a useful tool in predicting some behavioural traits, specifically fear and friendliness in shelter dogs. However, it does not appear effective in predicting aggressive behaviour or problem behaviour post adoption. This may reflect a fault of the instrument itself or could be the result of problems inherent in assessing behaviour in a highly stressful environment, where a stable human-canine relationship is absent, and using this information to predict behaviour in a home environment with a stable human-canine relationship. Shelters may therefore need to review their standard practices when making decisions based on the results of in-shelter behaviour assessments. A holistic approach including assessment of behaviour pre-shelter, in-shelter and post-shelter, together with stress reducing enrichment and rehabilitation training may assist to provide a more complete picture of canine behaviour and adoptability. Foster care programs are a potential alternative to extended shelter stays and warrant further investigation. Behaviour is complex and context specific and providing educational materials to provide adopters with an understanding of canine behaviour and training together with ongoing support may help to prevent the expression of aggressive and problem behaviour post adoption.

475 **References**

476 Royal Society for the Prevention of Cruelty to Animals Australia National Statistics 2012-2013:

477 http://www.rspca.org.au/sites/default/files/website/The-

478 facts/Statistics/RSPCA_Australia_National_Statistics-2012-2013.pdf. Accessed 25.07.14.

479 Beerda, B., Schilder, M., Van Hooff, J., De Vries, H., 1997. Manifestations of chronic
480 and acute stress in dogs. Applied Animal Behaviour Science 52, 307-319.
481 Beerda, B., Schilder, M., Van Hooff, J., De Vries, H., Mol, J., 1999. Chronic Stress in
482 Dogs Subjected to Social and Spatial Restriction. I. Behavioral Responses. Physiology &
483 Behavior 66, 233–242.
484 Bollen, K., Horowitz, J., 2008. Behavioural evaluation and demographic information in
485 the assessment of aggressiveness in shelter dogs. Applied Animal Behaviour Science 112,
486 120-135.
487 Christensen, E., Scarlett, J., Campagna, M., Albro Houpt, K., 2007. Aggressive behavior
488 in adopted dogs that passed a temperament test. Applied Animal Behaviour Science 106,
489 85-95.
490 Dias, B.G., Ressler, K.J., 2013. Parental olfactory experience influences behavior and
491 neural structure in subsequent generations. Nature Neuroscience 17, 89-96.
492 Diederich, C., Giffroy, J.-M., 2006. Behavioural testing in dogs: A review of
493 methodology in search for standardisation. Applied Animal Behaviour Science 97, 51-72.
494 Dowling-Guyer, S., Marder, A., D'Arpino, S., 2011. Behavior traits detected in shelter
495 dogs by a behavior evaluation. Applied Animal Behaviour Science 130, 107-114.
496 Field, A., 2005. Discovering statistics using SPSS. 2nd ed. ed. Sage, London.
497 Grønli, J., Murison, R., Fiske, E., Bjorvatn, B., Sørensen, E., Portas, C.M., Ursin, R.,
498 2005. Effects of chronic mild stress on sexual behavior, locomotor activity and
499 consumption of sucrose and saccharine solutions. Physiology & Behavior 84, 571-577.
500 Haverbeke, A., Pluijmakers, J., Diederich, C., 2014. Behavioural Evaluations Of Shelter
501 Dogs: Literature Review, Perspectives And Follow-Up Within The European Member
502 States's Legislation Ith Emphasis On The Belgian Situation. Journal of Veterinary
503 Behavior In Press. Accepted Manuscript.
504 Kis, A., Klausz, B., Persa, E., Miklósi, A., Gácsi, M., 2014. Timing and presence of an
505 attachment person affect sensitivity of aggression tests in shelter dogs. Veterinary Record
506 174, 196.
507 Klein, P., 1999. The handbook of psychological testing. 2nd ed. ed. Routledge, London.
508 Marder, A., Shabelansky, A., Patronek, G.J., Dowling-Guyer, S., D'Arpino, S., 2013.
509 Food-related aggression in shelter dogs: A comparison of behaviour identified by a
510 behaviour evaluation in the shelter and owner report after adoption. Applied Animal
511 Behaviour Science 148, 150-156.
512 Marina, M.-F., Lord, C., Andrews, J., Justera, R.-P., Sindia, S., Arsenault-Lapierrea, G.,
513 Fioccof, A.J., Lupien, S.J., 2011. Chronic stress, cognitive functioning and mental health.
514 Neorubiology of Learning and Memory 96, 583-595.
515 Martin, P., Bateson, P., 1993. Measuring Behaviour: an introductory guide, 2nd ed.
516 Cambridge University Press, Cambridge, UK.

517 Mornement, K.M., Coleman, G.J., Toukhsati, S., Bennett, P.C., 2010. A Review of
518 Behavioural Assessment Protocols Used by Australian Animal Shelters to Determine the
519 Adoption Suitability of Dogs. Journal of Applied Animal Welfare Science 13, 314-329.
520 Mornement, K.M., Toukhsati, S., Coleman, G.J., Bennett, P., 2014. Development of the
521 behavioural assessment for re-homing K9's (B.A.R.K.) protocol. Applied Animal
522 Behaviour Science 151, 75-83.
523 Shiverdecker, M.D., Schiml, P.A., Hennessy, M.B., 2013. Human interaction moderates
524 plasma cortisol and behavioral responses of dogs to shelter housing. Physiology &
525 Behavior 109, 75.
526 Tabachnick, B.G., Fiddell, L.S., 2007. Using Multivariate Statistics. 5th ed. Pearson
527 Education, Boston, MA.
528 Taylor, K.D., Mills, D.S., 2006. The development and assessment of temperament tests
529 for adult companion dogs. Journal of Veterinary Behavior 1, 94-108.
530 van der Borg, J.A.M., Beerda, B., Ooms, M., de Souza, A.S., van Hagen, M., Kemp, B.,
531 2010. Evaluation of behaviour testing for human directed aggression in dogs. Applied
532 Animal Behaviour Science 128, 78-90.
533 van der Borg, J.A.M., Netto, W.J., Planta, D.J.U., 1991. Behavioural testing of dogs in
534 animal shelters to predict problem behaviour. Applied Animal Behaviour Science 32,
535 237-251.
536

537

Table 1

The frequencies (%) with which participants rated the importance of various factors in their decision to adopt their dog*

Factor	Frequency (%)				
	Extremely unimportant	Unimportant	Neither important nor unimportant	Important	Extremely important
The size of the dog	0.0	9.6	8.2	**67.1**	15.1
The coat type of the dog	4.1	**35.6**	21.9	**32.9**	5.5
The appearance of the dog	4.1	**27.4**	21.9	**41.1**	5.5
The dog needed a home	0.0	6.8	5.5	**49.3**	**38.4**
The gender of the dog	2.7	**61.6**	15.1	11.0	9.6
The behaviour of the dog	0.0	6.8	5.5	**45.2**	**42.5**
The personality of the dog	0.0	4.1	8.2	**53.4**	**34.2**
I felt sorry for the dog	2.7	**28.8**	**31.5**	**30.1**	6.8

*The most common responses, selected by over 25% of respondents, are highlighted in bold.

Table 2

The frequency (%) with which newly adopted dogs displayed a range of behaviours*

Item	Never	Rarely	Sometimes	Often	Very Often
Shown fear of strangers	**60.8**	10.8	17.6	4.1	6.8
Greeted visitors in a friendly manner	6.8	1.4	10.8	20.3	**60.8**
Shown fear of strange noises/objects	**27.0**	23.0	**27.0**	12.2	10.8
Shown fear of other dogs	**60.3**	13.7	11.0	12.3	2.7
Toileted inside	**41.9**	**36.5**	9.5	8.1	4.1
Jumped on people	17.6	13.5	24.3	20.3	24.3
Pulled hard on the lead	19.4	15.3	16.7	15.3	**33.3**
Been overly active	24.3	23.0	18.9	16.2	17.6
Mouthed or chewed people in play	**54.1**	20.3	16.2	8.1	1.4
Chased small animals	**40.5**	12.2	20.3	20.3	6.8
Displayed aggression towards another animal	**47.3**	**25.7**	16.2	5.4	5.4
Escaped	**62.2**	24.3	6.8	2.7	4.1
Growled or snapped while eating a treat/bone	**93.2**	4.1	2.7	0.0	0.0
Growled or snapped while eating it's meal	**93.2**	5.4	1.4	0.0	0.0
Growled or snapped at or attempted to bite a person	**75.7**	16.2	6.8	1.4	0.0
Growled or snapped while playing with a toy	**93.2**	4.1	2.7	0.0	0.0
Been destructive	**41.9**	**28.4**	13.5	9.5	6.8
Been too noisy	**54.1**	**29.7**	10.8	4.1	1.4
Been anxious/stressed when home alone	**44.6**	**32.4**	16.2	1.4	5.4

*The most common responses, selected by over 25% of respondents, are highlighted in bold.

Table 3

The factor loadings for post adoption behaviour subscales derived from principal component analysis, followed by an Oblimin rotation, of survey items investigating the frequency newly adopted dogs displayed a range of behaviours*

Item	**Factor**		
	Fearful/ Inappropriate toileting	Problem behaviour	Aggression
Shown fear of strangers	**0.841**	-0.027	0.002
Greeted visitors in a friendly manner	**-0.773**	.125	0.078
Shown fear of strange noises/objects	**0.677**	0.035	0.135
Shown fear of other dogs	**0.524**	-0.075	0.203
Toileted inside	**0.474**	0.178	-0.200
Jumped on people	-0.270	**0.672**	-0.174
Pulled hard on the lead	-0.310	**0.597**	0.003
Been overly active	-0.029	**0.591**	-0.048
Mouthed or chewed people in play	0.203	**0.550**	-0.143
Chased small animals	0.021	**0.490**	0.140
Displayed aggression towards another animal	0.094	**0.489**	0.406
Escaped	-0.087	**0.483**	-0.156
Growled or snapped while eating a treat/bone	0.093	-0.44	**0.816**
Growled or snapped while eating it's meal	-0.004	0.038	**0.816**
Growled or snapped at or attempted to bite a person	0.214	-0.18	**0.583**
Growled or snapped while playing with a toy	-0.251	-0.018	**0.413**
% variance explained	15.06	13.16	11.03

*The significant factors are highlighted in bold.