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The application/evaluation of canine behavioural assessments in shelter environments to recognise behavioural problems and adoption suitability.

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Abstract

Behavioural assessments have been utilised in shelter environments in Australia and around the world to identify possible stable behavioural repertoires to help in the re-homing process. The assessments are further used to identify behavioural problems in dogs surrendered to shelters. In most cases, dogs are allowed a minimum three to five day acclimation period to the new unfamiliar environment before the assessment is conducted. Whilst the behaviour assessments are used by shelters to predict whether the dog is suitable for re-homing, the dynamic nature of behavioural patterns can introduce the potential for inaccurate assessments and interpretation. A thorough evaluation of the accuracy of the utilised sub-tests within the assessment is therefore required to understand if these methods are satisfactory in identifying behavioural problems and adoption suitability. The overall objective of this research was to review current assessments conducted at RSPCA shelters to understand whether there is a need to create more efficient and effective behavioural assessments, or whether the current assessments provide an accurate picture of a dog's behaviour in the new, adoptive home environment.

The primary studies of this research were focused on the assessing the current protocols in place for canine behaviour assessments at RSPCA Qld. but firstly looking at the current literature behind behaviour assessments and outlining their positive applications (Chapter 1 and 2). Secondly, was to focus on if the manifestation of behaviour problems found in the behavioural assessment could be identified in in-kennel over the first five days (Chapter 3). The results from these findings indicated that the in kennel behaviours associated with fear, anxiety, and arousal in dogs were significantly correlated with the same behaviours in the formal assessment. With respect to outcomes, dogs that displayed more whining, tense body posture, standing leaning forward, panting, ears forward, less barking, lowered body and balanced/relaxed body posture, standing still, and standing by the wall had increased odds of failing the behaviour assessment. Over the five days in the kennel, the frequency and duration of fear-related behaviours decreased, suggesting a reduction in arousal as the dog became accustomed to the shelter environment. Thus, the study demonstrates that monitoring kennel behaviour could detect early signs of behaviour problems.

The third goal of the thesis was to investigate the predictive value of a standardised test currently used by comparing behaviour assessment information to post adoption survey (Chapter 4). The results identified that friendly/social, fear and anxiousness identified in the shelter assessment significantly predicted their behaviour counterparts post adoption. However, behaviour problems such as aggression, food guarding and separation-related behaviours were not reliably predicted by the standardised behaviour assessment. The results suggest that further research is required to

evaluate the predictability of behaviour assessment protocols for more specific behaviour problems that include different categories of aggression and separation-related problems. The fourth goal of the thesis was to identify whether the behaviour assessment could be more efficient and effective by reducing tests and refining current procedures (Chapter 5). The results suggested that the current protocol of 12 test used in the behaviour assessment could be reduced to 8 tests. Furthermore, repeats of the tests can be refined from 3 repeats to only conducting the test once in regards to touch sensitivity, play interactions, response to unusual/unpredictable stimulus, food possession, novel stimulus, time alone, and dog interactions. Current binary scoring of behaviour can be changed to scaling methodology based on behavioural categories. The findings suggest that reduction in testing procedures can help reduce time and refine scoring processes to help create more efficient and effective procedures.

Finally, the fifth goal of the thesis was to suggest improvements to the behavioural assessment to identify predictability of the assessment from home information using questionnaire (Chapter 6). The study used information from home behaviour using a questionnaire and the implementation of a behaviour assessment of dogs in society. The results suggested that major findings in the study were consistent with previous chapters results in relation to positive correlations of fear, arousal, friendliness and anxiousness identified in home behaviour and the behaviour assessment. Furthermore, behaviours of friendliness, fearfulness, arousal, anxiousness, and aggression were positively predictive between home behaviour and tests in the behaviour assessment. This research has therefore developed a greater understanding of current canine behaviour assessment protocols used at RSPCA Qld. in regards to predictability of behaviour, behavioural problems and efficiency and effectiveness of testing procedures. This information will allow better identification of behaviour of dogs in shelters via earlier timing of reduced assessments procedures, in-kennel monitoring and re-testing of dogs.

Declaration by author

This thesis *is composed of my original work, and contains* no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, financial support and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my higher degree by research candidature and does not include a substantial part of work that has been submitted *to qualify for the award of any* other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award.

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Publications included in this thesis

Clay, Liam, Paterson, Mandy, Bennett, Pauleen, Perry, Gaille., Rohlf, Vanessa., Phillips, Clive, 2020, In Defense of Canine Behavioral Assessments in Shelters: Outlining Their Positive Applications, *Journal of Veterinary Behavior*, vol. 38 , pp 74 - 81.

Clay, Liam, Paterson, Mandy, Bennett, Pauleen, Perry, Gaille., Phillips, Clive 2019, Early recognition of behaviour problems in shelter dogs by monitoring them in their kennels after admission to a shelter, *Animals*, vol. 9, pp. 875

Clay, Liam, Paterson, Mandy, Bennett, Pauleen, Perry, Gaille., Phillips, Clive 2019, Do behaviour assessments in shelter predict the behaviour of dogs post-adoption? *Animals*, vol. 10, pp. 1225

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Submitted manuscripts included in this thesis

All manuscripts contained in this thesis have been published.

Contributions by others to the thesis

I acknowledge that my current advisory team comprising Professor Clive Phillips, Dr. Mandy Paterson, Dr. Gaille Perry, and Professor Pauleen Bennett contributed to the conceptualisation and design of this project. I would like to acknowledge the contribution of RSPCA and Renee Harris with data for Chapter 4 and 5. There were no other significant contributions to data entry, data analysis or drafting written material. All advisors had the opportunity to peruse and comment on chapter drafts.

Statement of parts of the thesis submitted to qualify for the award of another degree

No works submitted towards another degree have been included in this thesis.

Research Involving Human or Animal Subjects

All research pertaining to this thesis and the publications within it were approved by the University of Queensland Human and Animal Ethics Committee as seen below. Please find the project ethical approval letter contained in the appendix of this thesis.

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Dedications

This thesis PhD thesis is dedicated to the author's parents, loved ones, family and the ones no longer with us (Grandad, Nana, Pop), for their moral and unwavering support, guidance, and love through the good and bad times. Finally, to my godfather, Michael, I cherished the past year, countless games of 500, your endless support, and you putting up with my endless writing. I hope they are taking care of you up there, miss you mate.

"Remember that wherever your heart is, there you will find your treasure"

— Paulo Coelho, The Alchemist

Table of Contents

List of Tables

List of Figures

Abbreviations/Glossary

Aggression: Aggression in dogs is defined as an action that functions to threaten or harm its recipient (Archer, 1976, Horwitz, 2018).

Anxiety: Reponses to the anticipation of prospective or imagined danger or uncertainty (Ledoux, 2007, Sherman, Mills 2008)

Appeasement: Behaviour that serves to inhibit or reduce aggression between members of the same species, in situations where escape is impossible or disadvantageous (Mills et al, 2010).

Arousal: A state in which the animal is in a state of wakefulness, ranging from drowsy to very alert. It may be measured by responsiveness to standard stimuli or by the electrical activity of the brain (Mills et al, 2010).

B.A.R.K: Behaviour assessment for re-homing K9's (Mornement, 2014)

Behavioural Cue: micro action, described at the limb level, or a micro movement such as facial expression or head movement (Mcfarland, 2006).

Behavioural event: Behavioural Patterns of relatively short duration, such as a discrete body movement or vocalizations, which can be approximated as points in time. The salient features of events are their frequency of occurrence. E.g. number of times a dog barks in a 1 minute would be a measure of the frequency of a behavioural event (Mcfarland, 2006).

Behavioural State: Behavioural Patterns of relatively long durations, such as prolonged activities, body postures or proximity measures. The salient features of states are their durations (mean or total durations, or the proportion of time spent performing the activity). E.g. total time a dog spends sleeping in a 24 hour period would be a measure of the total duration of a state (Mcfarland, 2006).

C-BARQ: Canine Behaviour assessment and research questionnaire (Serpell and Hsu, 2005)

Context: the apparent function of the behaviour exhibited; i.e. all predator avoidance behaviours fall into one context regardless of other factors (Mcfarland, 2006).

Fear: State of alarm and agitation caused by a present or threatened danger (Ledoux, 2007, Sherman and Mills, 2008).

Motives: the desires or drivers that compel an individual to exhibit goal-oriented behaviour, which influence the expression of personality traits (Mcfarland, 2006).

Motivation: A reversible aspect of the animal's state that plays a causal role in behaviour. Changes in behaviour in an unchanging environment may be due to irreversible processes such as learning, maturation, injury, or reversible motivational processes (Mcfarland, 2006).

Personality: The measurable result of temperament and environment interactions (Mcfarland, 2006).

Phobia: A fear response that is persistent, maladaptive and out of proportion to the situation/stimulus (Sherman and Mills, 2008).

SAFER: Safety Assessment For Evaluating Rehoming (Weiss, 2007).

SAB: Socially Acceptable Behaviour (Planta et al., 2007)

Systematic desensitisation: Graduated exposure techniques originating from human behaviour treatment for anxieties, fears and phobia, where the graduated exposure is typically coupled with muscle relaxation techniques to replace the fear response with relaxed response (Butler et al., 2011; Cooper et al., 2007)

Temperament: the stable, inherent, and early appearing behavioural tendencies of an individual (Seiferle, 1972).

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Chapter 1: Introduction

"We are too young to realise that certain things are impossible, so we will do them anyway"
     William Wilberforce

Overview

The purpose of this research was to investigate canine behaviour assessments that are currently used at the Royal Society for the Prevention of Cruelty to Animals, Queensland (RSPCA Qld).

In Australia, according to 2019 statistics, there is currently an estimated 5.1 million pet dogs, with major breeds being Labrador Retrievers, Border Collies, German Shepherds, Staffordshire Bull Terriers, Chihuahuas and Golden Retrievers (Animal Medicines Australia, 2019). Despite the strong bond which often develops over time between the human owner of the dog and the dog itself, countless dogs are surrendered to shelters or abandoned. In RSPCA Australia between 2018 – 2019, a total of 33,863 dogs were received of which, 2, 906 dogs were euthanized due to behavioural problems (RSPCA, 2019).

Shelter organisations have implemented behavioural assessments with the aim of screening for behavioural problems and identifying adoption suitability. With the current attitudes towards behaviour assessments around the world, especially in the USA, the use of assessments in shelters to identify behaviour, behavioural problems and adoption suitability is being questioned (Patronek and Bradley 2016). However, in Australia behaviour assessments are still generally used as one tool in conjunction with numerous other information gathering instruments to build a behavioural profile of shelter dogs.

Current RSPCA Qld. assessment protocols are similar to assessments used around the world that include B.A.R.K, Match up II, and SAFER (Marder et al. 2013, Mornement et al. 2014, Weiss 2007). However, differences are seen with the scoring methods used, timing of tests, and experience levels of staff conducting the assessments. At this point in time, the current concerns are how effective and efficient procedures used at the RSPCA Qld are. It is crucial to improve standard procedures that are currently used in evaluating whether dogs are suitable for adoption, and helping to identify dogs that require training before adoption. Nevertheless, there are many limitations that are associated with behaviour assessments in shelters. Often these limitations are associated with the numerous different breeds, ages, rearing, socialisation, previous home environment, and management of stressors in the shelter. Despite these limitations, it is vital that more studies are

conducted to identify the best way to conduct assessments, and make them more efficient and effective for shelters to use to create a better behavioural profile of surrendered or stray dogs.

Research aims

My thesis presents research which explores one canine behaviour assessment that is currently used in RSPCA Qld shelters, including an examination of how well the behaviour assessment reflects the behaviour reported in the previous home environment, and how well it predicts future behaviour in the shelter and post adoption. The focus is particularly on outlining the positive application of such assessments. The overall aim was to provide knowledge that could be used to improve the RSPCA Qld shelter Behaviour Assessment, and to develop a more effective and efficient way to conduct the assessment of shelter dogs and match them to potential owners.

My research aims are:

Aim 1: Collate and review the published literature to determine the current knowledge behind behaviour assessments, their ability to predict behaviour in shelter and outlining their positive applications (Chapter 1 and 2).

Aim 2: Understand if the manifestation of behaviour problems found in behaviour assessments can be identified in in-kennel behaviour during the first five days of shelter acclimation (Chapter 3).

Aim 3: Understand if the behaviour displayed in behaviour assessment tests accurately reflects the behaviour displayed in the home environment (Chapter 4).

Aim 4: Compare behaviour assessment sub-tests to recognise whether there are behavioural similarities in dog's response to each subtest (Chapter 5).

Aim 5: Suggest improvements to behaviour assessments to increase the predictability of assessment based on home information (Chapter 6).

Structure of thesis

My thesis is comprised of an introduction chapter, two review chapters, four data-based chapters and a discussion and conclusion chapter.

Chapter 1: Provides background information specific to my research focus (behaviour assessments at RSPCA Qld.), the research aims, study design, and the current literature on canine behaviour and behavioural problems.

Chapter 2: Explores the benefits and positive applications of the use of behaviour assessments. This review chapter is currently published as 'Clay, L., Paterson, M., Bennett, P., Perry, G., Rohlf, V.,

Phillips, C.J.C., 2020, In Defense of Canine Behavioral Assessments in Shelters: Outlining Their Positive Applications, *Journal of Veterinary Behavior*, vol. 38 , pp 74 - 81.

Chapter 3: Compares in-kennel behaviour in the first five days to the results of behaviour assessment tests to understand if this data can provide information on the dog's stable behavioural repertoire and/or predict behavioural problems. This data-based chapter has been published (Clay, L., Paterson, M., Bennett, P., Perry, G., Phillips, C. 2019, Early recognition of behaviour problems in shelter dogs by monitoring them in their kennels after admission to a shelter, *Animals*, vol. 9, pp. 875).

Chapter 4: Compares post-adoption survey information of adopted dogs against the results of behaviour assessment tests to assess how well post-adoption behaviour and/or behavioural problems were predicted by the shelter assessment. This data-based chapter has been published (Clay, L., Paterson, M., Bennett, P., Perry, G., Phillips, C. 2019, Do behaviour assessments in shelter predict the behaviour of dogs post-adoption?, *Animals*, vol. 10, pp. 1225).

Chapter 5: Compares the results of the behaviour assessment tests to identify if the information is a valid representation of the designated purpose of each test, as well as if behaviour patterns are repeated across various tests therefore making some tests or repeats redundant.

Chapter 6: Compares dog behaviour reported by owners and the results of an assessment using RSPCA Qld assessment protocol. This data-based chapter has been published (Clay, L., Paterson, M., Bennett, P., Perry, G., Phillips, C. 2019, Comparison of Canine behaviour scored using a Shelter behaviour assessment and an owner completed questionnaire, C-BARQ, *Animals*, vol. 10, pp. 1797).

Chapter 7: Discusses how the project aims were achieved and the overall results. The importance of the research findings are highlighted and future research ideas are proposed.

Review of Literature

"It is the true duty of every man to promote the happiness of his fellow creatures to the utmost of his power"   William Wilberforce

The relationship between dogs and humans has strengthened over thousands of years (Morey, 2006) through domestication and the development of strong social bonds between the two species (Crawford et al. 2006). As knowledge and literature expand on these social bonds, it is important to further understand what humans seek in a companion dog. This improved knowledge can assist to further understand the reasons for the surrender of dogs to shelters and what behaviours make dogs attractive and suitable for adoption.

Despite the strong bond which often develops between people and their dogs, countless dogs are surrendered to shelters or abandoned across the world (Mornement et al. 2010). In Australia, dogs are relinquished daily to shelters such as the Royal Society for the Prevention of Cruelty to Animals (RSPCA), one of the main animal welfare organisations in Australia. In the 2018- 2019 reporting period, RSPCA Australia-wide received 33, 863 dogs, 27.27% of the total number of animals (all species) received in a year (RSPCA, 2019). Of these, 38.71% were re-claimed, 38.01% re-homed, 5.73% currently in care, and 12.72% euthanised. Interestingly, dog intake per year has decreased over the past 5 years (2014 – 2019) by 15.94%, with the numbers of re-claimed/re-homed rising and euthanasia decreasing (RSPCA, 2019). Nevertheless, the surrender of dogs to shelters remains a concern due to the pressure on animal welfare organisations in terms of shelter capacity, resources, and euthanasia and live release rates.

The reasons for owners surrendering their companions to shelters can include housing suitability, cost of care, problem behaviours and family issues (Bennett & Mornement 2009). However, behavioural problems are the most frequently reported reasons for relinquishment of domestic dogs (Bennett et al. 2012, 2015; Bollen & Horowitz 2008, Diesel et al. 2008), and is the leading reason for euthanasia at the RSPCA in Australia (RSPCA, 2016). Some of the problem behaviours cited, such as jumping or excessive digging, can be managed through training and alone are not a reason for euthanasia. Dogs that display severe behavioural problems (e.g. categories of aggression, fear and separation related issues) are an area of focus for most shelters due to the high intake of such dogs, and the ability of the shelter environment to exacerbate these issues. Even if shelters have useful resources available, i.e. behaviour modification programs to help such dogs, the dogs face a range of environmental variables (e.g. excess auditory and olfactory stimuli, changed sleeping arrangements and change in daily routines) that can have negative effects.

Shelter organisations have implemented behaviour assessments with the aim of screening for behavioural problems and identifying adoption suitability. However, these assessment methods have been highlighted by some academics who have questioned whether they serve any purpose due to the false positives and false negatives in the once off use of an assessment (Patronek & Bradley 2016). It has been argued elsewhere that behaviour assessments are used to identify adoption suitability and behavioural problems, assist in decreasing time in the shelter, and aid in monitoring dogs in a highly novel environment (Mornement et al. 2014). However, due to testing procedures that focus strictly on a pass/fail outcome, some of the results are not always accurate, thus causing a single negative perception of all testing procedures. To fully comprehend any behaviour testing procedure, it is necessary to understand the environment in which the assessment is performed, the previous home environment, any genetic predisposition, previous experiences (positive or negative), and the results displayed on the testing day. These combined factors will all give insight into the potential temperament and normal behaviour repertoire of the dog.

The focus of this review is to understand the role that canine behaviour assessments have in assessing the predictability of behaviour and adoption suitability of surrendered dogs. Furthermore, the review will focus on developing an understanding of the impact of shelter environments on behaviour, and the tools used to identify, monitor and aid in the combat of behavioural problems. The theoretical approach focuses on the predictability of behaviour, personality theory, and affective neuroscience.

Shelter environments

Shelters, such as those operated by the RSPCA, are at the forefront of developing strategies to improve companion animal welfare. Their role, as a non-profit organisation, focuses on welfare and re-homing animals that have been either surrendered, abandoned or neglected (Part et al. 2014). The capacity of shelters is limited and therefore, the intake of animals is dependent on the shelter's resources (Mornement, 2010). Dogs are one of the main companion animals relinquished to shelters for the many reasons mentioned previously. Data collected from previous owners can help to understand the dog and its suitability for re-homing.

Shelters strive to decrease euthanasia rates by increasing adoption whilst maintaining and improving welfare standards. However, due to shelter capacity and resource issues, negative stress can lead to the manifestation and/or exacerbation of behavioural problems (Hennessy, 2013). Shelters must first understand the novel experience the environment represents to individual dogs and how it differs from previous, usually, stable housing. Upon-surrender to a shelter, dogs encounter a form of social isolation due to the impact of environmental variables and the fracture of the bond that existed with the past owner (Hennessy et al. 2006). This dramatic change can have negative effects on the dogs' behaviour tendencies (Hubrecht, 1998).

These negative effects can lead to an acute stress response for dogs once surrendered to the novel environment. Part et al. (2014) demonstrated that cortisol levels, as an indication of stress, were significantly higher in dogs that were kennelled compared to a home environment. Furthermore, Hennessy et al. (1997) showed that cortisol levels in plasma and saliva were highest in dogs in the first three days after relinquishment. Tuber et al. (1996) reported a significant rise in cortisol levels in dogs placed into a novel environment alone compared with those that were paired housed. These findings show the tremendous stress that a novel environment can have on a social species.

RSPCA assessment of behaviour

In all RSPCA shelters, a behaviour assessment is used to determine whether a dog is suitable for adoption, and in addition, to optimise the match between potential adoptee and dog (Mornement et al. 2014). Furthermore, the assessment identifies specific behaviours that society deems negative or unacceptable, but which may respond to behaviour modification programs.

In the quest to understand dogs relinquished to the RSPCA, shelters implement more than just a single behaviour assessment to ascertain the behaviour of the dog. Upon surrender, a previous owner questionnaire provides some insight into the dog's behavioural tendencies in the home (Mornement et al. 2014). It can identify any problems associated with the dog, and reasons for

surrender that can be as simple as housing suitability, cost of care, and family issues (Bennett & Rohlf, 2006).

Immediately after surrender, medical evaluations are performed to diagnose any illness that may affect the dog's health, well-being, welfare, and behaviour. During the medical examination, behaviours shown when handled and tolerance to any non-invasive medical procedures are observed. Considering contexts that may elicit an adverse stimulus to the dog, such as veterinary exams, allows shelters to monitor situations and implement training methods to combat problems. Thereafter, dogs are placed into a kennel to acclimate for a period of 3 days (Mornement et al. 2015). Concurrently, during acclimation, dogs are evaluated during daily interactions with people and other dogs in the kennel, and on walks through the facility. As a result, shelter and behaviour staff are able to monitor any prominent issues that arise which may indicate acute stress (Bowman et al. 2015). Once acclimated, the behaviour assessment is conducted using 12 sub-tests, providing insight into the dog's responses to various stimuli (e.g. response to novel stimulus, stranger interactions, handling tolerance). For instance, the dog's behavioural repertoire includes social behaviour, level of arousal or anxiety under diverse stimuli, handling tolerance, and/or signs of fear or aggression. The results are discussed within the behaviour team, issues are identified, and behaviour modification programs are designed, thus giving dogs the best opportunity to adapt.

As outlined in the previous section the use of the behaviour assessment in shelters has evolved from previous paradigms to examine future behavioural problems and move beyond a simple pass/fail outcome. Shelters such as the RSPCA use multiple tools and tests to gain insight into the suitability of dogs for adoption and the existence of possible behavioural issues. If shelters can construct sustainable tools to monitor behaviour over time, it will allow for early recognition of behavioural problems and a decrease in euthanasia rates.

Evaluating the Behavioural Assessment

The RSPCA Qld. behaviour assessment protocol is just one of many existing tools, all of which differ in individual ways, but have a common goal, which is to understand and predict dogs' behaviour. Knowledge of a dog's behavioural tendencies can give valuable insight into issues that may cause people to hesitate when adopting. Identifying behaviour and character traits using the assessment can streamline the process for dogs immediately suitable for adoption, identify problems and help to find solutions. To understand a behaviour assessment, such as the one used at the RSPCA, it is necessary to first break it down into the methodology and tests applied.

The methodology used in the assessment can vary depending on the intended users and desired goal. For instance, Mornement et al. (2014) developed a standardised shelter behaviour assessment (B.A.R.K) for use in shelters across Australia to identify dog's suitability to be rehomed. The B.A.R.K protocol uses tests to identify behavioural cues using duration and frequency methods, categorised into behavioural states. In comparison, the goal of the C-BARQ assessment, developed by Hsu and Serpell (2010), is to measure behaviour and behavioural problems in pet dogs using owner questionnaires. The C-BARQ uses a question-based survey for owners, collating the information on a scaling system that focuses on behavioural categories. These testing procedures use either a qualitative or quantitative methodology.

Qualitative and/or quantitative assessments are used throughout shelter organisations, either in the form of a behaviour assessment in the shelter or a behaviour questionnaire for previous owners, or both. An example of a quantitative assessment is the B.A.R.K. protocol which focuses on the objective measure of behaviour, i.e., whether a behaviour is present or absent. Other studies that use similar methodology include the Canine Behaviour Assessment Research Questionnaire (C-BARQ), Modified Assess A Pet (mAAP), Match-up II, and finally the Safer Assessment for Evaluating Rehoming (Hsu and Sepell 2010, Marder et al. 2003, Sternberg 2004, Weiss 2007). The methodological approach used can vary from a scale of the behaviours displayed, a single behaviour cue, or a behavioural description (Mornement et al. 2015). The results are then categorised by behavioural and emotional traits, for example, fear, aggression, anxiety, compliance/trainability, friendliness, and activity/excitability. Quantitative protocols can be either thorough or broad, dependent on the goal of the test.

Tests

Behaviour assessment includes individual tests which give insights into how dogs react to novel stimuli, whether to replicate everyday home encounters or a one-off reaction to a negative stimulus (Mornement et al. 2010). However, behaviours displayed by a dog can be highly variable over time due to the underlining effects of motivation, required mental needs, previously learnt processes, and current environment (Ley et al. 2008). Nevertheless, the tests provide evidence of how the dog may react at any point during its life to a stressful situation.

The number of tests in any behaviour assessment can vary dramatically, ranging from 5 to 64. The purpose of each sub-test is to assist in the understanding of the dog's behavioural traits by implementing specific stimuli. These tests can include, aggression towards dogs and other species; resource guarding of food, toys, or other objects; tolerance when handled; ability to cope with a high sensory over-load environment; reaction to novel stimuli; play interactions; arousal; and separation anxiety (Bennett, 2015, Mornement, 2014, Weiss 2007). Further, each behaviour can be categorised into behavioural and emotional traits: Aggression, Fearfulness, Sociability, Arousal, and Friendliness (Haverbeke et al. 2009). These traits are normally categorised by a scaling system, using behavioural cues or a brief behavioural description. Understanding the quantitative methods helps to define the intended use of the stimuli and behaviours that each sub-test measures.

Character traits and behaviour problems in dogs identified in shelter

Fear

Fear is an aversive emotional state consisting of psychological and psychophysiological responses to an external threat or danger that is perceived as real by the fearful individual (Ledoux, 2007). The use of all tests in the behaviour assessment gives insight into behavioural problems associated with fear towards new environments, people, novel stimulus, handling and animals. These tests have been used in numerous behaviour assessments and questionnaires in the literature (Dalla Villa, 2017, De meester et al. 2011, Ley 2008, Marder 2013, Planta et al. 2007, Serpel, 2001, Van der berg 1991).

Fear can be classified based on the specific stimulus that invokes it which can be related to people, places, social situations, objects, and noise. For ease throughout the thesis, I classify fear into four categories: fear of people, animals, noises and places.

Fear of people: fear can be shown towards a particular person, all unfamiliar people, or a type of person (e.g. children, babies, people in uniforms, different appearances, disable individuals, gender).

Fear of animals: fear can be shown towards animals, either of the same species or of other species. Fear related to other animals is dependent on how the dog was socialised and what type of experiences occurred during the socialisation period.

Fear of places: fear can be shown in specific locations and surfaces, in similar ways that they can be with people, animals or noises. Places can include veterinary clinics, cars, crates, confined rooms, neighbourhoods, parks, particular environments or surfaces.

Noise sensitivity: Sensitivity to noises is a common occurrence in dogs and can affect 40-50% of dogs (Appleby et al, 2002, Storengen et al., 2014). It is a fear response that is persistent, maladaptive and out of proportion to the situation and/stimulus. Common noises that create a fear reaction can occur from storms, fireworks, engines, banging of doors, vacuum cleaners, and gun shots (Iimura, 2006).

Fear related to people, animals, places and objects can elicit emotional, psychological and physiological responses (Dietz et al, 2019, Horwitz, 2018, Puurunen et al, 2020). Fear of people can manifest at a young age between (6-12 months) or at the onset of social maturity (12-36 months), which suggests development, environmental, and or/genetic components (Dietz et al, 2019, Horwitz, 2018, Puurunen et al, 2020). Furthermore, there are other aspects that influence fear behaviours: genetic temperament, lack of exposure to a variety of locations, objects , and/or people

during the socialisation period (6-14 weeks), minimal positive exposures, and lack of learning through negative experiences (Dietz et al, 2019, Horwitz, 2018, Puurunen et al, 2020).

Fear in dogs has been discussed as the most predictable emotion due to its prominent behavioural cues and neurological pathway (Mornement et al. 2015). In a study by Mornement and co-authors (2015), fear measured in the B.A.R.K protocol with strangers, noises/objects and other dogs significantly predicted fearful/inappropriate toileting behaviours post adoption in the home environment. In addition, a study into the use of the RSPCA Qld. shelter assessment found that behaviour towards a novel stimulus and movement correlated both in shelter and in home environments (Poulsen et al. 2010). Furthermore, a study by van der Borg et al. (2010) suggested that fear may be a stronger, more stable behaviour compared to other categories like aggression.

Anxiety

Anxiety is the anticipation of future danger from unknown or imagined origins that results in psychological or physiological reactions associated with fear (Dias et al. 2013, Dietz et al, 2019, Mehrabian and Epstein 1972, Horwitz 2018, Ohman 2001). Anxiety may occur in the aftermath of a fear-eliciting event or as a result of unrelated environmental changes that are unpredictable. However, anxiety can occur in response to a specific trigger, or it may be generalised (Blackwell et al., 2013, Dietz et al, 2019, Horwitz 2018, Overall et al. 2001).

Anxiety in response to a specific trigger: Anxiety will occur due to a previous known interaction (conditioned response) that will create anxiety-based reactions upon seeing the conditioned trigger. More so, the trigger can be related to an object, item, specific place that the first anxiety response occurred, which in future can trigger the reaction (Ledoux, 2007). Identification of anxiety manifested from a specific trigger is difficult in shelters due to the multifactorial nature of the problem. Furthermore, anxiety due to a specific trigger can, over time manifest as general anxiety (Ohl et al., 2008).

General anxiety: This will occur in all situations without known triggers creating a state of general anxiety in everyday situations. Behaviours associated with general anxiety include: hypervigilance, scanning, pacing, trembling, repetitive activity, avoidance tension and possible aggression (Horwitz 2018, Ohl et al., 2008, Sherman and Mills 2008). Behaviour assessments are able to identify general anxiety during the conduct of the tests.

Separation Anxiety

Separation anxiety in dogs is the second most common behavioural problem in pets and is defined as distress in the absence of an attachment figure (Takeuchi et al. 2000). The problem itself can be a

major issue and very difficult to treat, with countless factors predisposing certain dogs to develop this behavioural problem. These factors include extended time with the owner without acclimating to time alone, shelter or kennelling, movement of the family to a new environment, or loss of another bonded pet (Sherman & Mills 2008).

The identification of behaviours associated with separation anxiety can aid in its diagnosis. Behaviours associated with separation anxiety include destructive behaviour, depression or inactivity, overactivity, self-injury, inappropriate urination/defecation, and vocalization occurring in the absence of the owner (King et al. 2000, Ogata 2016, Sherman & Mills 2008). Furthermore, behaviours associated with anxiety in the dog are seen, including increased activity level, salivation, vocalisation, and panting. From an owner's perspective, these can be undesirable, costly, and damaging to the bond between the owner and dog (Ogata 2016). Moreover, it could lead to the surrender of the dog to a shelter (Diesel et al. 2008, Miller et al. 1996).

The surrender of a dog to a shelter can be a form of social isolation that can lead to acute stress responses and anxiety. Therefore, to identify and monitor separation anxiety is vital while the dogs are in shelter care, especially during extended periods in the shelter (Palestrini et al. 2010). A time alone test gives insight into this common behavioural problem found in shelters (Ley 2009, Marder 2013, Mornement 2015, Storengen et al. 2014). The testing procedure involves placing the dog alone in a room for a pre-determined period of time. The dog is video recorded and monitored during this period to understand how the dog copes with separation from handlers (simulating owners).

A previous study conducted by Konok et al. (2011) outlined the use of video analysis tests for the diagnosis of separation anxiety, coupled with owner questionnaires. The authors found that dogs rated by their owners as anxious during separation and "happier" during the reunion showed higher activity levels and stress-related behavioural cues during separation and elevated affection once the owner returned when compared to dogs rated by their owners as not suffering separation anxiety. The results demonstrate that owners have a realistic perception of their own dog's separation anxiety and furthermore, the effective use of a separation-related behaviour assessment.

In a similar study, Mornement et al. (2014) argue that the time alone sub-test can reliably indicate anxiety and fear, demonstrated with re-testing and inter-rater reliability. Other behaviour assessment testing procedures, such as the C-BARQ protocol, outline the ability to distinguish separation-related problems using questionnaire procedures with owners (Tamimi et al. 2015). These studies confirm the ability of a testing procedure and questionnaire to successfully identify separation anxiety.

Aggression

Aggression in dogs is defined as an action that functions to threaten or harm its recipient (Balint et al, 2017, Horwitz, 2018, Lockwood, 1995). Aggression can be classified into two different categories. Non-affective aggression is associated with non-emotional behaviours, while affective aggression involves an emotional response that needs to be targeted towards the perceived source of the distress, but may be displaced onto other people or objects if the disturbing agent cannot be attacked (Horwits 2018, Lockwood, 1995, Lueschser 2008). There are also numerous other ways of classifying aggression. One useful way considers aggression to be either offensive or defensive. A broad definition of offensive aggression is classified as the intent to cause harm to another object or species (Luescher & Reisner 2008). Behavioural indicators of offensive aggression are body weight and ears forward, snarling, vertical lip retraction, displayed teeth, and unprovoked attack (Planta 2007). On the other hand, defensive aggression towards a stimulus is caused by fear, and behaviours displayed can be body weight and ears back, paw lifting, snarling, horizontal lip retraction, tail low, or tucked (Luescher and Reisner 2008).

A further classification depends on diagnostic categories or classified by targets (Horwitz 2018, Stelow, 2018). Categories of aggression can include: fear-induced, possessive aggression, conflict-related, territorial, predatory behaviour, play-related, pain-induced, maternal, and redirected.

Fear-induced: Fear related aggression is triggered by a stimulus that can appear threatening to the dog and is intended to increase the distance between the dog and the perceived threat. Fear can often be the underlying factor in many forms of aggression, therefore it is not always maladaptive or abnormal. Fear-inducing stimuli can include cars, trucks, unfamiliar objects, dogs or people, and result in an aggressive response.

Possessive aggression: This refers to aggressive behaviours exhibited when a dog is in proximity to something it perceives as valuable (Horwitz 2018, Jacob et al., 2018). Valuable resources can include toys, bones, other food-related items, resting places, and particular people. The behaviour can be directed towards humans or other pets in the home environment or outside the home and can be a component of a broader type of aggression.

Conflict-related: Conflict-related aggression refers to the behaviours seen when there are competing states of motivation and where there is a build-up of frustration over the inability to perform desired behaviours. Therefore, if behaviours manifest they can lead the dog to display aggression. Individuals that display this aggression can often be dogs that are fearful or anxious (Landsberg et al., 2013).

Territorial and protective: Territorial aggression is defined by its target, target behaviours, and location. The behaviour is manifested in the environment of the dog, and can include the home, garden, cars, and is directed towards a target such as an unfamiliar person or animal that is approaching or entering the area. Whereas, protective related aggression is elicited by the presence of a pet and/or family member that the animal is protecting (Landsberg et al., 2013).

Predatory Behaviour: This refers to the action of dogs when they chase small animals such as rabbits, cats or small dogs (Blackwell 1991; Christensen et al., 2007; Miklosi 2014). Clinically, it refers to the sequence of behaviours that are associated with the catching and killing of another animal for consumption (Horwitz, 2019). The sequence of behaviours can include: orient, eye, stalk, chase, grab-bite, kill-bite, dissect, and consume (Coppinger and Coppinger 2002, Coppinger and Feinstein 2015).

Play-related: This behaviour refers to normal behaviour in young dogs and is accompanied by playful postures and behaviours. A large portion of canine play involves aggressive behaviours, such as growling, biting, bumping and attacking (Landsberg et al., 2013).

Redirected: This refers to aggressive behaviours that are directed to a person or object that is not the stimulus associated with the aggressive response. It can arise due to manifestation of frustration, different forms of aggressions, or hyperactivity (Landsberg et al., 2013).

Pain-induced: This type of aggression refers to aggression which is directly related to experiencing pain and is very commonly exhibited in veterinary clinics (Landsberg et al., 2013).

Maternal: Maternal aggression refers to aggression that is directed towards people or other animals by a bitch with her puppies. The response is an instinctual behaviour to protect, and can vary in intensity between individual animals (Landsberg et al., 2013).

Further, aggression can be classified by target: aggression toward familiar people, aggression toward unfamiliar people, aggression toward familiar animals, and aggression toward unfamiliar animals (Balint et al, 2017, Horwitz, 2018, Lockwood, 1995, Stelow, 2018)

Possessive aggression (resource guarding)

The guarding of resources (RG)/food guarding (FA+) is a high priority issue for shelters to identify as it is thought to be associated with other forms of aggression that may impact the safety of shelter staff and the public. Aggression towards people over food-related items is a common behavioural problem reported by pet owners and dog behaviour professionals (Duffy et al. 2008, Guy et al. 2001, 2008; Mcgreevy 2008). In the sub-test used to identify resource guarding behaviour, a dog is

given a food-related item such as a bowl of food, a bone, or a pig's ear. Thereafter, the handler approaches and touches the dog with a rubber hand, moving it along the body towards the item to determine if behavioural cues are displayed that are deemed food aggressive (Marder et al. 2013). Such behavioural testing procedures are incorporated into most assessments as the behaviour is considered dangerous and associated with other forms of serious aggressive problems. One major problem associated with resource guarding is the inability of young children to anticipate the danger when interacting with dogs while they are eating, and even more important is their inability to understand the subtle behavioural cues displayed as warning signs. Due to this, children are at a greater risk of serious harm if such a behavioural problem is present in the home (Reisner et al. 2007).

The tests used in shelters for resource guarding have been shown to be inconclusive with a number of false positives and false negatives recorded. Dogs offered for adoption that have shown signs of resource guarding are adopted under strict conditions that could include only going to a home with no children, an owner with experience in handling dogs, or requiring the owner and dog to attend training classes. Due to such restrictions, these dogs become at greater risk of longer periods in shelters due to a decreased chance of finding a suitable adopter. Under extreme conditions they are deemed unsuitable for adoption, leading to euthanasia (Patronek et al. 1995). A study conducted by Marder (2013) that used the Match-up II standardised behaviour- assessment for the detection of resource guarding, showed a significant association between the test results and the behaviour after adoption. The results indicated that the likelihood of a positive test prediction (dogs that displayed FA in the shelter and in the home) was 55%, in comparison to the likelihood of a negative test prediction (dogs that did not display FA in shelter and not in the home) that was 78%. Furthermore, the dogs classified as FA + after adoption exhibited the behaviours rarely (93%), whereas 7% were described as FA+ frequently or always (Marder 2013).

Consequently, an online survey by Mohan et al. (2012) of 77 shelters in the USA, outlined that the most common reason for considering dogs unadoptable was aggression over food or non-food items. In comparing both studies, dogs that displayed FA+ in shelter would be deemed unsuitable for adoption, even though the likelihood of the positive test prediction was only 55%. More so, in Mohan et al.'s (2012) survey, 34% of shelters that had FA+ dogs in the population tried to modify the behaviour and placed the dog into adoption, whereas, 51% made no attempt to modify the behaviour or offer the dog for adoption.

Nevertheless, the identification of a behavioural problem such as resource guarding should be thoroughly examined for environmental factors and the extent of behaviour response to the stimuli.

When making a life or death decision based on the behaviour responses a thorough examination must be conducted. A thorough examination of the behaviour responses may give insight into the extent of the behavioural problem.

Stranger or child directed aggression

Aggression towards people, either strangers, toddlers, or family members is another well-known behaviour problem. This is reflected in dog bite statistics in Australia and in specialist clinics around the world (McGreevy & Masters 2008). Gilchrist et al. (2008) found that the estimated dog bites per 1000 people are 15.8 in the USA alone, whereas, in Australia dog-related injuries (a dog bite or being struck by a dog) are estimated at 17 cases per 100,000 people (Australian Institute of Health and Welfare 2017). Nevertheless, the identification of these behaviours is a high priority for shelters for the safety of staff and adopters. Stranger and toddler testing procedures are widely used and are prominent throughout most behaviour assessments. Testing using "real toddlers" has ethical implications and can be very dangerous, therefore, toddler tests use fake toddler dolls (Mornement, 2010, Weiss, 2007).

The purpose of the testing procedures is to identify behavioural traits that could indicate fear or aggression. To predict behaviour that may elicit a fear or aggressive behavioural response allows shelters to determine whether a dog could be offensively aggressive or display intent to cause harm to an individual, stranger, or child. However, there have only been a few studies into the validation of the sub-test to determine its reliability to predict aggression. One such study by Doreen and De Meester (2007) outlined the use of the Socially Acceptable Behaviour (SAB) test, which uses individual tests to identify unacceptable social behaviour and aggressive tendencies. The testing procedures are very similar to behaviour assessments such as SAFER, Match-up, and B.A.R.K. However, differences are seen in the tests used. SAB uses 16 tests to identify whether the behavioural problem of stranger aggression is prominent. The second part of the study focused on the ability of the assessment to predict aggressive biting behaviour towards people (True Positive) in the assessment by follow-up surveys post-adoption. The predictability of the assessment was reported at 81%, meaning that the assessment can predict in a statistically significant way the occurrence of aggressive biting in dogs towards unfamiliar people in the first year after testing (De Meester et al. 2007).

Similarly, Dalla Villa et al. (2017) evaluated whether the SAB testing procedure could be a reliable indicator of aggression and fear in a population of dogs located in Italy. The study compared the findings in the SAB assessment and owner perceptions of the dogs' aggressiveness using the C-BARQ protocol. The results showed that the use of the SAB testing protocol can reliably assess

aggression directed towards unfamiliar people, due to its thoroughness and in-depth screening process and its ability for classification of behavioural problems.

<u>Intraspecific aggression</u>

Intraspecific behaviour testing in shelters can have positive or negative consequences in interactions (Dalla Villa et al. 2017). The negative aspects of intraspecific behaviour testing can be fearful and/or aggressive behaviours that can vary, for example, either in an offensive or defensive state towards a situation. Positive interactions are controlled and supervised play interactions that can increase social tolerance and fulfil social needs in dogs (Byosiere et al., 2018). However, research has shown that play behaviours are widely misinterpreted as aggressive behaviour (Luescher & Reisner 2008).

Behaviour assessments can either use fake dogs or real dogs depending on the capacity and resources of the shelter. The testing procedures involve the slow introduction of an unfamiliar male or female dog from a distance, and with time, gradually decreasing the distance to determine threshold or behavioural reaction (RSPCA, 2016). The Socially Acceptable Behaviour assessment (SAB) is also used for the identification of aggression in dog interactions between unfamiliar dogs. Planta et al. (2007) found that dog owners reported that for some dogs, although there were no signs of biting tendencies to unfamiliar people (232), 2.6% of the dogs had some aggressive tendencies. However, of the owners that indicated that their dogs had biting tendencies (92), only 22.8% showed biting behaviour. The validation study by Dalla Villa et al. (2017) used SAB coupled with C-BARQ assessment and showed that aggressive reactions during the assessment obtained a higher score on the C-BARQ sub-test 'familiar dog aggression', in comparison to dogs that did not show aggressive behavioural cues. However, the sub-test in SAB "Approach to an unfamiliar dog" failed to identify owner-reported aggression in C-BARQ assessment towards unfamiliar dogs. The results may be due to numerous factors triggering aggressive behaviours, such as handler-related, gender choice, or behavioural tendencies of the dog being introduced (Dalla Villa et al. 2017). Furthermore, De Meester et al. (2008, 2011) found an association between posture scores and aggression towards other dogs, showing a highly significant inverse correlation between posture score and aggressive behaviour.

Predatory behaviour

Research into predatory behaviour describes the behaviours as a motor pattern following a sequence of behaviours that include: orient, eye, stalk, chase, grab-bite, kill-bite, dissect, and consume (Coppinger and Coppinger 2002, Coppinger and Feinstein 2015). However, due to selection by humans for traits required to perform specific tasks, certain stages of the sequences of behaviour

can be present, absent or follow a different order in certain breeds (Coppinger and Feinstein 2015). Predatory behaviour is classified as non-affective aggression thereby it differs significantly from other forms of aggression that are performed with intent to intimidate or threaten another entity (Coppinger and Coppinger 2002, Coppinger and Feinstein 2015, Lindsay 2000). Neurologically, stimulation of the lateral hypothalamus and medial forebrain facilitates predatory behaviour, whereas, stimulation of the ventromedial hypothalamus evokes affective aggression (Lindsay 2000).

A study by Christensen et.al. (2007), outlined aggressive behaviours in dogs that had been adopted after passing a temperament test in the USA. The results outlined that in 66 dogs that passed the temperament test, 13.6% (9) displayed signs of predatory aggression. The temperament test used was similar to RSPCA Qld. Protocol, with variations in scoring methodology (Sternberg, 2003). However, interactions were conducted with a cat in a cage and scored using comments (Christensen et al., 2007). Nevertheless, predatory behaviour in dogs is self-rewarding and can never be cured, however, effective management strategies and behaviour modification can help (Howell et al., 2020).

Conclusions

The review of the literature on dog behaviour assessment tests in shelters emphasises the potential value of a number of assessments that use testing procedures for predictability of behaviour. Moreover, the use of these assessments is limited by many variables that are found in a shelter environment, due to the novelty and social isolation that may occur. Currently, the major shelter organization in Queensland, the RSPCA, uses a behaviour assessment to determine the suitability of dogs for adoption. However, research is needed to determine the efficiency and effectiveness of this assessment to develop a more effective and efficient way to conduct the assessment of shelter dogs and match them to potential owners.

Chapter 2: In defence of canine behavioural assessments in shelters: Outlining their positive applications

Contributions: Liam Clay (90%), Mandy Paterson (3%), Pauleen Bennett (2%), Gaille Perry (2%), and Clive Phillips (3%) conceived the project. Liam Clay drafted the paper, reviewed studies, wrote the paper (90%) and all authors had input into modifying it into the present format (10%).

"You have to believe that something different can happen" Will Smith

Abstract

Behavioural assessment of dogs is performed at shelters worldwide, often in an attempt to identify dogs that may have behaviour problems following adoption. However, the assessment components have been shown to have unknown or in some cases limited predictability for exhibition of problems in the new home, with generally good predictability for sociability and friendliness aspects of assessment, but weaker predictability for with problem behaviours. Despite the fact that some components of commonly used assessments have not been shown to be valid particularly with respect to problem behaviours, we believe that they can usefully contribute to an understanding of dogs' behaviours when combined with history from the previous owner, and shelter volunteer and staff observations. Learning about a dog's behaviour may allow the dog to be matched with an adopter's requirements and help the adopter to understand the dog. Some assessments can identify dogs with problem behaviours and these dogs can be directed to a behaviour modification program. If staff are adequately educated and uniform assessments are used across shelters, continual monitoring of behaviour can identify welfare issues and other challenges that may highlight problems within a shelter that contribute to welfare concerns for the dogs. We conclude that shelters should focus on using standard behaviour assessments in conjunction with other tools to improve shelter practices and potentially mitigate behaviour issues.

Introduction

Across Australia, dogs are relinquished daily to shelters for a number of reasons that are similar to other places in the world. These reasons may include owner relocation, management issues, health issues or cost of treatment, and behaviour problems (Salman et al., 2000; Marston et al., 2004; Marston et al., 2005; Bamberger and Houpt, 2006; Mornement et al., 2014; Barnard et al., 2016; Hemy et al., 2017). One role of shelters is to facilitate the release of dogs back into society, which often requires that they help manage some of the issues that resulted in surrender, including behaviour problems. Recognition of behavioural problems is a priority for shelters in Australia, with the major sheltering organisations, including the Royal Society for the Prevention of Cruelty to Animals (which manages approximately 40,000 dogs a year), the Animal Welfare League and the Lost Dogs Home, all conduct routine, standardized canine behaviour assessments (Chua et al., 2017; RSPCA, 2019; The Lost Dogs Home, 2019: AWLA, 2019). Behaviour assessments in Australia, are used to develop a good understanding of the dogs and to identify potential behaviour problems, enabling shelter staff to explore possible solutions for any problem that could influence re-homing ability. Assessments may also help identify dogs that are having difficulty adjusting to the shelter environment (Mornement et al., 2014; Mornement et al., 2015). In Australia there is no legislation concerning qualifications and/or training for people that offer a service in behaviour diagnosis and treatment in companion animals. Shelters therefore typically implement assessments using a team-based approach, with paraprofessionals in the industry identifying problematic behaviour and presenting solutions

The use of behavioral assessments in shelters is common in many developed countries. Van der Borg et al. (1991 first considered whether a standardized behaviour assessment could be used to predict four problem-related behaviours aggression, fear, obedience, and separation anxiety prior to reports by new owners. Van der Borg et al. (1991) found that behaviour testing was a better predictor of behaviour related to aggression towards dogs and disobedience than interviews with shelter staff. Specifically, the test predicted the absence of pulling on lead, aggression towards adults, and separation anxiety better than the staff reported. Despite this early work demonstrating that behavioural assessments can be efficacious, their use has become increasingly controversial. Using a statistical test model and considering only canine aggression, Patronek and Bradley (2016) argued that false positives in an assessment, which they believed to be common, result in dogs being unnecessarily euthanised and, less commonly, that false negatives result in potentially aggressive dogs being placed in the community. They suggest that as a result behavioural assessment should be abandoned.

The aim of this paper is to examine the use of behavioral assessments more broadly, focusing on their potential benefits as one source of information collectively used within the shelter environment to gain a comprehensive understanding of a dog's behaviour.

It is important to acknowledge that the authors agree with Patronek and Bradley (2016) that one test alone is insufficient to make a life or death decision about a dog. In other contexts, where standardized, validated diagnostic tests exist (e.g., fasting blood glucose), concordance on diagnoses is common. Behaviour, however, reflects multiple determinants and, conversely, a single determinant might result in multiple behaviours. Behavioural reactions are influenced by environmental factors, previous experiences and learning, and medical conditions. A dog who reacts to a stimulus in one situation, may not react in another. For example, a dog commonly exhibiting aggressive behaviours might not show this tendency when in an unfamiliar environment. While this precludes use of a single test to predict behaviour, we argue that a standardised assessment protocol allows for multiple tests to provide information about a dog's behaviour, which can then be combined with information collected through other means to provide a comprehensive understanding. Indeed, our view is that there are three distinct reasons to use behavioural assessments:

1) A shelter assessment is made up of many component tests and these together can lead to a better understanding of individual dogs which in turn allows better matching with available adopters (Marder et al., 2013). Dogs displaying unwanted behaviours such as aggression can be further assessed and decisions made about their future in terms of whether to instigate a rehabilitation program for them or to euthanise.

2) In stray dogs cases for which no information is available, assessments allow shelter staff the opportunity to build an understanding of the dog. This information should be contributed to by everyone who interacts with the dog: shelter staff, veterinarians, inspectors, behaviourists, trainers etc. All the information gathered is assessed by the behaviour team leader and improves the understanding of the dog.

3) Staff training, development and professionalisation is essential and can be promoted. Shelters cannot risk rehoming dogs that display dangerous behaviours. If standardised assessments are carried out, however, the shelter, if prosecuted because an adopted dog displays dangerous behaviours, can argue they have followed responsible procedures. Also, staff feel confident that the procedures in place with standardised assessments ensure that the only dogs euthanised on behavioural grounds are those displaying dangerous behaviours

Improving our understanding of individual dogs in order to match them with available adopters or plan appropriate rehabilitation or management strategies

Shelters aim to identify behaviour issues which may influence the adoption suitability of the dog, how it will react in the shelter environment, any remedial help it may need and to optimise the matching procedure with potential adopters (Mornement et al., 2014). Information gained from assessments therefore helps shelters find homes that suit the behaviour of the particular dog (Christensen et al., 2007; Bollen and Horowitz, 2008).

Factors involved in the decision-making process for adopters include the size of the dog, its coat type, appearance, personality, the fact that the dog needs a new home, and its behaviour towards the adopter (Mornement et al., 2015; Weiss et al., 2012). Desirable characteristics that adopters look for in dogs include friendliness towards people and children, calmness, and obedience (King et al., 2009). It is important to be able to identify these desirable characteristics before they are influenced by environmental variables, monitor them while the dog is in the shelter, and incorporate positive training methods to encourage their retention and development. In addition, it is important to identify undesirable characteristics, such as fear related problems, separation related problems, and problems comprising aggression behaviours, and to remediate these where possible. Many studies have found that the most common dog-related reason for surrender involved behavioural concerns (Miller et al., 1996; DiGiacomo et al., 1998; Patronek et al., 1996; Wells et al., 1996; Salman et al., 2000; Bennett and Coleman, 2004; Coe et al., 2014; Hemy et al., 2017). A good description of a dog's behaviour in the shelter and any behaviour concerns revealed at surrender informs the understanding of the dog and aid in the adoption process.

In addition, shelters can be a novel, stressful and socially isolating environment for dogs (Dudley et al., 2015; Hennessy et al., 1997; Polgar et al., 2019; Stephen and Ledger, 2006), depending on neuroplasticity, their life experiences, genetics and learned behaviours. Whilst these cannot be readily understood, learning ability of the dogs can and is important for adaptability to the new home. Tests could be added to the existing suite of behaviour tests.

Each dog can react to the shelter in various ways, either positively or negatively, over extended periods of time (Hewson et al., 2007; Rooney et al., 2007). Extreme negative reactions often are the result of an extended stay in the shelter (Polgar et al., 2019). Shelter staff therefore must monitor both medical and behavioural health (Wells et al., 2002; Hewson et al., 2007; Dalla Villa et al., 2017). For example, staff at the Royal Society for the Prevention of Cruelty to Animals, Queensland (RSPCA Qld), the major animal sheltering organisation in Queensland, Australia, assess dog behaviour shortly after entry to the shelter and monitor daily staff/dog interactions using

shelterbuddy software program, in order to continue to build a picture of the dog's behaviour and character. After the behaviour assessment, appropriate plans are implemented for behavioural rehabilitation if necessary (Figure 1). In the last year at RSPCA Qld, 13% of dogs (1,956) were put on behaviour modification programs (RSPCA, 2018).
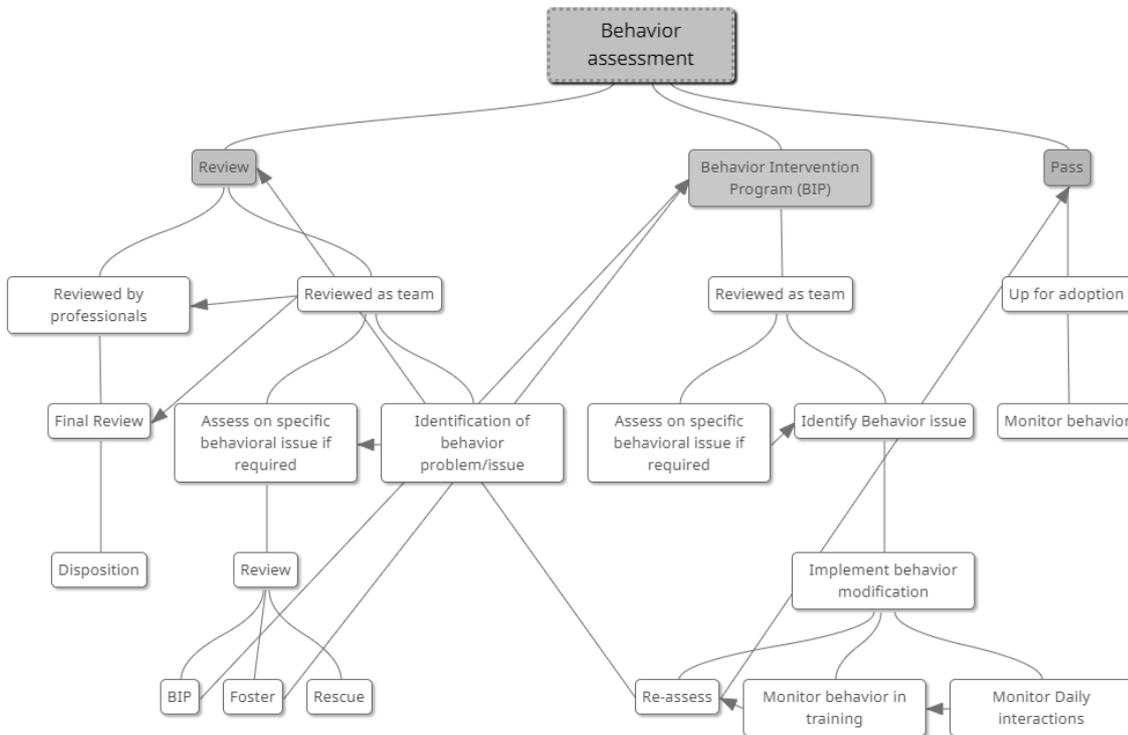
Figure 1: RSPCA Behavior assessment flow diagram

The behaviour assessment is an important step in building an understanding of an individual dog, but it is not the only tool used, with information provided by the owner at relinquishment and by staff and volunteers who care for the dogs also being considered. Few dogs are euthanised on the basis of the assessment alone. In 2015-2016, 13,495 dogs were assessed at RSPCA Qld; euthanasia for behavioural reasons (identified in assessment, reassessment or in the shelter) was only 5.32% or 718 dogs (RSPCA Australia, 2016).

Recently, a study conducted by Goold and Newberry (2017) modelled personality, plasticity, and predictability of behaviour in shelter dogs interacting with unfamiliar people. The results indicate that repeatability increased with days since arrival when accounting for plasticity and personality, highlighting the value of a longitudinal assessment rather than a singular pass/fail test for understanding dog behaviour. In Australia, the RSPCA uses similar longitudinal monitoring of behaviour to aid in a thorough description of the dog's behavioural repertoire by using upon surrender information, staff information of interaction and in kennel behaviour, veterinary check information/notes on behaviour, training monitoring and behaviour assessment data. Behaviour

assessors have a thorough understanding of each test in the assessment so that they build a robust understanding of the dog's behaviour.

Behaviour assessments typically consist of a series of tests that use commonly encountered stimuli to mimic situations that dogs may encounter in a home or that may arise when in a novel environment to identify behavioural responses (Dowling-Guyer et al., 2011; Mornement et al., 2015). While it is acknowledged that it is difficult for a shelter to mimic a home environment, valuable information can still be gained which must be interpreted with this caveat in mind. The tests are used to gauge how a dog could react in situations with potential environmental variability. The situations commonly included and assessed are how the dog explores the room when alone in it, how it interacts with the various people who enter the room, and how it interacts with other dogs in controlled situations (Mornement et al., 2014; Bennett et al., 2015).

Using Bella, a 4-year-old Border Collie cross relinquished to RSPCA Qld, as an example of information that can be collected, the following was recorded. In an exploration of the room she exhibited signs of anxious behaviour but relaxed response towards the stationary handler. Once exploration concluded, she displayed signs of displacement behaviour (Increased lip licking, yawning, shaking, self-grooming) in her tolerance of handling (collar and forelimb/hind limb handling). In a play test scenario, Bella was reported to be eager, focused, and engaged with the handler. However, in a run and freeze test her behaviour returned to anxiety and previous displacement behaviour. This continued in the following test, with an increase in anxious behaviour once an unfamiliar person entered the room carrying a fake-toddler doll. Finally, time alone caused an increase in anxious behaviour, with increased duration and frequency in pacing from door to window, jumping, and barking. The behaviour displayed by Bella indicates signs of anxiousness and fear with novel stimuli but positive behaviours in play situations.

The description of Bella's behaviour is clearly unscientific and includes a mix of observed behaviours and the assessor's interpretations of these behaviours. This is potentially problematic but, when such observations are repeated over time or recorded by experienced personnel, such anecdotes becomes valuable data, which can be subjected to behaviour analysis. While these interpretations may or may not be correct, Bella's assessment did not result in a pass or fail conclusion but a better understanding of the strengths and weaknesses in her behaviour at the time of testing. This information was used to inform remedial training in certain areas that may have hindered her adoptability e.g. anxiousness and fearfulness. The behaviours were slowly reduced using behavioural modification (e.g. systematic desensitization) and no longer identified to be an issue in later testing. Moreover, Bella's behaviour during the assessment allowed her to be paired

with suitable adopters, a calm and quiet family with children (Weiss et al., 2007). This example illustrates the value of a rigorous, consistent, and repeatable assessment to identify and address behavioural issues. If assessments can identify dogs with minimal issues and ideal desired behaviours, it allows these dogs to be fast-tracked to adoption, decreasing their time in the shelter. Subsequently, space and resources to treat problematic dogs are more available for those who need it.

The identification of behavioural problems

A formal assessment can be used to identify behavioural issues in a single context and a single moment in time. The assessment utilised at RSPCA Queensland was developed over more than a decade and involves a number of tests both with and without a handler. In an evaluation of the repeatability of these tests in a relatively small sample of dogs placed in new homes (n = 39), Poulsen et al. (2010) found that dog responses to several tests were correlated between the shelter and the new home. Most highly correlated were tests that did not involve direct contact with a handler – food guarding, reaction to noise and toys, play attempt. Of many dog and environmental variables considered for influences on the test in the shelter, only one, the presence of faeces from a previous dog, had any influence, increasing a dog's chance of passing. This suggests that the test is relatively robust to outside influences and has some predictive value. The information from the assessment at RSPCA Queensland and many other shelters may be added to other longitudinal information to gain a fuller understanding of adoption suitability (Dowling-Guyer et al., 2011; Mornement et al., 2014; Mornement et al., 2015). Even authors reporting poor predictability, such as Mornement et al (2014), typically recommend not that behavioural assessments be ceased, but that they be more carefully designed and used in conjunction with many other sources of information.

Even though there will likely always be false positives and false negatives when predicting behaviour problems using a single assessment test, such as a resource guarding test, some behaviour problems can be identified reasonably reliably. For example, separation-related behaviours are a common cause of surrender of dogs to shelters and a frequent problem after adoption (Wells and Hepper, 2000; Overall et al., 2001; Shore, 2005; Marston and Bennett, 2003; Mondelli et al., 2004; Sherman and Mills, 2008; Hemy et al., 2017). In dogs affected by this problem, signs of distress are exhibited when the dog is away from owners or people in general; including vocalisation, destruction, elimination, drooling, escaping, and depression (Storengen et al., 2014; Ogata, 2016). To test for separation-related behaviours, shelters implement a 'time alone' test during the behaviour assessment, during which dogs are placed in an unfamiliar room alone and observed for a set amount of time (Blackwell et al., 2013). Responses can indicate mild signs of anxiety, hyper-attachment, or severe separation anxiety (Palestrini et al., 2010). During 10 minutes of separation, dogs with separation anxiety spend the majority of the time vocalising, orienting to the environment, panting, and engaging in destructive behaviour (Blackwell et al., 2013). Although barking and orienting to the environment decrease over time, panting increases, demonstrating the onset of fatigue and acute anxiety (Blackwell et al., 2013). While it is not known to what extent the exhibition of these

behaviours during the assessment is predictive of similar behaviours in the home environment, the time-alone component of the test represents a time efficient and low-cost way to identify a dog with separation-related behaviours in the shelter (Blackwell et al., 2013; Konok et al., 2011). This allows available resources to be used to treat the behaviours, a preventative measure which quite possibly increases adoptability and improves the welfare of the dog while it is in the shelter, although it is evident that additional research is required to establish the ecological validity of the test.

A lack of socialisation within or between species can help explain the presence of severe behaviour problems such as aggressive behaviours, or signs fear or anxiety. Displaying signs of aggression is one of the major causes for euthanasia in shelters, but such signs do not represent a simple diagnosis. Aggression can be divided into numerous categories including resource guarding, fear-induced, conflict, territorial, predatory, play, and excitement induced aggression (Luescher and Reisner, 2008). Using various tests can potentially give insight into situation-specific types of aggression, as well as fear or anxiety, which may predict issues in the new home. A study conducted by Planta (2007) used a similar test to the RSPCA's protocol to identify categories of aggressive tendencies in dogs. There was good agreement between the occurrences of aggressive biting behaviour in the initial evaluation and in a second one after a year. A further study by Dalla Villa et al. (2017) validated the protocol by comparing results to a questionnaire protocol (C-BARQ). The results indicated significance in a logistic regression analysis of aggressive tendencies towards unfamiliar people. The diagnosis of the type of aggression displayed by a dog can lead to an appropriate intervention program being designed to help the dog become adoptable. A recent study by Willen et al. (2019) outlined enrichment programs which, when used for fear-induced aggression in shelters dogs increased numbers passing a screening test (SAFER). Although the examples outlined above are not studies conducted in shelters, they provide evidence of the benefit of having owner input and pre-surrender assessment whenever possible.

Another test, resource guarding, can result in immediate euthanasia in some shelters (Luescher and Reisner, 2008). Possessive aggression or food related aggression, sometimes termed resource guarding, may represent aggression towards people over high-value items (which can be food or toys or people) and is tested in shelters using food and toy items. Its aetiology stems from competition for resources and it is influenced by genetics, history, and the various foods available (Mohan-Gibbons et al., 2012;). However, guarding behaviours can also be provoked by other dogs, children, personal space infringement, and specific people (Mohan-Gibbons et al., 2012). At the RSPCA, such a display of aggression in a single test is not a cause for immediate euthanasia. In a study by Marder, et al. (2013) only 11 out of 20 dogs displaying resource guarding in a behaviour assessment displayed it

outside the shelter and, even so, adopters did not deem this to be a problem. Therefore, there is a likelihood of false positives occurring when using the behaviour assessment to predict resource guarding behaviour post adoption, and a likelihood that the impact of the behaviour post adoption will be over-emphasised (Patronek and Bradly, 2016). Nonetheless, resource guarding is an issue for some dogs and it remains worth identifying to help in the management of the dog in the shelter. If identified, steps can be undertaken to assess antecedents of the issue and implement solutions. One simple solution is for new owners to be advised not to take food from the dog and separation of the dog from people during feeding time. A recent study by Mohan-Gibbons, et al. (2018) suggests that shelters that discontinue using the resource guarding test do not increase the risk of bites and other injuries to staff or adopters. Even so, the resource guarding test component should still be used in the assessment as it provides other useful information which may influence the management of the dog in the shelter, the use of a rehabilitation program and what advice is given to new owners. To stop using this test on the basis of one published paper study could be seen as rash.

In summary, shelters or individuals using a one-off assessment should rarely do so to identify whether a dog lives or dies (Goold and Newberry, 2017), any more than behavioural problems in humans should be identified and confirmed in a single consultation by any behaviourist or psychologist. One-off assessments do offer important supporting evidence when conducting longitudinal assessments, which should include daily behaviour monitoring designed to evaluate plasticity of behaviour over an extended time frame.

Lack of resources and information for dogs

Shelters and rescue organisations are typically not-for-profit groups using limited resources to hold and rehome animals. To implement behaviour assessments and ensure appropriate outcomes from the test requires resources that may be limited due to available staff, volunteers, training, shelter capacity, marketing, or behaviour support. Furthermore, by limited resources, there can be time and funding constraints for treating behaviour problems. Shelters are, therefore, frequently forced to make difficult decisions on housing dogs until they can be rehomed or whether behaviour problems warrant euthanasia. Such shelters can use assessments as a basis for understanding a dog's behaviour in the rare situation that no history or background of the dog is available, e.g. a stray. They can also use information gathered in assessments and from other sources (e.g. animal control, veterinary examination or inspectorate reports upon seizure) to determine the behavioral quality of life for dogs (Kiddie and Collins, 2015). A shortage of volunteers, money and trained staff dramatically decreases the quality of dogs' lives in shelters (Wells, 2004; Coppola et al., 2006; Taylor and Mills, 2007a; Taylor and Mills, 2007b; Normando et al., 2009; Kiddie and Collins, 2014; Kiddie and Collins, 2015). Furthermore, confinement over long periods can cause a serious reduction in a dog's quality of life and lead to development of behaviour problems. We encourage use of various foster options rather than long-term housing in shelters. However, when these are not available, the best option may be to identify and address behaviour problems as they arise.

RSPCA uses upon-surrender behaviour surveys to learn about behaviour history (Appendix 1). Training modification programs are implemented to combat behaviour problems, however if problems persist, reassessments are conducted. RSPCA staff continually monitor in-kennel behaviour in the shelter, which allows for an improved understanding of the welfare state of dogs in care (Broom and Johnson, 1993).

The role of behaviour assessments in staff development and professionalisation of the industry

One of the issues in the use of behavioural assessments is not their application per se, but a lack of training of shelter staff in how they should be administered and used. Shelter and rescue organisations need cost-effective ways to increase knowledge and qualifications for behaviour training of staff. Shelter staff require professional training and thorough knowledge of canine assessment tools, behaviour analysis and sampling, training, and comprehension of environmental variables. The current inadequacies create inconsistent results between staff, and difficulties in consistently detecting dogs with behaviour problems. There are ways to improve this; a study by Goold and Newberry (2017) indicated that inter-rater reliability was higher in staff that monitored behaviour in a shelter using colour coding behaviour scaling. However, inter-rater reliability decreased dramatically when staff were asked to describe the dog's underlying characteristics of fear, aggression, anxiety, and friendliness. In a study by Mornement et al. (2014) a behaviour scaling methodical approach produced no improvement in inter-rater reliability of ratings of anxiety and fear in dog-dog interactions, friendly behaviours in handling interactions, and activity levels in resource guarding. Furthermore, these behaviours were weakly correlated and there was a decrease in inter-rater reliability and consistency of behaviour over tests. Thus, further training, in particular in the recognition of emotional states of dogs, is necessary and emphasizes the need for qualified/well trained staff to identify and use assessment properly.

Studies have indicated individual variation in identification of behaviour using quantitative or qualitative analysis. However, each method can, under certain circumstances attains a suitable standard of inter-rater reliability (Jones and Gosling, 2005; Fratkin et al., 2015). In 2015, Fratkin et al. compared specialists and non-experts' ratings in behaviour assessment, and results indicated that minimally trained non-experts in some sub-tests were a viable alternative to experts. However, minimal reliability and validity were found in four sub-tests: chase-receive, mental possession, activity, and excitability. Dog experts interpreted body postures thoroughly in comparison to non-experts, who focused attention on the head (Kujala et al., 2012).

In Australia, professionals are trained in animal behaviour as part of several academic disciplines, including veterinary, psychology, agriculture, zoology and biology. Dog trainers currently only have two recognised certifying bodies, Delta Institute and National Dog Training Federation, and no legislation exists to require formal qualifications. This is relevant here because, if individuals conducting assessments are not properly trained, and/or have no proper qualifications, they are making decisions without appropriate professional oversight. As an example of a solution to this problem, RSPCA Qld use team-based decisions incorporating staff information and behaviour

assessment information collected by trained assessors and veterinary behaviourists, to identify remedial solutions before deciding on euthanasia. Veterinarians and psychologists are governed and regulated by a standard of care and professional ethics with a professional board having oversight. This allows veterinarians to implement assessment tools in shelters and clinics to identify chronic pain and environmental and management factors that may impact the quality of life (Wiseman-Orr et al., 2006; Kiddie and Collins, 2015; Wojciechowska et al., 2005). On the other hand, psychologists use risk assessment tools to provide a probabilistic estimate of violence and re-offending rates in prisoners in the USA, UK and Australia (Fazel et al., 2012).

One avenue that could be explored is to attempt to increase the predictive value of assessments by decreasing error rates. A method has been used for screening risks in airport security which randomly distributes "pseudo-targets" into the screening process with feedback (Wolfe et al., 2007; Lau and Huang, 2010; Wolfe et al., 2013). This method avoids a high miss rate when the presence of a target is very infrequent (low prevalence) (Wolfe et al., 2007; Lau and Huang, 2010; Wolfe et al., 2013). In signal detection terms the prevalence effect can be explained as a criterion shift and not a change in sensitivity (Lau and Huang, 2010; Wolfe et al., 2013; Wolfe et al., 2007). This could potentially decrease the error rates in real-life low prevalence situations, such as an aggressive dog in a shelter assessment. Staff will gain experience that will help to decrease errors. In behaviour assessments, video recordings of aggressive dogs can be reviewed regularly, or dogs can be re-assessed with feedback to all staff, providing staff development and training by professionals.

Acknowledging that a particular assessment may be deficient in any capacity is the first step to finding a solution to the problem. Assessment procedures in any area have varying sensitivity and specificity, and these are often lower in behavioural disciplines, such as psychology, veterinary behaviour, or ethology, than they are in the 'hard' sciences. However, assessments are not thrown away, but, evaluated, reviewed, and continuously reworked to find the best possible way to do the assessment. Behaviours are to some extent repeatable; the behavioural sciences are built upon this established fact. We do need to continually revise assessment procedures and always acknowledge their limitations, but they nonetheless provide information not able to be obtained through any other means. This justifies their continued use.

Protecting staff from prosecution and guilt associated with having to euthanise dogs on behavioural grounds

The behaviour assessment in shelters can also be defended on compassionate grounds. It takes the difficult decision of whether a particular animal should live or be euthanised away from compassionate staff who would otherwise use subjective tools: decisions which can cause major emotional impact in their life. The decision and act of euthanasia commonly falls to animal shelter personnel, with many experiencing stress and strain as a consequence (Reeve et al., 2004; Reeve et al., 2005; Bennett and Rohlf, 2005). The majority of animal shelter workers enter the occupation because of a love of animals (Bennett and Rohlf, 2005) and many are unprepared for the fact that they may be required to kill the very animals that they care for. This can result in a form of moral stress, a particular form of stress resulting from being required to perform actions that are in conflict with personal morals and core values (Crane et al., 2015; Rollin, 2011). Reeve et al. (2004), for example, found that animal shelter workers directly involved in euthanasia had greater levels of general job stress, work-to-family conflict and less job satisfaction compared to those who had no involvement in euthanasia. Rohlf and Bennett (2005) also found that participation in euthanasia is linked to traumatic stress symptoms, including intrusive thoughts and memories associated with euthanasia and avoidance of reminders. The presentation of euthanasia related traumatic stress has been referred to as perpetration-induced traumatic stress (PITS) (Macnair, 2002; Bennett and Rohlf, 2005; Macnair, 2015), a form of post-traumatic stress, where the symptoms result from active participation rather than witnessing or being the victim of a traumatic event (Macnair, 2002; Macnair, 2015).

Participation in euthanasia does not always lead to stress and trauma. Rohlf and Bennett (2005) found that only 50% of animal care professionals including veterinarians, veterinary nurses and animal shelter staff, reported trauma symptoms related to their participation in euthanasia. A number of job and personal factors influence shelter worker occupational stress (Scotney et al., 2015; Scotney, 2016). While further research is required to better understand risk and protective factors for euthanasia related stress (Scotney et al., 2015; Scotney, 2016), the degree to which euthanasia is perceived to be morally acceptable (Rollin, 2011), necessary (Reeve et al., 2005), and a team-based decision supported by a protocol (Von Dietze and Gardner, 2014; Scotney, 2016) may, in combination, significantly reduce the likelihood of guilt and stress outcomes. These findings indicate that having a clear, well-understood set of guidelines and a decision making protocol which is supported by all staff within animal shelters is likely to offer some protection

against euthanasia-related stress. The euthanasia of healthy animals has been found to be more stressful for staff than the euthanasia of sick or injured animals (Sanders, 1995; Reeve et al., 2004).

An objective means of assessment may also minimise the possibility of litigation against staff after adoption, due to a dog displaying aggression. According to legal opinion in the USA, staff can only be liable if the adopted dog is known or suspected to be dangerous, or is assumed to be safe and represented as such without evidence to support this conclusion (Dog bite Law, 2018). Although a behavioural assessment alone may not be adequate to prove the necessary due diligence (Patronek and Bradley, 2016), these assessments should be used in conjunction with a dog's past history, full disclosure of any other recorded observations made of the dog when in the shelter, and the full and final transfer of ownership to the new owners with the shelter acting only as caretaker. This should decrease the chances of liability (Lutz, 2009).

We acknowledge that laws vary by country, state and locality, and hence it is the responsibility of shelter administration and management to ensure that they behave in a manner which upholds the law and minimises litigation. Seeking legal advice regarding the suitability of a shelter's behavioural assessments is recommended by the authors. We maintain nonetheless, that a validated behaviour assessment, administered by well-trained and competent staff and documented in full, is preferable to a situation in which no assessment has taken place, particularly should a rehomed dog subsequently engage in aggressive behaviour which results in serious injury or even a fatality.

Conclusions

We have reviewed several potential benefits of conducting behaviour assessments as one of several tools to use with dogs in shelters. We suggest that a behaviour assessment contributes to an overall assessment of dogs' behaviour, which should be augmented by information about its history contributed from the previous owner, volunteer and staff at the shelter. This overall body of knowledge enables dog behaviour profiles to be better matched with an adopter's requirements and it identifies dogs that may require a behaviour modification program to help with behavioural problems. We also argue that behaviour assessments can be improved by increasing staff training of dog behaviour and by using a team-based approach, especially when making difficult decisions about euthanasia. Behaviour is multifactorial and continual monitoring can help understand dogs' behaviour in a given situation. These benefits stem from a broader set of considerations than the narrow perspective adopted by Patronek and Bradley (2016). Our view is that, such assessments should continue to be conducted, as long as staff are adequately trained and as long as it is acknowledged that existing tests are imperfect and require continuous research and development.

Abandonment of the use of behaviour assessments risks an increase in dog-bite incidents in the shelter and post adoption, euthanasia of even more dogs without behaviour problems, exacerbation of stress to workers in shelters and increasing uncertainty of dog safety in the minds of those adopting shelter dogs. All stakeholders in the process are likely to suffer. Therefore, we contend that the best approach for shelters is to acknowledge that we currently cannot be certain about the predictive ability of behaviour tests in shelters, but that, as part of a suite of measures to better understand a dog's characteristics, they remain beneficial.

Chapter 3: Early recognition of behaviour problems in dogs using in-kennel monitoring over the first five days after admission to a shelter

Contributions: PhD candidate (LC) designed the experiment, collected data, conducted behavioural analysis, analysed the data, drafted and wrote the paper (90%). Supervisory support was offered from (CJCP, MP, GP, PB) for methodological oversight and editing the paper (10%).

"You may choose to look the other way but you can never say again that you did not know"

William Wilberforce

Abstract

Canine behaviour assessments are commonly used in shelters to identify behaviour problems in dogs prior to adoption. The aim of this study was to evaluate whether kennel monitoring of dogs could identify early signs of behaviour problems, thereby facilitating early intervention and better management of dogs displaying behaviour problems. Kennel behaviour was monitored for dogs (n = 38) in their first five days in kennels at a shelter in Brisbane, Australia. This was compared to a formal assessment of exploratory, handling, play, run/freeze, and food guarding behaviour, as well as stranger and fake toddler interactions, and behaviour when the dog was alone, conducted five days after shelter admission. Kennel behaviours associated with fear, anxiety, and arousal in dogs were significantly correlated with the same behaviours in the formal assessment. Positional correlations were also evident. With respect to outcomes, dogs that displayed more whining, tense body posture, standing leaning forward, panting, ears forward, less barking, lowered body and balanced/relaxed body posture, standing still, and standing by the wall had increased odds of failing the behaviour assessment. Over the five days in the kennel, the frequency and duration of fear-related behaviours decreased, suggesting a reduction in arousal as the dog became accustomed to the shelter environment. The study demonstrates that monitoring kennel behaviour could detect early signs of behaviour problems.

Introduction

The largest Australian animal welfare organisation, the Royal Society for Prevention of Cruelty to Animals (RSPCA), received 40,286 surrendered dogs in the 12 months from July 2017 to June 2018 (RSPCA, 2018). Reasons for dog relinquishment commonly include behaviour problems, e.g., inappropriate toileting, barking, digging, separation anxiety, fear, or aggression (Salman et al. 2000; Marston et al. 2004; Shore, 2005). Entry to a novel shelter environment, plus alienation from its former owner, home, and routine, is likely to result in a potentially stressful form of social isolation in a surrendered dog (Hennessy et al. 1997). Dogs experience fear and anxiety upon relinquishment to a shelter, with overt signs of stress sometimes persisting for several weeks after relinquishment (Hennessy et al. 1997; Stephen et al. 2006). Furthermore, as the length of time in a shelter increases, the detrimental impact on dogs' emotional state worsens (Wells et al. 2002; Hewson et al. 2007; Dalla Villa et al. 2017). Coping capacity differs considerably between individual dogs, with variable habituation to the environment and the same stressor being experienced as neutral or aversive (Hiby et al. 2006; Rooney et al. 2007; Titulaer et al. 2013). Therefore, in order to reliably and effectively assess and monitor the mental well-being of surrendered dogs, it is important that early interactions with the novel environment are recorded to identify signs of negative affect, e.g., separation anxiety, which occur with high frequency in adopted dogs from shelters (Serpell et al. 2001).

Behaviour assessments are used in shelters globally, assessing adoption suitability, identifying behaviour problems, and matching dogs with the most suitable adoptees (Mornement et al. 2015). Veterinarians also implement a variety of testing procedures for quality of life assessments in animals with medical and behavioural issues (Barnard et al. 2016). However, behaviour assessments in shelters have been recently criticised, due to both the nature and consequences of pass or fail assessment procedures and doubt about their ability to accurately predict behaviour problems (Patronek et al. 2016). It is claimed that they cannot accurately determine the frequency of false positive (identification of a behavioural problem that does not really exist e.g., aggression, which renders the dog unfit for adoption) or false negatives (failure to detect a behavioural problem during the test). Usually, dogs are removed from their kennel to undertake the test in a standard facility, through which many other dogs have passed. This single context assessment is likely to present a stressful situation for the dog, which is unlikely to replicate the best environment to examine their anticipated behaviour in the home in which they are adopted. For example, the presence of excreta from previous dogs, or potentially even odours from dogs previously tested, can affect the outcome of tests (Poulsen et al. 2010).

An alternative is to observe behaviour in their kennel (hereafter kennel behaviour), handler interactions, and interspecies behaviour, allowing them to be tested in the environment into which they are becoming settled. Kennel monitoring has been used previously in shelters to identify behaviour problems (Palestrini et al. 2010; Konok et al. 2011; Goold et al. 2017). Furthermore, kennel behaviour monitoring could potentially be automated, using for example motion sensing or by programming computers to recognise specific behaviour patterns, e.g., escape attempts (Barnard et al. 2016).

There is a need for better observational tools for assessment in shelters (Rayment et al. 2017). These could include assessing behaviour longitudinally in shelters, to account for plasticity, and the greater predictability of behaviour when measured over a period of time (Diesel et al. 2008). Therefore, the aim of this study was to compare the manifestation of behaviours in a structured assessment with behaviours observed in their kennel over the first five days in a shelter.

Materials and Methods

Ethical Approval

This study was granted ethical approval from the University of Queensland Animal Ethics Committee (AE04214). All dogs were owner-surrendered, and permission was obtained from the owners to enrol their animals into the study.

Subjects

Criteria for dogs to enter the study were that they were between six months and 10 years of age, had no predisposed medical conditions and had not been previously admitted to the shelter. Thirty-eight dogs (18 male, 20 female) of mean age 3.1 years (SEM 0.37 years) and weight 20.3 kg (SEM 1.43) that had been surrendered to the RSPCA Queensland's Animal Care Facility over a three month period were enrolled into the study. They represented the following 20 different breeds: Bull terrier ($n = 9$), Kelpie Cross ($n = 6$), Mastiff ($n = 4$), Beagle cross ($n = 2$), Staffordshire Bull Terrier ($n = 2$), and one each of Jack Russell cross, Alaskan Malamut, American Bulldog, Australian Cattle Dog, Australian Shepherd Cross, Border Collie, Boxer, Bull Arab cross, German Shepard cross, Husky cross, Labrador Retriever, Papillon, Poodle Cross, Portuguese Podengo, and Spoodle. All had been privately surrendered, with owners being required to declare the reasons for surrender.

Housing and Feeding

Dogs were housed in a single block of kennels, which held 16 dogs in individual kennels. Each kennel had a floor area of 3.5 m^2 (120 cm × 180 cm), concrete floors and two solid walls separating each kennel and a gate opening into the kennel block, a fence opening out toward a garden area, a

separate sleeping area with a raised bed, soft bedding, and toys. The dogs were fed twice daily with a combination of dry and wet food and had access to fresh water. Each dog received walks twice a day at 09:00 and 15:00 by shelter staff or volunteers.

Behaviour Monitoring

Kennel

Dogs were observed on days 1–5, following surrender on day 1, for 60 min (07:30–08:30, before interactions with volunteers). Data were collected using two video surveillance cameras (KOBI CCD video cameras, Model: K-32HCVF, Taipei, Taiwan) placed in each individual kennel at a height of 3 m.

Standard Behaviour Test

The standard RSPCA Qld behaviour assessment (RSPCA, 2018) was conducted on day 6, i.e., the day after the five days of kennel observations, as used by Queensland RSPCA shelters in each state to assess adoption suitability in shelter dogs. The assessment comprised a series of 10 tests of increasing provocation. Dog responses were scored based on frequency and durations of a variety of behaviours as described below. The tests were performed over 15 min with the following aids: a 1.8 m leash, tennis ball, plush squeaky toy, rope, plastic hand on a extend pole, bowl, raw hide or bone, and combination of wet and dry dog food.

The assessments were performed in a room (3×5 m) 20–30 m from the kennels, with one window and two half frosted doors, and a concrete floor with hospital-grade non-slip painted covering. All dogs were moved on lead from their kennel block to the assessment room. A single lead was attached to the wall for a 1.8 m leash to restrain the dog. During the assessment, one researcher acted as the handler, and a second person helped in observer interaction and implementing two tests requiring two people (Stranger and Fake toddler tests, described below). Data for all the following tests were recorded using a video recorder (Digital Video Recorder 1.1, Model: XQ-L400H, Manufacture: Kobi, Seoul, Korea).

Exploring the Room, One Minute

The handler entered the room, dropped the lead attached to the dog, and sat in the centre on a chair. Then, the observer started a timer and waited for 1 min without any interaction with the dog by either person.

Sociability to Handler

At the end of test 1, the handler called the dog to them in a friendly voice, remaining in the chair with no other body movement. If there was no response, a second attempt was made, and if still no

response the handler clapped their hands on their lap and said 'come here' in the direction of the dog, trying at least three times to call the dog to them. When the dog came (at the first, second, or third call), the handler picked up the leash and then stroked the dog from the base of neck to tail three times. If the dog did not respond to the first, second, or third, call the handler approached the dog, picked up the leash, and gave the dog three strokes from the base of neck to tail. Following each stroke, the observer and handler counted 10 s, with behaviours exhibited noted.

Tolerance to Handling

The handler dropped the leash and held the dog's collar. With the dog standing, the other handler (in the standing position, or crouching if a small breed of dog) picked up the dog's rear inside foot, then the front inside foot, then reached over its back to pick up its rear outside foot, and finally the front outside foot. Each foot was held for 2 s. After picking up all four paws in this manner, the handler stood for 10 s with no dog interaction and finally removed the dog's leash.

Toy Interactions

A tennis ball, squeaky toy, and tugging rope were shown to the dog and gently thrown across the room, and the handler verbally engaged the dog in play. If the dog picked up the ball, the handler waited to see if it returned to the handler without encouragement. If it did not, the handler encouraged the dog to bring the ball back by calling his/her name and saying "come". If the dog still did not return, the handler went to the dog.

In both situations, the handler waited 10 s to see if the dog dropped the ball. If it did not, he/she asked the dog to "drop it". If the dog did not respond, then a second command was given, "give", and if necessary, a third attempt, "out", was tried. If the dog did not respond to these commands, the handler approached the dog carefully and removed the ball from the dog's mouth. These steps were repeated for a second throw, and after completion, the handler waited 10 s with no interaction before moving on to the next test.

Tag (Run and Freeze)

The run and freeze test was used to mimic a tag game. The handler gently moved the dog to the opposite end of the room and left it standing against the wall. Then, he gently moved one hand over its head, down toward the back to gently tap the rump area, and then ran across the room, laughing and waving arms, followed by suddenly stopping, folding his arms, and ignoring the dog. The tap, run, and freeze series was repeated a second time. The handler waited for 10 s after the run and freeze, ignoring the dog, before moving onto the next test. The dog was then placed back on the leash.

Resource Guarding

The handler tethered the dog to the wall for safety reasons, and proceeded to give the dog wet canned food, smeared in a bowl. The bowl was then placed near the dog at the end of the leash perimeter, allowing the dog to begin eating for 2 s. The handler then proceeded with a plastic hand, walking to the side of the dog while it was eating. Using the fake hand, the handler patted the dog on the head, continuing to stroke down its back and body twice. The fake hand was then placed 5 cm in front of the bowl and moved around in a semi-circle. The hand was then placed on the inside edge of the bowl and moved around the edge of the bowl next to the dog's face, without touching it. Finally, the bowl was pulled away from the dog using the fake hand. The bowl was then returned to the dog, which was observed for 10 s.

The handler then gave the dog a pig's ear or bone, depending on dog's food interest, and it was allowed to chew it for 30 s. The steps above with wet food were repeated; then, the handler attempted to retrieve the food, asking the dog to "drop it", "leave it", or "give" before attempting to retrieve it by offering a higher value treat/food, e.g., the pig's ear.

Stranger Interaction

The handler placed the dog on a leash as the observer exited the room and returned dressed in a reflective vest, large brimmed hat and using a walking stick. The observer entered the room, and bent down to extend an open flat hand as if to pat the dog on the head. The observer then talked to the dog normally and stopped for 3 s, allowing the dog to approach. If the dog approached, the observer patted the dog on the top of its head for 3 s. If the dog did not approach, it was observed for 10 s, with an emphasis on any interaction between the handler and/or the observer.

Fake Toddler Interaction

The handler stood and held the dog's leash while the observer exited the area and returned carrying a toddler doll simulating a small child. Once the toddler was within the leash perimeter from the dog, the observer placed the doll on the floor facing the dog, with the doll's arm extended toward the dog. The handler allowed the dog to approach if it desired. If the dog did not approach the observer, it was observed for 20 s.

Time Alone

The handler and observer removed the leash from the dog and left the room for 2 min, with a video camera in the front of the room monitoring behaviour and vocalisations. Then, the handler and observer re-entered through the same door.

Behaviour with Another Dog

This test was conducted in a yard (10−20 m), allowing adequate space between the test dog and another dog, both with handlers. Each dog had a handler, who interacted with their dog by giving treats and ignoring the other handler and dog. The handler had a short, 1 m, leash, so that the dog walked close to the handler. At the start, both handlers walked parallel to each other, 5 m apart, with the dogs on the outside. If one or both dogs were reactive and pulled toward each other, the distance between the handlers was increased. If both dogs were relaxed and focused on their handler, the handlers moved the dogs to an exercise circle. If the dogs did not breach a minimum distance of 5 m between them, they were introduced on opposite sides of a fence. There followed a circling activity, which required one handler to stand still with their dog on no more than 1.5 m of leash while the other handler and their dog completed a circle around the handler. Handlers then swapped places and repeated the circling activity. If no adverse behaviours were displayed, the handler in the middle of the circle remained at that location, ensuring that the only tension on the leash was from the dog. The other handler identified the leash threshold of the dog in the centre and moved close enough to allow the dogs to be nose to nose, also ensuring that the only tension on their leads was caused by the dog pulling, not them pulling against the dog. Once the leads became loose, and the dogs stopped pulling against the handler, the handlers took a step closer to each other, allowing the dogs to interact if they chose. Leashes remained loose. If there were signs of adverse reactions or aggression, dogs were then separated by increasing the threshold.

Behaviour Scoring

Following preliminary observation of dogs in their kennel and during the formal behaviour assessment, an ethogram with 48 behaviours, classified as either long duration behaviours (for which the duration was recorded) or events (for which the number of occurrences was recorded) was devised. The behaviours focused on eight components: activities of the mouth, body, tail, tail movement, ears, eyes, position, and movement (Table 1). Descriptions of each behaviour are presented in Table 2 and their connection to emotions (Anxiety, Fear, Friendliness, Arousal, Aggression) (Diesel et al. 2008, Dowling-Guyer et al. 2011, Hennessy et al. 2001, Valsecchi et al. 2011, Mornement et al. 2014) in Table 3. Kennel behaviours were continuously recorded over a 1 h period (07:30–08:30), and the formal behaviour assessments were recorded for all tests. Behaviour recording was assisted by coding software (BORIS)(Oliver et al. 2016). The following behaviour variables with no or only one occurrence were discarded: Squint, Whale eyes.

The RSPCA staff classified the dogs for adoption suitability following the formal behaviour assessment: (1) pass and ready for adoption, (2) some behaviour issues which should be addressed

in a behaviour modification program, and (3) fail due to extreme behaviour problems. However, in the current study no dogs were classified under category 2.

Table 1. Canine behaviours recorded for each body part, as well as positions and movement types

Mouth	Body	Tail	Tail Movement	Ears	Eyes	Position	Movement
Open/Closed	Weight forward	Low	Wagging	Alert	Soft	Front	Pacing
Panting	Weight back	Med	Fast	Back	Hard	Bed/Sleep	Sit/Lay
Mouthing	Balanced	High	Stiff	Forward	Direct	Wire	Stand
Lip Lick	Relaxed	Tucked	Slow	Open	Squinty	Wall	Still
Snap	Tense				Whale Eyes		
Bite	Lowered				Dilated		
Whining	Play bow				Targeting		
Barking	Jumping up				Diverting		
Growl	Lowered head						
Howling	piloerect						

Table 2. Behaviours measured, their descriptions and mean values (± SEM) for duration and frequency during kennel observations

Behaviour	Description	Duration (s/days)	Frequency (no./days)
Mouth			
Open/Closed	Mouth is open or close, no visual signs of panting	3017 ± 568.0	4.35 ± 0.83
Panting	Increased respiration, deep gasps, and salivation	8314 ± 654.0	22.2 ± 5.35
Mouthing	Nipping or play biting	0	0
Lip Lick	Licking of the upper lip	21.9 ± 21.60	0.17 ± 0.040
Snap	Rapid open and close mouth, possible baring teeth, growl, bark, lunge	0	0
Bite	Closure the teeth on victim causing a wound	0	0
Whining	A sustained, high pitched, plaintive sound	0.464 ± 0.360	0.10 ± 0.060
Barking	Brief vocalization	952 ± 299.0	19.2 ± 5.86
Growl	Low guttural prolonged vocalisation	6.99 ± 6.990	0.12 ± 0.060
Howling	Raise muzzle perpendicular to ground, vocalise over extended period, open jaws	0	0
Body			
Weight forward	Body weight forward while standing still	204 ± 82.7	4.5 ± 2.03
Weight back	Body weight back while standing still	3371 ± 466.0	17.7± 2.823
Balanced	Balanced body posture standing still	6546 ± 633.0	37.6 ±4.960
Relaxed	Body posture relaxed in movement	0	0
Tense	Body Posture is still and tense in association to stimulus	669 ± 147.2	3.98 ±0.922
Lowered	Body lowered to ground	728 ± 183.1	4.85 ±1.1676
Play bow	Stretching front legs out in front, leaning down on its elbows	14.1 ± 11.70	0.625 ±0.2454
Jumping up	Jumping in air	568 ± 115.1	31.9 ± 5.21
Lowered head	Lowered head as body posture is high	0	0
Piloerect	Hackles rise	0	0
Tail			
Low	Tail positioned low	6438 ± 469.6	25.4 ±3.56
Med	Tail positioned in line with spine	2945 ± 404.7	23.6 ± 4.34
High	Tail high or above spine	871 ± 325.2	6.85 ± 1.86
Tucked	Tail positioned underneath body	1721 ± 395.1	3.91 ± 0.6460
Tail Movement			
Wagging	Relaxed tail movement	0	0
Fast	Movement of tail fast	29.8 ± 16.10	1.88 ± 1.2500
Stiff	Still and no movement in tail	9531 ± 397.1	38.4 ± 3.68
Slow	Slow movement of the tail	2030 + 264.1	35.9 +- 4.17
Ears			
Alert	Ears forward and directed at an object, stimulus, or sound	243 + 169.0	1.88 + 0.8610
Back	Ears positioned back and flat	4470 + 617.0	18.0 + 3.07
Forward	Ears positioned forward	3066 ± 621.0	9.6 ± 1.760
Open	Ears neutral	4221 ± 473.0	17.0 ± 2.22
Eyes			
Soft	Relaxed eyes	275.6 ± 80.5	1.85 ± 0.361
Hard	Hard focused stare	0	0

Direct	Directed at object	5832 ± 516.0	11.4 ±- 0.997
Squinting	Eyes not fully open	0	0
Whale Eyes	Showing whites of eyes	0	0
Dilated	Pupil dilation	219 ± 137.0	1.28 ± 0.699
Targeting	Constricted pupils and targeting object or stimulus	0	0
Diverting	Eyes moving and not maintaining eye contact	5585 ± 484.0	11.1 ± 0.94
Position			
Front	At the front of the kennel/front of room	4705 ± 388.0	136.9 ± 12.70
Bed/Sleep	In bed	1022 ± 224.0	19.8 ± 3.69
Wire	At wire	5065 ± 334.0	134.8 ± 12.50
Wall	At wall of kennel or in behaviour assessment room	1303 ± 237.0	18.7 ± 2.46
Movement			
Pacing	Repeated movement in a regular pattern	3540 ± 308.0	128.8 ± 9.62
Sit/Lie	Sitting position	4290 ± 352.0	62.4 ± 5.19
Stand	Standing on all fours	4242 ± 295.0	119.5 ± 9.45
Still	Motionless	0	0
Walking	Progressive locomotion with at least three legs on floor at one time	0	0

Table 3. The behaviours contributing to the emotional states Fear, Anxiety, Aggression, Arousal, and Friendliness.

							Behaviour number								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Fear															
Diverting	Ears Back	Lip Licking	Lowered Body	Lowered head	Shiver	stiff tail	Tail Low	Tail tucked	Tense Body Posture	Weight back	Yawn				
Anxiety															
Fast tail	High tail	Jumping	Licking	Lip licking	Medium	Pacing	Panting	Stiff Tail	Tense body	Weight back	Weight forward	Whining			
Aggression															
Biting	Ears Forward	Growling	High tail	Lip Licking	Lowered head	Medium tail	Snapping	Standing	Stiff tail	Still tail	Targetting	Vertical Lip Raise			
Arousal															
Barking	Diverting Gaze	Fast tail	High Tail	Jumping up	Jump off	Licking	Medium Tail	Mouthing	Pacing	Panting	Weight forward	whining			
Friendliness															
Balanced	Body Curve	Direct eye	Ears forward	Ears open	Fast tail	Handler interaction	Jump	Medium Tail	Play	Relaxed body	slow	Sniff	Soft	Tail loose	Walking

Statistical Analysis

Results were analysed using Minitab 17, Lead technology Inc., Pennsylvania State University, Pennsylvania, USA. Behaviours were entered as the percentage of the total observation time or percentage of the frequency of occurrence during their period in the kennel and during the behaviour assessment. These two were compared using multivariate general linear models with the following factors: reason for surrender, age, weight, animals, days since entry, and outcome (adopted/euthanized). Residuals were checked for normal distribution using the Anderson Darling test. Spearman's rank order correlations were computed between kennel and formal behaviour assessment variables. As comparisons with 38 other behaviours were made for each behaviour in each test of the behaviour assessment, results were corrected for false discovery using the Benjamini-Hochberg procedure (McDonald 2014). The Bonferroni correction was rejected as it assumes independence in the individual tests. The Benjamini-Hochberg procedure ranks the P values for each test and compares P values to critical values [(rank/no. tests) x false discovery rate (selected as 0.20 as recommended by McDonald, 2014)]. All P values up to the critical one were considered to indicate a significant difference (McDonald 2014). Correlations were further analysed on tests of the sample split according to owner surrender information, sex, adopted vs euthanasia, and daily behaviours. Linear and Binary Logistics Regressions were conducted to compare dog behaviour with RSPCA classification of outcomes and comparing behaviours over days for different tests. Two tests, Time Alone and Exploration of the Room, were subjected to additional logistic regression because of their predictive ability for kennel behaviour.

Results

Reasons for Dog Surrender

The reasons for surrender were moving away or insufficient time to care for the dog (22.2%); dog being aggressive or escaping, or family issues (8.3%); medical concerns (5.5%); and arousal, barking, chasing, destruction, owner's death, resource guarding, or separation anxiety (2.8%).

Emotional characteristics of dogs in their kennels that were or were not subsequently euthanased

Emotional States of Dogs in their Kennel

Over the first five days, dogs spent most time and had the highest frequencies of the following behaviours (Table 2): weight back, balanced body, and jumping up. Tail movement and position were spent in tail low and medium with still or slow movement, not wagging (Table 2). Ear position was most commonly ears back, then ears open, and finally ears forward. Eye direction was most commonly direct and diverting. In regards to position, dogs spent the most of the time in a kennel at the wire or front and the least amount of time in bed/sleeping or at the wall. Movement patterns were commonly standing, sit/lay, and pacing (Table 2). Over the five-day period, dogs spent 36% of their time in friendly behaviours, 25% displaying fear, 13% displaying anxiousness, 15% in high arousal, and 7% displaying aggression. Dogs' frequency of emotions differed from duration, with 33% of occurrences being high arousal, 25% friendliness, 24% anxiousness, 16% fear, and 2% aggression. Thus, friendliness and fear were displayed less frequently but for a longer duration compared with arousal and anxiousness, which were of short duration but more frequent.

Over the five-day period, there was a significant reduction in the frequency of fear-related behaviours, including tense body posture ($p < 0.05$), tail tucked ($p < 0.05$), and alert response in ears ($p < 0.05$) (Figure 2). There was increases in stiff and slow tail movement ($p < 0.05$) (Figure 2) and the duration of time spent at the front of the kennel ($p = 0.016$), wire of the kennel ($p = 0.008$), and in bed/sleep ($p = 0.0019$) (Figures 2, 3).

There were reductions in time spent panting ($p < 0.001$) (and corresponding increase in mouth open or closed, $p < 0.001$), a reduction in lowered ($p < 0.008$) and tense body posture ($p < 0.001$), and reductions in tucked tail and stiff tail movement, and a corresponding increase in slow tail movement ($p < 0.05$) (Figure 4).
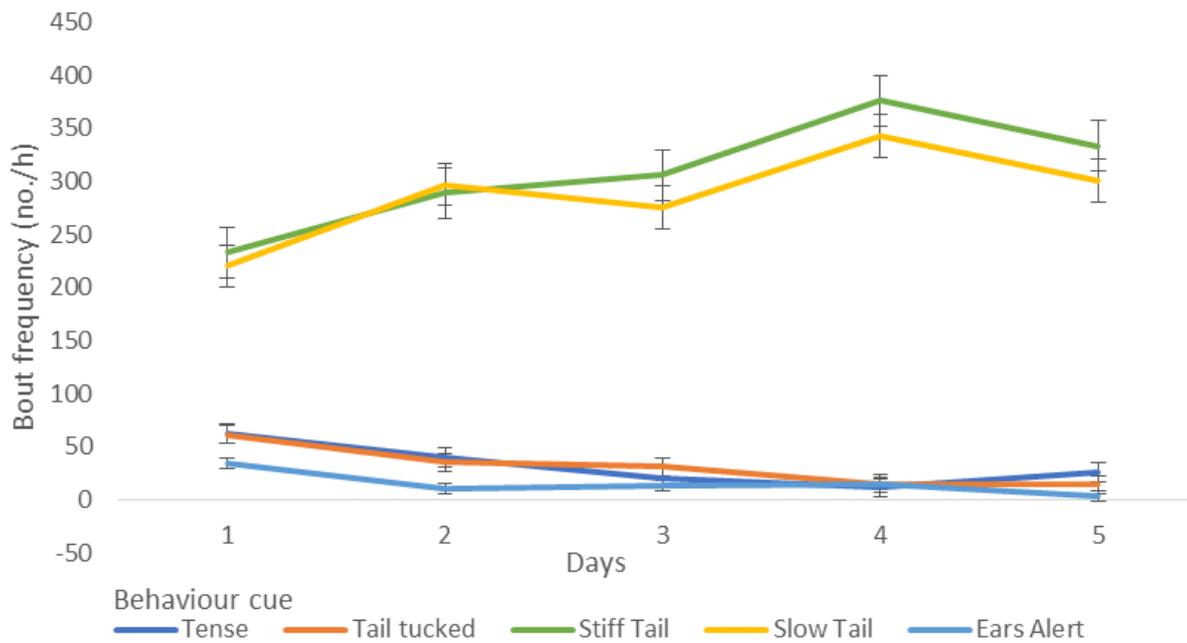
Figure 2. The frequency of fear-related behaviours, alert ears and tail behaviours over the first five days that dogs (n = 38) spend in a shelter
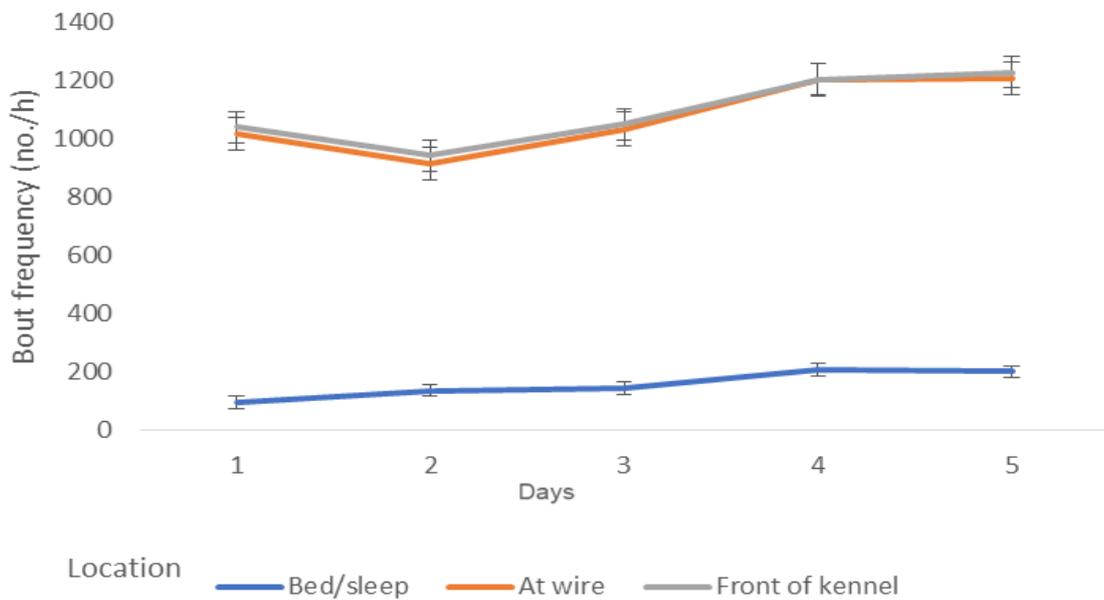
Figure 3. The frequency of position over the first five days that dogs ($n = 38$) spent in a shelter.
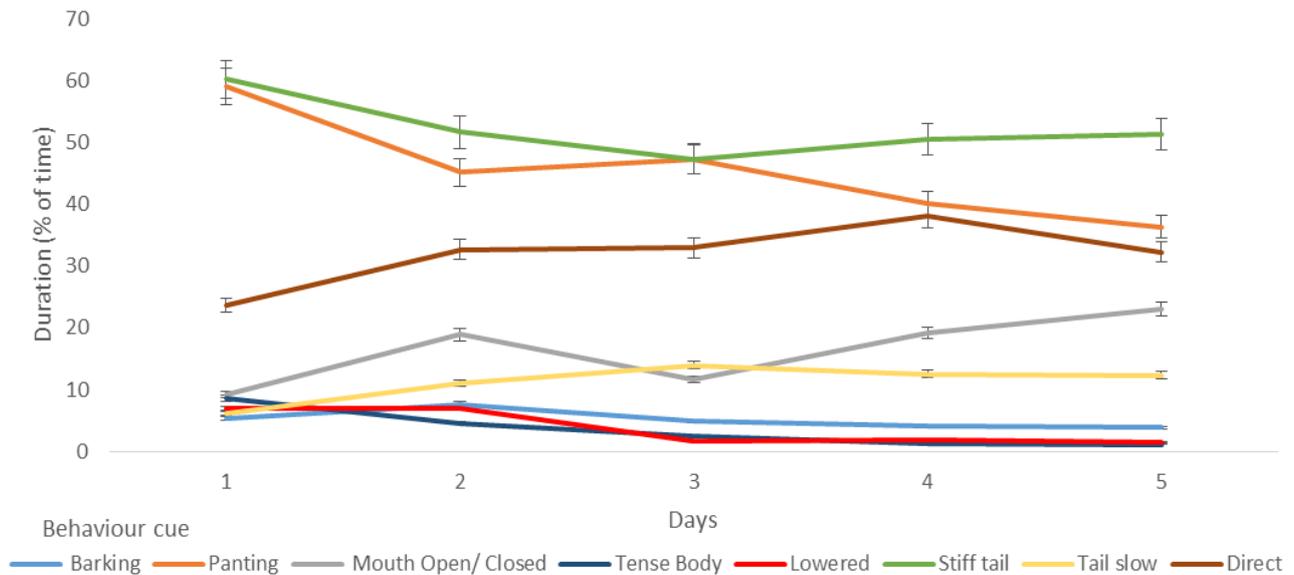
Figure 4. The duration of fear-related behaviours, arousal behaviours, and tail behaviours over the first five days that dogs (n = 38) spent in a shelter.

Relationship between Kennel Behaviour and Outcome for the Dogs

Comparing behavioural characteristics of dogs that were adopted or euthanized, the latter had an increased duration of tense body posture overall, but inspection of changes over time revealed that this was mainly on the first day, with this behaviour declining over time in both sets of dogs (p = 0.001) (Table 4, Figure 5). Conversely, dogs that were adopted, which generally exhibited more mouth open/closed behaviour, had similar levels to euthanased dogs by day 5. Dogs that were adopted had a greater frequency of balanced/relaxed posture, but this declined over time, in contrast to euthanased dogs, which had little evidence of decline over time (p = 0.004). Jumping kennel was more common in euthanased dogs, and this declined over time in both euthanased and adopted dogs (p = 0.03) (Figure 6).
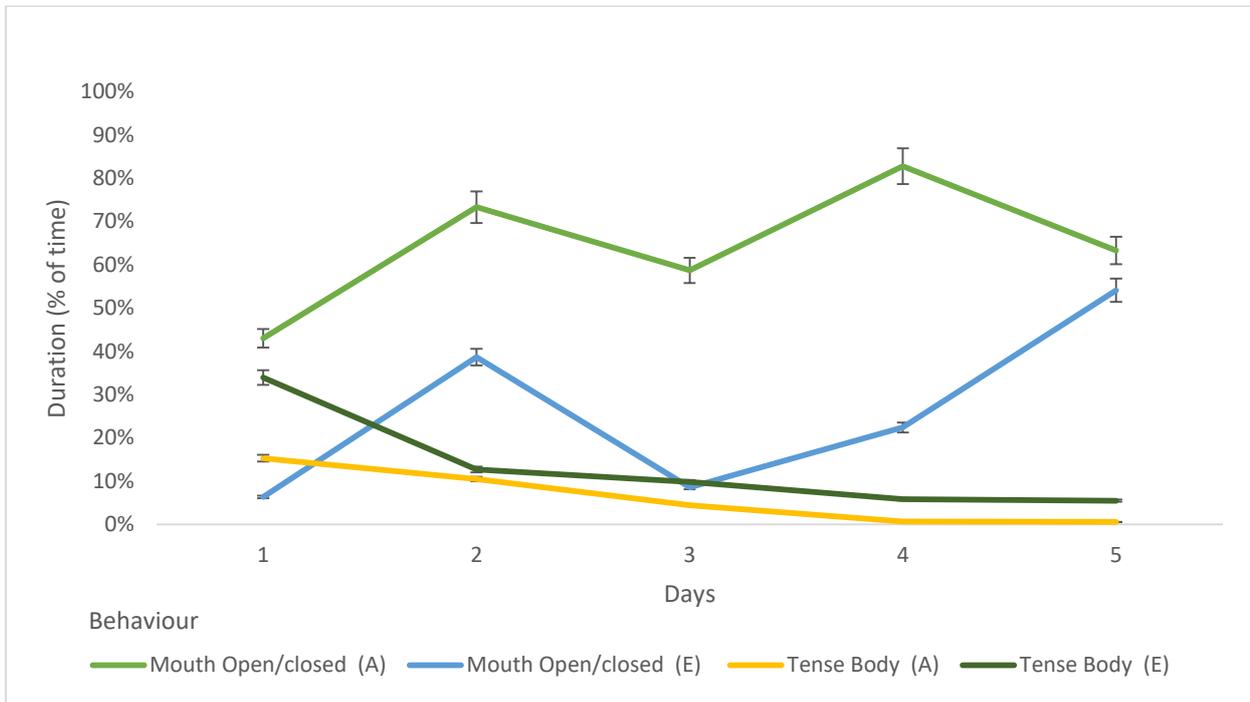
Figure 5. The duration of behaviours over the first five days that adopted or euthanased dogs (n = 38) spent in a shelter.
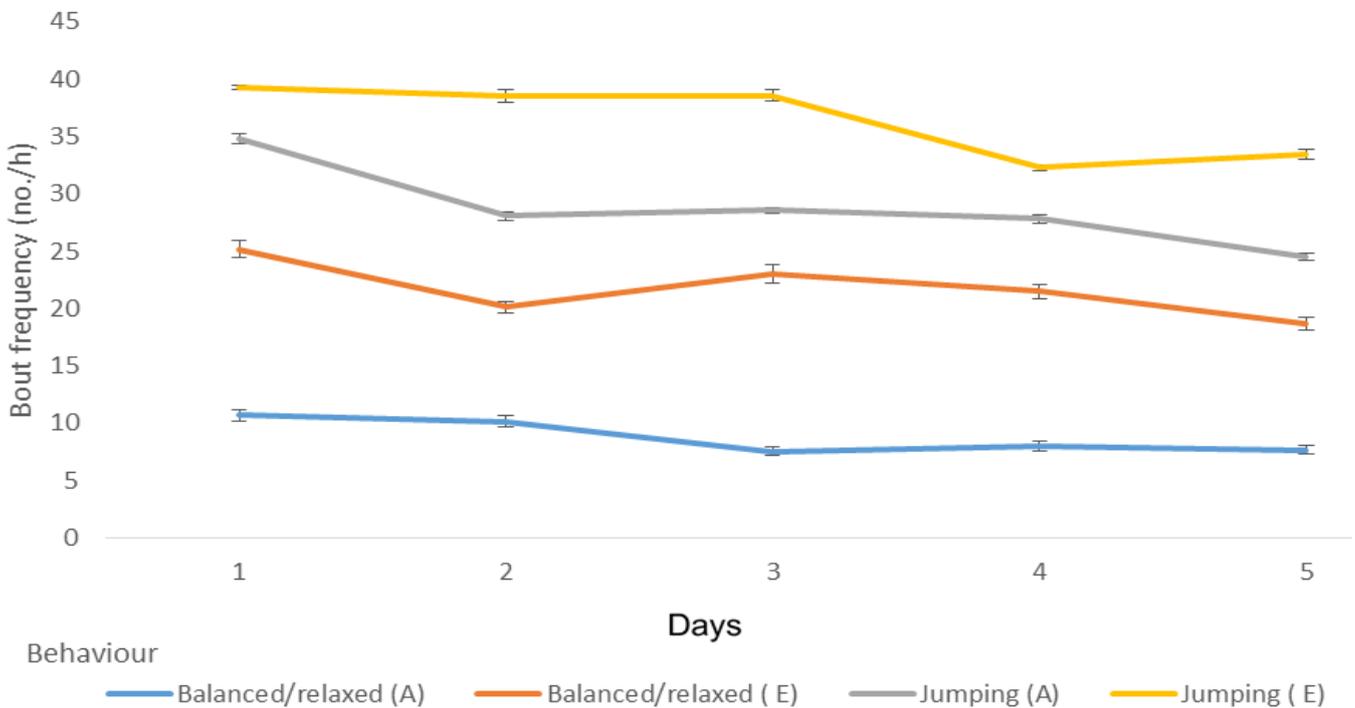
Figure 6. The frequency of behaviours over the first five days that adopted or euthanased dogs (n = 38) spent in a shelter.

Table 4. Differences in kennel behaviour between dogs that were euthanased and adopted, either overall or on certain days.

F/D	Behaviours	Interaction	*p*-Value
F	Tense body	A/E	0.001
D	Balance/relaxed	A/E	0.002
D	Tense body	A/E	0.002

D = Duration, F = Frequency; A/E = Adopted/Euthanased.

Emotional characteristics of dogs in the Behavioral Assessment that were or were not subsequently euthanased

Behaviour of Dogs in Formal Behaviour Assessment

In the behaviour assessment, dogs spent 39% of their time in friendly behaviours, 17% displaying fear, 17% displaying anxiousness, 24% in high arousal, and 3% displaying aggression. Considering the frequency of behaviours, 26% were incidences of high arousal, 41% friendliness, 19% anxiousness, 12% fear, and 2% aggression.

Total scores for each behaviour were obtained from the formal behavioural assessment and categorised into emotional domains (Anxiety, Fear, Friendliness, Aggression, and Arousal). See Table 5 for Pearson's correlations of scores, with significance levels corrected using the Benjamini-Hochberg procedure.

Table 5. Spearman Rank correlation coefficients between behaviours recorded in the formal behaviour assessment in shelter dogs (n = 38) (Numbered behaviours relate to those presented in table 3)

Fear

Fear	1	2	3	4	5	6	7	8	9	10	11	12
1		*0.4*	*0.32*	-0.22	*0.33*	0.19	*0.4*	0.17	0.27	-0.11	0.09	-0.18
2			**0.61**	**0.48**	**0.6**	-0.26	-0.03	0.21	0.02	**0.49**	**0.43**	*0.38*
3				0.02	0.02	0.12	*0.35*	-0.35	-0.1	0.31	0.19	0
4					0.08	-0.18	**0.55**	*0.32*	**0.56**	-0.06	**0.61**	0
5						-0.18	-0.04	0.03	*0.34*	*0.36*	*0.32*	0
6							0.32	0.15	-0.08	0.21	-0.22	0
7								**0.41**	**0.6**	*0.48*	**0.59**	0
8									**0.65**	0.18	**0.45**	0
9										**0.43**	**0.42**	0
10											-0.15	**0.54**
11												0

Anxiety

Anxiety	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1		0.18	**0.51**	*0.35*	-0.05	**0.77**	0.32	**0.47**	**-0.64**	-0.13	*-0.32*	**0.42**	-0.03	*0.36*
2			-0.11	-0.14	0	*-0.35*	-0.2	-0.2	-0.17	-0.14	-0.17	*0.41*	0.17	0
3				-0.12	-0.08	*0.37*	**0.4**	**0.39**	-0.16	-0.12	-0.08	**0.53**	0.15	0
4					-0.01	-0.2	**0.56**	**0.36**	-0.02	**0.69**	-0.07	**0.64**	**0.39**	0
5						-0.05	0.13	**0.56**	**0.44**	**0.63**	0.19	**0.81**	-0.14	0
6							**0.53**	**0.37**	**-0.37**	0.07	-0.07	**0.38**	-0.23	0

		1	2	3	4	5	6	7	8	9	10	11	12	13
	7							0.56	**0.44**	**0.63**	**0.48**	**0.47**	0.09	0
	8								0.04	-0.01	0.05	**0.47**	-0.07	0
	9									**0.48**	**0.59**	-0.29	-0.16	0
	10										-0.15	**0.72**	**0.43**	**0.53**
	11											*0.35*	0.22	0
	12												0.03	**0.49**
	13													0

Aggression

		1	2	3	4	5	6	7	8	9	10	11	12	13
Aggression	1		*0.33*	**0.9**	-0.08	*0.31*	0.24	-0.01	**0.72**	0.07	*0.29*	**0.79**	-0.03	0
	2			0.25	0.21	-0.19	-0.16	-0.15	0.18	0.16	0.12	0.16	-0.11	*0.33*
	3				-0.03	-0.01	**0.55**	*0.34*	**0.97**	**0.59**	0.05	**0.71**	-0.04	**0.9**
	4					-0.33	**0.37**	-0.19	-0.01	0.04	0.08	0.22	**0.44**	-0.08
	5						*0.31*	0.16	-0.08	-0.02	0.35	0.27	0.1	*0.31*
	6							0.24	**0.51**	**0.41**	0.13	0.06	-0.17	0.24
	7								*0.36*	**0.44**	-0.37	0.02	0.05	-0.01
	8									**0.6**	**0.55**	-0.02	**0.72**	0.01
	9										-0.02	0.06	0.07	0.07
	10											*0.32*	0.24	*0.29*
	11												**0.7**	**0.7**
	12													-0.03

Arousal

		1	2	3	4	5	6	7	8	9	10	11	12	13
Arousal	1		0.05	-0.23	**0.45**	-0.1	-0.09	-0.2	-0.24	-0.19	-0.19	-0.11	-0.09	-0.16
	2			*0.35*	0.27	*0.33*	-0.03	*0.31*	0.26	*0.34*	0.23	**0.37**	*0.31*	0.03

	1	2	3	4	5	6	7	8	9	10	11	12	13
3				-0.08	**0.51**	0.09	*0.32*	**0.77**	*0.32*	0.24	**0.47**	**0.41**	-0.16
4					-0.06	-0.07	*0.33*	-0.19	-0.03	0.26	0.06	0.2	0.02
5						-0.02	0.02	*0.37*	**0.43**	**0.4**	**0.38**	**0.52**	0.13
6							0.09	-0.02	-0.15	**0.46**	**0.41**	0.15	-0.16
7								0.16	**0.44**	**0.56**	**0.36**	**0.64**	**0.39**
8									**0.51**	0.16	*0.37*	**0.38**	-0.01
9										0.15	*0.34*	**0.42**	*0.31*
10											**0.56**	**0.81**	0.1
11												**0.47**	-0.21
12													*0.3*

Friendliness

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1		-0.03	0.3	**0.39**	**0.36**	0.08	-0.16	*0.31*	0.18	0.18	**-0.47**	**0.54**	0.05	-0.04	0.11	**0.51**
2			**0.36**	-0.1	-0.17	*0.36*	*0.31*	0.2	*0.35*	0.03	*-0.36*	0.15	**-0.39**	**-0.47**	-0.25	0.13
3				0.09	0.01	*0.35*	0.14	-0.22	**0.39**	-0.01	-0.15	0.26	-0.18	**-0.4**	-0.1	0.08
4					**-0.54**	*-0.37*	-0.01	-0.28	-0.15	0.26	0.11	0.2	*0.36*	0.03	0.14	0.01
5						0.21	-0.06	0.08	0.11	*0.31*	0.09	0.17	0.25	0.15	0.06	0.24
6							0.3	**0.51**	**0.77**	-0.04	-0.25	0.04	-0.25	-0.25	-0.12	0.02
7								*0.3*	0.32	0.1	*0.33*	0	-0.2	0.25	0.12	-0.24
8									*0.37*	**0.43**	-0.24	-0.18	*0.39*	**0.38**	-0.15	-0.08
9										0.07	-0.13	0.27	-0.21	-0.14	-0.01	-0.08
10											**0.53**	0.21	**0.48**	*0.34*	-0.04	-0.03

Row group label: **Friendliness**

11	0.05	*0.36*	**0.39**	-0.06	-0.21
12		-0.18	-0.19	0.04	**0.44**
13			**0.47**	0.2	-0.05
14				**0.65**	-0.24
15					-0.01

Almost all correlations were statistically significant but ranged from weak to strong for both positive and negative correlations. There were positive correlations between the following behaviours that we associated with Fear: ears back, lip licking, lowered body, lowered head, shiver, tail low, tail tucked, tense body posture, weight back, and yawning; Anxiousness: fast, high tail, jumping, licking, lip licking, medium tail, pacing, panting, stiff tail, tense body posture, weight back, weight forward, and yawning. There were positive correlations between the following behaviours that we associated with Aggression: biting, ears forward, growling, high tail, lip licking, lowered head, medium tail, snapping, standing, stiff tail and still tail, and targeting gaze. There were positive correlations between the following behaviours that we associated with Arousal: barking, diverting gaze, fast and high tail, jumping up and off, licking, medium tail, mouthing, pacing, panting, weight forward, and whining. There were positive correlations between the following behaviours that we associated with Friendliness: balanced body posture, body curve, direct eye contact, ears forward and open, fast tail, handler interaction, jumping, medium tail, play behaviour, relaxed body, slow tail movement, sniffing, soft eye contact, wag loose, and walking.

Relationship between Kennel Behaviour and Formal Behaviour Assessment

There were positive correlations between anxiety, fear, and arousal behaviours displayed in kennels and in the formal behaviour assessment: whining, diverting eye contact, lip licking, panting, barking, jumping up, ears alert and forward, ears back, lowered body and tense body posture, tail tucked and stiff, and body weight back ($p < 0.02$) (Table 6). In addition, there were positive correlations between position in the kennel (at wall, wire, and at front door) and locations in behaviour assessment (at wall, window, and door) ($p < 0.02$) (Table 7).

Table 6. Significant (p < 0.05) Spearman Rank correlation coefficients between behaviours recorded in kennel and the formal behaviour assessment of shelter dogs (n = 38), listed for the emotional states of Arousal, Fear and Anxiety.

Arousal		Fear		Anxiety	
Barking	**0.57**	Diverting	*0.34*	Ears back	**0.57**
Diverting Gaze	*0.30*	Ears Back	**0.46**	Fast tail	**0.40**
Fast tail	**0.40**	Lip Licking	**0.42**	High tail	**0.63**
High Tail	**0.63**	Lowered Body	**0.44**	Jumping	*0.35*
Jumping up	**0.53**	Lowered head	**0.45**	Licking	*0.31*
Jump off	*0.35*	Shiver	**0.41**	Lip licking	*0.29*
Licking	*0.31*	Stiff tail	*0.33*	Medium tail	**0.45**
Lip licking	*0.29*	Tail Low	**0.45**	Pacing	*0.42*
Medium Tail	**0.45**	Tail tucked	*0.25*	Panting	*0.25*
Mouthing	*0.59*	Tense Body Posture	*0.28*	Stiff tail	*0.33*
Pacing	*0.31*	Weight back	**0.41**	Tense body	0.28
Panting	**0.42**	Yawn	*0.33*	Weight back	**0.41**
Weight forward	**0.38**			Weight forward	*0.38*
Whining	**0.36**			Whining	*0.36*

p **< 0.01**, *p* < 0.05.

Table 7. Significant (p < 0.05) Spearman Rank correlation coefficients between locations recorded in kennel and formal behaviour assessment of shelter dogs (n = 38).

Location	Behaviour Assessment			
Kennel assessment	Door	Front of room	Wall	Window
Front of kennel	**0.45**	−0.08	*−0.36*	−0.11
Wall	−0.22	0.00	**0.49**	−0.23

p **< 0.01**, *p* < 0.05

Exploration of Room

Comparing exploration of the room in the behaviour assessment with kennel behaviours, there were significant correlations between many duration and frequency behaviours in the anxiety, arousal, and fear emotional states (Table 8). Nearly all correlations were positive, demonstrating that for most behaviours recorded in the kennel were related to those exhibited in the behavioural

assessment. Only two—whining and lip licking—were negatively related, suggesting that these are not reliable indicators of the room exploration test.

Table 8. Spearman Rank correlation coefficients between behaviours recorded in kennel and behaviours exhibited during the 'exploration of room test' in the behaviour assessment of shelter dogs (n = 38) within the emotional domains of arousal, fear, and anxiety.

Arousal	Title	Fear	Title	Anxiety	Title
Barking	*0.40*	Ears Back	**0.59**	Ears back	**0.59**
Diverting Gaze	*0.35*	Lip Licking	*−0.12*	Fast tail	**0.38**
High Tail	**0.69**	Lowered Body	*0.33*	High tail	**0.59**
Jumping up	**0.45**	Lowered head	**0.46**	Jumping	**0.28**
Jump off	*0.33*	Shiver	**0.52**	Licking	*0.34*
Licking	*0.35*	Stiff tail	**0.39**	Medium tail	*0.36*
Lip licking	0.27	*Tail Low*	*0.25*	Pacing	**0.44**
Medium Tail	*0.36*	Tail tucked	*0.25*	Panting	**0.46**
Pacing	*0.25*	Tense Body	*0.30*	Stiff tail	**0.39**
Panting	**0.46**	Weight back	**0.42**	Tense body	*0.36*
Weight forward	*0.33*			Weight back	**0.49**
Whining	*−0.50*				

p < 0.01, *p < 0.05*.

Time Alone Assessment

Similarly, comparing the time alone assessment with kennel behaviours, there were also significant correlations between many duration and frequency behaviours in the anxiety, arousal and fear emotional states (Table 9). Nearly all correlations were positive, demonstrating that most behaviours recorded in the kennel were related to those exhibited in the time alone assessment. Only three—whining, fast tail, and direct eyes—were negatively related, suggesting that these are not reliable indicators of the time alone test. There were also positive correlations between locations (Table 10).

Table 9. Significant (P<0.05) Spearman Rank correlation coefficients between behaviours recorded in kennel and behaviours exhibited during the time alone test in the behaviour assessment of shelter dogs (n = 38) within the emotional domains of arousal, fear, anxiety

Arousal		Fear		Anxiety		Friendliness	
Barking	**0.54**	Diverting	**0.52**	Ears back	**0.64**	Direct eye	*−0.32*
Fast tail	*−0.24*	Ears Back	**0.45**	Fast tail	*0.36*	Ears forward	**0.61**
High Tail	**0.61**	Lowered Body	*0.28*	High tail	**0.61**	Ears open	*0.29*
Jumping up	**0.38**	Lowered head	*0.30*	Jumping	**0.38**	Fast tail	**0.50**
Licking	**0.47**	Tail Low	**0.42**	Lip licking	*0.28*	Mouth open	**0.48**
Lip licking	**0.46**	Tail tucked	**0.43**	Medium tail	**0.46**	Medium tail	**0.46**
Medium Tail	**0.43**	Tense Body Posture	*0.23*	Pacing	*0.36*	Relaxed body	**0.51**
Pacing	**0.41**	Weight back	**0.47**	Panting	**0.41**	slow	**0.52**
Weight forward	*0.31*			Stiff tail	**0.50**	Sniff	*0.35*
Whining	*−0.23*			Tense body	*0.33*	Stand	**0.51**
				Weight back	**0.47**	Walking	**0.39**
				Weight forward	*0.31*		
				Whining	*−0.23*		

p < 0.01, p < 0.05.

Table 10. Significant (p < 0.05) Spearman Rank correlation coefficients between locations recorded in kennel and the time alone test of shelter dogs (n = 38).

Kennel Assessment	Time Alone Test		
	Door	Wall	Window
Front	*0.34*		
Wall		**0.54**	
Window		**−0.45**	*0.31*

p < 0.01, *p < 0.05.*

Relationship between Outcomes for the Dogs and summarised behaviour results

Comparing the time spent in the various behaviours for dogs that were adopted with those that were euthanased, dogs that displayed more barking, balanced or lowered posture, or positioned by the wall in the kennel assessment, or balanced/lowered posture or pacing in the behaviour assessment, or balanced posture or jumping up in the time alone test had an increased likelihood of being adopted (Table 11). Those that displayed more tense body posture in the kennel test or sitting/lying in the behavioural assessment were more likely to be euthanased.

Comparing the frequency of the various behaviours for dogs that were adopted with those that were euthanased, dogs that displayed more barking in the kennel assessment or balanced posture in the kennel or behaviour assessment or the time alone test had an increased likelihood of being adopted (Table 12). Those that displayed more panting in the kennel assessment, lowered head, or scanning in the behaviour assessment were more likely to be euthanased.

Table 11. Time spent in behaviours in the kennel, the formal assessment and time alone test of dogs (n = 38) that were adopted or euthanased, with Odds Ratio and Confidence Interval (CI) tested by binary logistic regression.

K/B/T	Behaviour	Adopted (% time)	Euthanased (% time)	Odds Ratio	95% CI
K	Barking	5.58	1.30	**1.47**	0.98–2.21
K	Balanced	44.06	22.34	**1.23**	1.03–1.49
K	Lowered	3.25	4.30	**4.22**	0.98–18.16
K	Tense	1.50	6.49	**0.09**	0.01–1.07
K	Wall	7.99	6.60	*1.53*	0.96–2.42
K	Sit/Lay	21.51	24.93	**1.52**	0.44–1.00
B	Balanced	66.41	44.60	**1.67**	0.97–2.87
B	Lowered	7.97	16.04	**1.72**	0.84–3.48
B	Pacing	37.59	30.94	**1.58**	0.98–2.51
T	Panting	59.21	68.99	*0.95*	0.89–1.00
T	Balanced	78.67	44.66	**1.50**	1.10–2.04
T	Jump up	18.35	30.21	**1.44**	1.07–1.92

$p < 0.01$, *$p < 0.05$*. K: Kennel B: Behaviour assessment T: Time alone.

Table 12. Frequency of behaviours in the kennel, behaviours in the formal assessment and time alone test of dogs (n = 38) that were adopted or euthanased, together with the significance of the difference tested by binary logistic regression.

K/B/T	Behaviour	Adopted (% Frequency)	Euthanased (% Frequency)	Odds Ratio	95% CI
K	Barking	19.32	8.50	*1.09*	1.01–1.19
K	Panting	54.64	65.46	*0.95*	0.91–1.00
K	Balanced	45.24	26.13	**1.19**	1.05–1.35
B	Balanced	40.89	27.72	**1.48**	1.11–1.98
B	Lowered Head	12.29	12.77	**1.25**	0.99–1.55
B	Scanning	3.08	4.66	**0.65**	0.44–0.95
T	Balanced	54.68	35.58	**1.34**	1.11–1.62

p < 0.01, *p < 0.05*; K: Kennel B: Behaviour assessment T: Time alone.

Discussion

One solution to increasing adoptability of shelter dogs is the early detection of behaviour problems followed by modification programs aimed at helping dogs develop desired behaviours. Longitudinal monitoring of behaviours using both kennel and formal behaviour assessment information to help create comprehensive insight of the dog's behaviour can help achieve this aim (Goold and Newberry 2017). Recent studies have pointed to the uncertainty of single behaviour assessments (Patronek and Bradley 2016), but the work of Goold and Newberry and this current research clearly demonstrate the benefit of continual monitoring. Continual monitoring allows correct identification of behavioural cues associated with separation-related behaviours, anxiety, fear, arousal, and friendliness. To identify these behavioural cues using monitoring tools in the first five days allows behaviour modification to be implemented to help these dogs to cope effectively in a socially isolating environment. Using a formal behaviour assessment, as customarily practiced in shelters, as a single context assessment of a dog's behaviour creates an ineffective profile of stable behavioural tendencies.

Behaviour in the Five Days after Surrender

This study focused on behaviour observations in the first five days after admission to a shelter and compared these to behaviour identified in a formal behaviour assessment. Over the first five days after admission, dogs displayed decreasing tense body and tucked tail, which are probably the best indicators of fear in the dogs. Previous studies that found that over the first five days after relinquishment to a shelter dogs will experience social isolation due to the breaking of social bonds with previous companions/owners (Hennessy et al. 1997; Stephen and Ledger 2006). Prior studies report numerous contradictory indications of the extent to which shelter dogs adapt over time, displaying behavioural and physiological indicators of positive and negative stress (Protopopova 2016). Some studies report a reduction in stress and fear related behaviours over time in shelters (Stephen and Ledger 2006; Hiby et al. 2006; Stephen and Ledger 2005), whereas others indicate that dogs display acute signs of negative stress and fear due to the high novelty of the shelter environment (Protopopova 2016; Kis et al. 2014). Although environmental factors influence these behaviours, including new olfactory, auditory, and sensory stimulation, dogs can either have a positive or negative coping style, thereby demonstrating effective or ineffective ability to cope in a new environment (Rayment 2015; Protopopova 2016; Taylor and Mills 2007. These diverse results are likely to be due to differences in resources offered by shelters.

The ability to monitor kennel behaviours associated with positive and negative stress or coping styles can help identify changes in the quality of life (QoL) of dogs in shelters (Barnard et al. 2016; Kiddie and Collin 2015). Identifying dogs that have a deterioration in positive behaviours allows early treatment. Interestingly, dogs that were deemed not suitable for adoption had higher durations of tense body posture in-kennel and increased frequency of jumping behaviour in kennel. Conversely, positive behaviours, including a balanced/relaxed body posture, had lower frequency of occurrence in dogs suitable for adoption.

Another interesting finding in the present study is the association between positive behaviours that include friendliness in dogs in the first five days, which agrees with previous studies (Stephen and Ledger 2006; Hiby et al. 2006; Goold and Newberry 2017; Stephen and Ledger 2005). These

findings highlight the benefit of longitudinal monitoring of behaviour in shelter kennels to identify stable behaviours that included docility and friendliness (Goold and Newberry 2017).

Behaviours in Assessment

Anxiousness, arousal, and fear tendencies correlated with its corresponding emotional domain in the behaviour assessment (Table 5), indicating a positive relationship with the domains identified in kennel and behaviour in the standardized assessment. Previous research by Mornement (2014) in behaviour assessments in Australian shelters indicated fear and friendliness were the only behaviours that were predictive. Other research using similar test protocols with social (stranger and toddler interactions) and non-social stimuli reported fear related behaviours as found in this research (Stellato et al. 2017; De Meester et al. 2011). As stated previously, the effect of acute stress and social isolation in dogs when relinquished to a novel environment have the ability to dramatically change behaviour. Thus, the result of increased fear, arousal, and anxious behaviour found in the kennel and at assessment (Table 4) suggest time-independent coping mechanisms that a dog may implement to help respond to the changing environment (Rayment et al. 2015; Bateson et al. 2011; Hohoff 2009). The results go beyond the previous study, suggesting that if coping mechanisms are ineffective at helping the dog cope with the environment, then those behavioural tendencies can manifest into behaviour problems that can be identified in an assessment.

Comparison between Kennel and Behaviour Assessment

The comparison of kennel behaviour and the formal behaviour assessment indicates that kennel behavioural cues associated with fear, anxiety, and arousal were confirmed in the formal behaviour assessment (Table 6). Furthermore, in the analysis of the position in kennel, we confirmed that position in the behaviour assessment was associated with front of kennel, door, and wall in each situation (Table 7).

Once the formal assessment was separated into component parts, specifically exploration of room and time alone, there were associations between behaviours found in these tests and kennel behaviours reflecting separation-related behavioural cues, anxiousness, arousal, and fear (Table 8, 9). Separation related behaviours are associated with increased whining, pacing, excessive

salivation, barking, jumping in orientation of owner's departure, and escaping behaviour (Ogata 2016). Studies show that separation-related behaviours can be correctly identified in video analysis of dogs in their time alone once the owner has left (Palestrini et al. 2010).

Furthermore, a study by Blackwell et al. (2013) into the identification of separation-related behaviours in shelters showed the importance of using a time-alone test to assess dogs with behaviour problems. The results clearly demonstrate the positive predictive value of the time alone test to identify separation related behaviours (Blackwell et al. 2013). Separation-related behaviours have been identified as a common problem post adoption (Serpell and Hsu 2001). Therefore, to identify these issues early is the key to early treatment, which could lead to an increase in the likelihood of successful adoption and therefore decreasing euthanasia. The findings with respect to fear are consistent with that of Mornement (2014), who identified its predictive validity. Research by Tiira et al. (2016) outlined high comorbidity between different anxieties, showing that fearful dogs had significantly higher noise sensitivity and separation anxiety.

Dogs with behaviours associated with separation-related problems, such as arousal and fear, were less likely to be deemed adoptable (Table 11, 12). Dogs that displayed friendly, low arousal, and docile behaviours were more likely to be adopted (Table 11, 12). Behavioural issues that have been linked to reasons for relinquishment of dogs include separation-related behaviours, arousal, and fear (Herron et al. 2014; Hemy et al. 2017; Neirdhard et al. 2002; New et al. 2000; Patronek et al. 1996; Salman et al. 1998). In contrast, behaviours that adoptees look for in dogs are associated with friendliness toward people, docility, and low arousal (King et al. 2009). Thus, increasing positive behaviours and decreasing separation-related behaviours, fear, and high arousal are critical to increase adoptability, thereby decreasing euthanasia. Early recognition of ineffective behaviours and coping mechanisms allows shelters to implement behaviour management programs before behavioural problems manifest (Sherman et al. 2008; Takeuchi et al. 2000). Behaviour assessments are comprised of numerous tests that allow for a snapshot of a dog's behaviour that is multifactorial. Therefore, a paradigm shift should occur in shelters to implement assessments as continuous tools to monitor a dogs' behaviour over time. Once unsuitable or problem behaviours are identified,

shelters can create effective modification plans to allow issues to be solved before manifesting into serious behavioural problems. Using assessments in shelters to identify past behaviours in the previous home or to predict future behaviour is difficult. However, using assessments as a tool to understand the behaviour of dogs in conjunction with continual kennel monitoring and everyday interaction may allow identification of behavioural issues and ineffective coping mechanisms. Further research into monitoring of behaviours associated with the manifestation of behavioural problems in shelters is warranted.

Some limitations are associated with this research that future studies should consider. To allow for comprehensive behaviour analysis of dogs, previous home environment could be taken into consideration. Therefore, we should try to more accurately represent behaviour in the home. Our sample size was relatively small, but due to the nature of the study, which identified changes in behaviours over time on single dogs, it is not seen as a major restriction. Finally, the limitation of variability between each shelter should be taken into consideration and warrants further study.

Conclusions

Previous research suggests that behaviour assessments are ineffective, focusing on the lack of their accurate predictability of behaviour. However, in this study, we found that behaviour assessment information can be related to behaviour over the previous days since relinquishment to the novel environment. Effectively monitoring kennel behaviour allows early recognition of problems. Numerous authors have recommended continual monitoring procedures to help identify key behavioural problems as early as possible. This research has demonstrated numerous correlations between kennel behaviour and that displayed during formal assessments. We suggest that shelters should use continuous monitoring techniques at the same time as supporting automated behaviour problem recognition. Continuing to use formal assessments and incorporating longitudinal monitoring of behaviour to help identify dogs unable to cope effectively in shelter environments may also provide useful additional information of dog behaviour problems. Such monitoring allows early implementation of training modification, thereby increasing adoptability of dogs that once would be deemed unadoptable.

Chapter 4: Do behaviour assessments in a shelter predict the behaviour of dogs post adoption?

Contributions: PhD candidate (LC) designed the experiment, collected data, conducted behavioural analysis, analysed the data, drafted and wrote the paper (90%). Supervisory support was offered from (CJCP, MP, GP, PB) for methodological oversight and editing the paper (10%).

"If to be feeling alive to the suffering of my fellow-creatures is to be a fanatic, I am one of the most incurable fanatics ever permitted to be at large" *William Wilberforce*

Abstract

In shelters it is usual to conduct standardised behaviour assessments on admitted dogs. The information gathered from the assessment is used to identify dogs that are suitable for adoption and assist in matching the dog with suitable adopters. These assessments are also used to guide behaviour modification programs for dogs that display some unwanted behaviours. For some dogs, the results may indicate that they are unsuitable either for re-training or for adoption. In these circumstances the dogs may be euthanised. We investigated the predictive value of a standardised behaviour assessment protocol currently used in an Australian shelter for dog behaviour post-adoption. A total of 123 dogs, aged 1–10 years and housed in an animal care shelter, were assessed before they were adopted. The new owners of the dogs took part in a post-adoption survey conducted 1 month after adoption, which explored the behaviour of their dog after adoption. Ordinal regression analyses identified that friendly/social, fear and anxiousness identified in the shelter assessment significantly predicted corresponding behaviours post-adoption. However, behaviour problems, such as aggression, food guarding and separation-related behaviours, were not reliably predicted by the standardised behaviour assessment. The results suggest that further research is required to improve the predictability of behaviour assessment protocols for more specific behaviour problems, including different categories of aggression and separation-related

problems. We recommend that dog behaviour assessments in shelters are used only in conjunction with other monitoring tools to assess behaviour over the whole shelter stay, thus facilitating increased safety/welfare standards for dogs, shelters and the wider community.

Introduction

In Australia, the Royal Society for the Prevention of Cruelty to Animals (RSPCA) is a National, not-for-profit organisation that accepts approximately 46,000 dogs per year (RSPCA, 2018). A 2014 study found that these dogs, most of which were adult, were most commonly admitted after being collected by local council officers as strays (34%) (Hemy et al. 2017). Others were presented by members of the public as strays (24%), owner surrenders (19%), or euthanasia requests (4%), with a small number being brought in by Humane Officers, employees of the RSPCA tasked with rescuing animals from situations where their welfare may be compromised (6%). Other studies have shown that relinquishment reasons are usually human-related (unwanted, changed circumstances, financial, owner's health, household problems) but medical issues and behavioural problems also lead people to relinquish their dog (Wells, 1996; Miller et al., 1996; Patronek et al., 1996; DiGiacomo et al., 1998; Wells et al., 2000; Martson et al., 2004; Mondelli et al., 2004; Orihel et al., 2005; Hemy et al., 2017). In the Australian study most dogs were either reclaimed (32%) or adopted (43%), with 14% euthanised. Reasons for euthanasia were dog behaviour (53%), dog health (23%), and owner requested (20%) (Hemy et al. 2017). If euthanased for behavioural reasons, it is likely that the dog displayed severe aggression, fearfulness and/or escaping behaviour.

Many shelters attempt to identify behavioural problems by continually monitoring behaviour and by formal behaviour assessments (BAs) while dogs are in care (Goold and Newberry, 2017; Mornement et al., 2015). The behaviour assessments aim to identify behaviours that may cause problems in the dog's future home, and to give an overview of the dog for potential adopters (Mornement et al., 2014). However, their ability to predict future behaviour or behavioural issues is questioned (Patronek and Bradley, 2016). There is a concern that dogs that appear aggressive during a BA are being unnecessarily euthanased because they would not necessarily be aggressive in a

home environment, and that non-aggressive dogs may be adopted out only to become aggressive at a later stage in the new home.

Life in a shelter is stressful and traumatic for dogs due to sensory overstimulation, social isolation, change/loss of control of daily routines and the novelty of the environment (Mornment; 2014; Shiverdecker et al. 2013; Polgar et al.; 2019). Stress has wide-ranging impacts, including on cognitive ability, behaviour and the dogs' emotional state (Gronli et al., 2005; Ledoux, J 2007; Dbeic and Ledoux, 2009).

Therefore, a standardised BA conducted in shelters may not provide an accurate representation of the normal behaviour of the dog in a more stable and settled home environment.

Research conducted by Mornement et al. (2014) in Australia compared the results of a Behaviour Assessment for Re-homing, K9′s (B.A.R.K.), administered in shelters, with results of a post-adoption survey. They reported that the only predictable outcomes were friendliness and fear-related behaviours. However, other behaviours, in particular aggression and food guarding, are rare post-adoption; Mohan-Gibbons (2012) found that only six out of 96 adopted dogs were reported to display at least one incident of food guarding in the first 3 weeks, and at 3 months the adopters reported no food guarding behaviours at all. There was no evidence in this study, or a subsequent study, that food guarding increased return of the dogs to the shelter (Mohan-Gibbons et al. 2018). In addition, injuries to staff, volunteers and adopters were rare and did not change if the food guarding test was omitted from the assessment.

'Time alone' tests have been used to identify dogs with separation-related behaviours (Blackwell et al. (2013). Separation causes dogs to exhibit anxiety when away from owners or people in general; it is expressed as vocalisation, destruction of their environment, excretion, drooling, attempting to escape and depression-like responses (Storengen et al., 2014; Ogata, 2016). Most shelters include a time alone test in their BA, during which the dog is placed alone in an unfamiliar room and observed for up to 10 min (Blackwell et al. (2013). Dogs with separation-related anxiety spend the majority of the time vocalising, orienting to escape, panting and engaging in destructive behaviour.

Despite the current controversy about the use of BAs in shelters to gain an understanding of a dog's behaviour and to identify any major or minor behavioural problems, we consider that assessments still have a role to play (Clay et al. 2020). They can be used to identify stable behaviours. To further our understanding of how well BAs can predict dog behaviour in adoptees' homes, we aimed to identify whether the standard BA protocol conducted at a Queensland shelter 5 days after admission predicted behaviour in adopters' home environment, as assessed 1 month post-adoption.

Materials and Methods

<u>Ethical Approval</u>

This study was conducted with the approval of The University of Queensland Human Ethics Committee (2017000044). The RSPCA Animal Welfare and Ethics committee approved the use of data from the RSPCA Queensland survey of adoptees and behaviour assessment data.

<u>Subjects</u>

The dogs used in the study were housed at the RSPCA Queensland Animal Shelter at Wacol. Before inclusion in the experiment, dogs were assessed by a veterinarian and identified as having no apparent medical problems. Upon admission to the RSPCA, behaviour profiles were completed by the owners for owner-surrendered dogs (these were not available for stray dogs). Each dog was then evaluated by an RSPCA behaviour assessor using the RSPCA Qld. behaviour assessment 5 days after admission (Clay et al., 2019). Data were collected from 955 dogs. Of the 955 owners that adopted these dogs, 125 were successfully contacted later and completed a post-adoption survey (14% response rate). Two owners initially agreed to participate in the study when contacted but later declined to take part.

<u>Behaviour Assessment</u>

A standardised behavioural assessment (Appendix 2) was conducted on all dogs during their stay at RSPCA Queensland by two staff (one Handler and one Observer/Rater) responsible for evaluating the dogs' suitability for re-homing. These assessments were not able to be repeated due to staffing changes, therefore intra-rater and inter-rater reliability assessments were not possible. The assessments monitored the following behaviours: room exploration, behaviour when on a leash, sociability, tolerance, play behaviour with toys, tag (run and freeze), possessive behaviours, toddler and stranger interaction, time alone and social interactions with other dogs (RSPCA, 2012) (Clay et al., 2019). The assessment comprised 11 different tests performed over a 15 min period, 10 have previously been described in detail (Clay et al., 2019). The additional test 'Response to a fake cat" is outlined in Appendix 2. The equipment used followed RSPCA Queensland's protocol and

included a 1.8 m leash, tennis ball, squeaky toy, rope, plastic hand on an extended pole, bowl, raw hide or bone, and combination of wet and dry dog food. At the conclusion of the behavioural assessment, animals were either deemed suitable for re-homing ($n = 772$), enrolled in a behaviour modification program ($n = 133$) or scheduled for euthanasia ($n = 50$). Decisions for behaviour modification and/or euthanasia were made by a professional review panel.

Behaviour Scoring by RSPCA Assessors

In each test, one RSPCA assessor rated the behaviour of the dog using binary occurrence of behavioural states (present or absent), except for the resource guarding test, which relied on a score by the assessor on an 8 point scale (Table 13). An overall score using the 11 tests was determined. All behaviours were assessed in each test using binary scoring (present or not) (Table 14)

Table 13. Resource guarding scoring system aimed at identifying possessive aggression by the dogs in defence of food.

Possession Level	Description
Level 1	Stops eating, wags tail loosely, and sniffs hand and looks to handler with soft eyes and relaxed body. Body language indicates no distancing behaviours.
Level 2	Continues eating, soft eyes, wags tail loosely, and body language indicates no distancing behaviours; typically a relaxed body stance/carriage.
Level 3	Continues eating but at a faster rate of intake. Body is slightly tense, particularly on human approaching the dog; tail wagging with an increased speed, especially on interaction with the dog and/or the food/treat. The dog blocks access to the food with their body (head and shoulder over the food and treat).
Level 4	The dog's discomfort and behaviour starts to escalate. The dog glares, lifts its lip in a snarl, and/or produces a low growl. Increases eating speed, or with a treat the dog will whip its head away in an attempt to move it away from handler.
Level 5	Dog will carry the food item under a chair, bed, or into its crate, then growl on approach. If it cannot pick the food/treat up, it pushes the food bowl farther away. Dog freezes (stops eating or chewing), with whale eyes (exhibiting sclera) or direct stare, with or without lifting the lip in a snarl or other type of growl.
Level 6	Dog snaps but with no contact with fake hand. Level 5 behaviour usually continued but dogs move through the behaviours rapidly.
Level 7	Dog's protectiveness increases with one or more rapid bites that touch the fake hand with quick and hard contact.
Level 8	Dog freezes with whale eyes or direct eye contact and biting aimed at the intruder even if they are at the perimeter of the room. At this level, it may be too dangerous to step into the perimeter to determine if the dog will bite or not.

Table 14. Behaviours evaluated in the Royal Society for the Prevention of Cruelty to Animals (RSPCA) Queensland canine behaviour assessment.

Behaviours	Definition
Play	Interacting with toys in social manner, may interact with handlers.
Friendly	May jump up on the person/dog licks person, dog nudges hand; play bow.
Social	Approaches and looks at assessor; stays with assessor making regular soft eye contact; low tail wagging, body relaxed, when assessor interacts may lower body.
Fearful	Cowers; runs away or avoids interaction, may tremble; tail tucked tightly, attempts to hide; at end of taut leash; mouth closed or panting excessively.
Anxious	Inability to settle and relax, distressed vocalisation, wide eyes, dilated pupils, excessive panting and licking, yawning and proximity seeking behaviour.
Arousal	Medium to hard mouthing of person; jump up and grab person's clothing or body part; may mount person; inability to calm down; takes little to escalate the arousal levels.
Predatory behaviour	Sequence of behaviours that are associated with the catching and killing of another 'animal' for consumption, in this case a fake cat.
Reorienting	Changes direction away from stimulus.
Avoiding stimulus	Moves away from the stimulus.
Unresponsive	No behaviours change due to stimulus.
Aggression	Growls; shows teeth; snaps; directed stare; dilated pupils; attacks; bites
Displacement	The transfer of feelings or behaviour from their original object to a person or thing. Displacement behaviours include self-grooming, touching, stretching, yawning, displayed when an animal has a conflict between two motivations, such as the desire to approach an object while at the same time being fearful of that object.
Attracted to stimulus	Moving all the way to the end of the lead towards a stimulus until it is in full tension.
Appeasement	Individual attempts through appeasement displays to avoid injury by a dominant dog or human.
Reactive	Dogs respond with excessive reactions to a stimulus.
Separation related behaviours	Behaviours that are associated with being left alone; behaviours can include panting, pacing, excessive vocalisation, scratching at doors, excessive jumping, and damage.
Possessive behaviour	Aggression whilst guarding things (food bowls, rawhides, stolen, or found items, toys).

Post-Adoption Phone Interview

Participants were asked when adopting a dog if they would agree to be included in a post-adoption phone survey. The survey was conducted by RSPCA customer service staff 1 month after adoption of the dog. The phone survey asked about the dog's behaviour in the home environment and in different everyday situations (Appendix 3). It took approximately 10 min to complete and consisted of 36 multi-choice questions with the option to add additional information.

Participants rated the frequency of socialisation to owners and children, and behaviour with run and freeze play, an unfamiliar person, unfamiliar children, an existing dog, an unfamiliar dog, and interactions with cats, on a 5 point scale (1: moves towards you in a playful manner, 2: moves, leans, or looks away, 3: no response, 4: moves or leans away in a manner that concerns you, 5: moves towards you in a way that concerns you).

Statistical Analysis

Statistical analysis was conducted using Minitab 18. Behaviour data were first screened for errors and then transposed into percentage of occurrence in tests for descriptive analyses. Ordinal logistic regression analysis using a logit model was used to identify behaviours in the assessment that best predicted dog behaviour post-adoption.

Results

Descriptive details

The sample included 123 companion dogs (males: 61, females: 62) over the age of 1 year and under 10 years. The sources for the 125 dogs were as follows: owner surrender (45%); transfer (17%); RSPCA officer intake (13%); stray (12%); return (6%); lost (5%); emergency ambulance intake (3%); and pound (1%). The majority of dogs in the study were mixed breeds (45%). Median time of stay in shelter was 55.5 days (range 3–114 days).

Behaviour assessment (Table 15)

The number of dogs displaying the different behaviours during each test is presented in Table 15.

In Test 1, "Exploring the Room", in the Exploration and Upon Call phases, dogs had a high occurrence of Friendly behaviour, with low occurrences of Anxious, Fear, and Arousal behaviours (Table 15). In Test 2, "Tolerance to Handling", in all components the majority of dogs displayed friendly interactions with the assessor, with increases in Anxious behaviours in Stroke and Foot Sensitivity (Table 15). In Test 3, "Startle Response", there was higher Avoidance, Fear, and Arousal in the Startle component, compared to the Recovery period, with a high occurrence of dogs displaying Friendly behaviours (Table 15). Recovery times varied between dogs, with 68% recovering within 5 s, 22% within 6–10 s and 3% taking over 10 s (7% of dogs did not exhibit as startle response).

In Test 4, "Toy Interactions", there was a high occurrence of Play in all components of the test, with low instances of Fear and Anxious behaviour (Table 15). The component with the greatest number of dogs exhibiting Arousal was Rope interactions. In Test 5, "Response to Unusual/Predictable Stimulus", there were high occurrences of Friendly behaviour in the Run and Freeze components but low levels of Anxious, Arousal and Fear behaviours (Table 15). In Test 6 (data not shown), "Resource Guarding", dogs displayed a high occurrence of levels between 2 and 3 with wet (68.2%) and dry food (80%). There were low occurrences of levels 4–6 with bone (9.9%) or pig's ear (7.43%).

In Tests 7 and 8 "Stranger Interactions" and "Toddler Interactions", there were high occurrences of dogs displaying Friendly behaviour, with under 10% displaying Anxious or Displacement behaviours, Fear, or No Response towards the stranger (Table 15). Furthermore, there was only one dog that displayed Aggressive behaviour in each test. In Test 9, "Fake Cat", there were high occurrences of Friendly behaviour towards the fake cat, with minimal dogs displaying other behaviours (Table 15). In Time Alone (Test 10), 51% of dogs displayed Separation-Related behaviours, 31.4% displayed no problematic behaviours and 18% displayed Anxious behaviours.

Finally, in Test 11, "Behaviour with Another Dog", Friendly behaviours had the highest occurrence in dogs in all components of the test, with low levels of all other behaviours (Table 15). One

interesting finding was the higher instance of Reactivity towards the opposing dog during the Walking component, which did not occur in the Circling or Nose to Nose components (Table 15).

Post adoption behaviour

Only three participants no longer had the dog they had adopted. The remaining 120 participants still had their dog. With regard to the dogs' living arrangements, 49% were indoor/outdoor dogs, 29% mainly indoors and 23% mainly outdoors.

Participants were asked how the dog responded to different situations (Table 16) with most owners outlining that the dog "moves towards the stimulus in a playful manner" and a low occurrence of the opposite response. In situations related to unfamiliar visitors and unfamiliar dogs, there were higher levels of "moves, leans or looks away", "moves or leans away in a manner that concerns you", and "moves towards in a way that concerns you" (Table 16).

In terms of interactions with cats, 93 (74%) participants did not answer, with 32 participants answering that their dogs interact with cats with 19% of dogs moving towards them in a playful/friendly manner, and under 3% displaying other behaviours. With respect to resource guarding, participants were asked whether they were concerned about their dog's behaviour around food, treats, toys, and human food; over 90% reporting that there were no issues and under 10% saying there were issues (Table 17).

Table 15. Number of dog (and %) exhibiting behaviour's in the various test components in the behavioural assessment of shelter dogs (n = 123).

Test	Component	Friendly	Anxious	Fearful	Arousal	Appeasement	Aggression	Avoided	No response	Displacement	Reorientated away	Predation	Attraction to stimulus	Reactive	Play	Possession	Separation related behaviours
1	**Exploring the room** Exploration	111 (85)	12 (9)	3 (2)	1 (1)	0	0	0	0	0	0	0	0	0	0	0	0
	Upon Call	91 (70)	13 (10)	23 (18)	3 (2)	0	0	0	0	0	0	0	0	0	0	0	0
2	**Tolerance to Handling** Collar	73 (58)	19 (15)	10 (7)	2 (1)	21 (17)	0	0	0	0	0	0	0	0	0	0	0
	Stroke	70 (56.5)	20 (15.6)	7 (5.6)	6 (5)	21 (16.7)	1 (0.6)	0	0	0	0	0	0	0	0	0	0
	Foot	68 (54.8)	15 (11.63)	6 (5.35)	12 (9.23)	23 (18.49)	1 (0.5)	0	0	0	0	0	0	0	0	0	0
3	**Startle response** Startle	29 (24)	13 (10)	24 (19)	24 (19)	1 (1)	0	34 (27)	0	0	0	0	0	0	0	0	0
	Recovery	102 (82)	14 (11)	9 (7)	0	0	0	0	0	0	0	0	0	0	0	0	0
4	**Toy interactions** Tennis ball	0	0	5 (4)	11 (8.5)	0	0	0	16 (13)	0	0	0	15 (12)	0	75 (60)	3 (2)	0
	Squeaky toy	0	0	3 (2.2)	10 (7.7)	0	0	0	14 (11.3)	0	0	0	28 (22.5)	0	68 (54.5)	3 (2)	0
	Rope	0	9 (7.5)	9 (7)	19 (15.1)	0	0	0	4 (3)	0	0	0	8 (6)	0	75 (60)	0	0
5	**Response to unusual/unpredictable stimulus** Run	87 (69.35)	16 (12.9)	12 (10)	0	0	0	0	3 (2.3)	1 (1)	0	0	0	0	0	0	0
	Freeze	73 (58.25)	15 (11.7)	1 (1)	18 (14)	0	0	0	3 (2.6)	6 (4.5)	17 (14.3)	0	0	0	0	0	0
7	**Stranger interaction** Entry	105 (84)	9 (7.7)	3 (2)	0	0	0	0	5 (3.6)	3 (2.4)	0	0	0	0	0	0	0
	Approach	98 (78.65)	7 (5.74)	8 (6)	1 (1)	0	0	0	1 (1)	9 (7.3)	10 (14.3)	0	0	0	0	0	0
	Leaving	68 (54)	0	0	0	0	1 (0.84)	0	0	15 (12.1)	41 (33.06)	0	0	0	0	0	0
8	**Fake toddler interaction** Approach	93 (74)	8 (6.34)	9 (6.9)	4 (3.54)	0	1 (1)	0	0	11 (8.7)	0	0	0	0	0	0	0
	Leaving	71 (56.41)	0	0	0	0	1 (1)	0	0	9 (6.84)	43 (34.19)	0	0	0	0	0	0
9	**Fake Cat** Approach	101 (81)	0	7 (5.36)	2 (1.7)	0	2 (1.7)	0	5 (4)	5 (4.34)	0	2 (1.7)	0	0	0	0	0
10	**Time alone** 2 minutes	0	22 (18)	0	0	0	0	0	39 (31.4)	0	0	0	0	0	0	0	64 (51)
11	**Behaviour with another Dog** Walking	100 (79.84)	0	0	0	0	3 (2.48)	0	0	7 (5.52)	0	0	0	15 (12.16)	0	0	0
	Circling	88 (70.07)	6 (4.71)	2 (1.39)	8 (6.5)	0	9 (7.12)	0	2 (1.39)	4 (3)	0	0	7 (5.81)	0	0	0	0
	Nose-Nose	82 (65.93)	5 (3.9)	8 (6.45)	8 (6.23)	0	4 (3.15)	0	0	10 (14.33)	0	0	8 (6.23)	0	0	0	0

* Test 6 resource guarding was not included in the table due to the different method of scoring of the behaviour.

Participants were asked how their dog reacts to a loud noise or something else startling the dog. 37% ignored the question, 25% reported a mild startle response from their dog, 9% of dogs ran and hid, and 4% displayed a pronounced startle response. With dogs that were startled, participants were asked how long it took them to recover; 45% recovered immediately, 29% recovered within a few seconds, 15% recovered between 5 and 10 s, and 11% took longer than 10 s, avoided the situation and did not settle.

Participants were asked if they had ever left the dog alone, with 114 saying yes, and only nine saying no. Of the 114 participants that responded yes, 59% of dogs were left outside, 24% were left inside, 14% were allowed a combination of inside and outside, and 3% were left in a laundry or garage. Time spent alone ranged from 5 to 12 h (55%), 1–4 h (36%) and less than an hour (9%). Participants were asked whether their dog's behaviour changed when they were preparing to leave, with 72% reporting no change and 28% some changes in behaviour. Participants were asked if any behaviours were of concern, with 80% saying no, and 21% saying yes.

Table 16. The percentage (%) of dogs (n = 120) displaying specific behaviours post-adoption.

Question	Moves towards in a Playful Manner (1)	Moves, Leans or Looks Away (2)	No Response (3)	Moves or Leans away in a Manner that Concerns you (4)	Moves towards in a Way that Concerns You (5)
Attention (Q5)	91.87	0.82	3.25	0.82	3.25
Children (Q7)	88.73	1.41	2.82	1.41	5.63
Run and freeze (Q8)	91.89	1.00	4.50	1.00	2.70
Unfamiliar visitors (Q9)	73.17	9.76	4.88	6.50	5.69
Unfamiliar children (Q10)	85.58	3.85	5.77	1.92	2.88
Existing dog (Q14)	84.62	5.13	0.00	2.56	7.69
Unfamiliar dog (Q16)	60.16	6.50	11.38	2.44	7.32

Table 17. The percentage (%) of dogs (n = 120) displaying possessive behaviour post-adoption.

Concern about Behaviour around Food, Treats, Toys and Human Food	No	Yes
Dog food	90.8	9.2
Treats	95.0	5.0
Toys	95.8	4.2
Human food	93.3	6.7

Standardised assessment scores verses Owner surveys

Ordinal regression analyses were conducted to determine whether scores derived from the behaviour scores in assessment tests could predict behavioural traits in the new home using reported behaviour in the home environment as the dependent variable. Questions from the survey that called for a response along a 5-point scale were related to relevant tests in the assessment that measured interactions with the handler, children, strangers and dogs, as well as the startle response, response to usual stimulus, food items and time alone situations. The regression analyses found that friendly/social behaviours (scored in tests: Interaction with Assessor in exploration of room, Response to unusual/unpredictable stimulus, Stranger interactions, Behaviour with another dog) significantly predicted 'playful/friendly manner' behaviour post-adoption in interactions with owners, children, strangers, existing dogs and unfamiliar dogs (Table 18). Anxious behaviour (scored in the tests: Assessor in exploration of room, Response to unusual/unpredictable stimulus, Fake toddler doll and Behaviour with another dog) significantly predicted 'Moving towards owner/children/stranger in a way that concerns you' behaviour post-adoption with interactions with owners, unfamiliar child, running and freezing, and unfamiliar dog (Table 18). Fear (scored in the tests: Assessor in exploration of room, and Fake toddler doll) significantly predicted 'Moves or leans away in a manner that concerns you' post-adoption with interactions with owners, and children (Table 18). The remaining 13 post-adoption behaviours were not predicted by the standardised behaviour assessment protocol conducted at the shelter.

Table 18. Significant or trend level (p < 0.10) relationships between behaviours scored from the shelter behaviour assessment and responses in the post-adoption survey, analysed by ordinal logistic regression.

Behaviour	Test	Proportion Showing Behaviour in each Survey Category	Post Adoption	Coef	SE Coef	Z	p	Ratio	Lower	Upper
	1	0.91	Owners	2.50	1.45	1.73	0.05	12.21	0.71	208.88
	8	0.88	Children	2.68	1.20	2.23	0.02	14.65	1.39	154.41
Friendly/social	7	0.73	Stranger	1.06	0.55	1.94	0.05	2.89	0.99	8.46
	11	0.84	Existing dog	1.23	0.63	1.94	0.05	3.42	0.99	11.83
	11	0.60	Unfamiliar dog	1.42	0.63	2.27	0.02	4.14	1.21	14.16
	1	0.03	Owners	−1.43	0.79	−1.80	0.07	0.24	0.05	1.14
	11	0.07	Unfamiliar dog	−1.40	0.53	−2.62	0.01	0.25	0.09	0.70
Anxious	8	0.03	Unfamiliar child	2.38	1.02	2.34	0.02	10.83	1.47	79.46
	5	0.03	Run and freeze	−1.40	0.53	−2.62	0.00	0.25	0.09	0.70
	1	0.01	Owners	2.20	1.10	2.00	0.04	9.00	1.05	77.36
Fearful	8	0.01	Children	1.50	0.81	1.86	0.05	4.49	0.92	21.85

Discussion

The aim of this paper was to evaluate how well the standardised behaviour assessment (BA) protocol currently used in a Queensland RSPCA shelter predicted post-adoption behaviours. In general, the ability of the standardised BA protocol to predict specific behaviours post-adoption was only somewhat effective. It appears, then, that the standardised BA may, as previous authors have outlined (Mornement 2015), be useful as a tool for providing an overall measure of dog behaviour, particularly with respect to friendly, fearful, and anxious behaviour, but that it requires supplementation with other sources of information. However, our study was unable to adequately assess whether behavioural problems, specifically the identification of different categories of aggression, possessive behaviour (resource guarding), or separation anxiety, can be predicted from shelter assessments, since dogs displaying these behaviours were not rehomed.

There are several possible explanations for why the assessment was not more strongly predictive of our outcome measures. One constraint is that we cannot predict how an owner's behaviour or personality, and other animals/individuals in the household, can influence/affect the dog's behaviour post-adoption. Such effects may be substantial. Due to this, it may not be realistic to expect to be able to predict with accuracy behaviour over time.

A further explanation is that the standardised protocol may be inadequate as a tool to assess complex canine behaviours and behavioural problems either because of the structure of the assessment and/or its administration or due to the complex nature of such behavioural problems. We argue that the instrument is unlikely to be inadequately designed as it draws upon countless research studies and has been used and modified over many years (Mornement et al., 2014; Marder, et al., 2013; Weiss, 2007; Bennett et al., 2015; Planta et al., 2007). The administration is also unlikely to have been inadequate, due to the standardised nature of the tests. Staff were trained and evaluated in the shelter, with the majority of the dogs in the large sample being assessed by the same individuals.

Another possible explanation is that due to the nature of canine behaviour, only some aspects of behaviour are stable (Diederich and Giffroy 2006; Taylor and Mills, 2006). Some aspects of canine behaviour may not be predictive in a single test, including aggression or other behaviour problems. Consistent with this idea was the number of new owners who reported their dog moving towards an individual in a way that concerned them, even though these dogs did not show these behaviours in the shelter assessment, or were not identified by shelter staff as displaying aggressive tendencies outside of the assessment. Dogs that displayed aggressive tendencies in the BA, or at other times during their stay at the shelter in the Queensland facility, were reviewed by a consultant for further testing. Such dogs were either then enrolled in a behaviour modification program or deemed to be unsuitable for adoption. Indeed, this study is similar to other studies in the area of canine behaviour assessment in shelters (Mornement et al., 2014; Mohan-Gibbons et al. 2010; Mohan-Gibbons et al. 2018), where only dogs that did not show signs of aggression were made available for adoption and therefore included in the sample.

This suggests that there is a high possibility of a number of false negatives in the initial BA, which therefore is not offering a valid index of aggression. As seen in numerous studies, to reliably identify aggression and diagnose its causation is difficult, due to its infrequency and the nature of behavioural problems. Canine aggression is complex, and may be context specific (Luescher, 2008). The belief that one can assess a dog and diagnose it as aggressive is incorrect and should not be done. A specialist trained to identify and classify canine aggression would be in a better position to have a comprehensive understanding of physiology, behaviour and neurology, thus allowing a more nuanced diagnosis to be drawn (Stelow, 2018). Even in an assessment used primarily for identification of aggression, for example, the Dutch Socially Acceptable Behaviour (SAB) test, a portion of aggressive dogs remained undetected and the test was substandard for the assessment of

types of aggression unrelated to fear (van der Borg et al, 2010). This leads to the idea that fearful and anxious behaviours may be more stable and easier to detect than forms of aggression that can be motivated by numerous factors (Polgar et al., 2019).

The final possibility is that canine behaviour may be predictable and the standard BA protocol used may be adequate at measuring certain categories of common/prominent canine behaviours (Friendly, Fearful, Arousal, Anxious), due to the common occurrence of these behaviour in everyday populations. However, due to the administration of the assessment after 5 days in the new environment, the tests may produce deceptive results. While many shelters maintain the highest standards of animal welfare, dogs still suffer from social isolation, abnormal sleep patterns, auditory pollution, olfactory overstimulation, and emotional stress, especially if individuals have no prior experience in shelters and do not habituate using positive coping mechanisms. The stressors that are inherent in any shelter may force some dogs to employ negative coping mechanisms (avoidance, inhibition or appeasement) as an outlet rather than displaying aggression (Christensen et al,. 2007; Heath, 2019). This may especially be the case after surrender and over the first few days of entering the shelter, with some dogs likely to experience acute stress and social isolation (Polgar et al,. 2019). Research into this area has found that shelter dogs showed more aggression when tested 2 weeks after being admitted to a shelter in comparison to 1–2 days after surrender (Kis et al., 2014). Furthermore, only a few studies have studied the relationship of aggression with welfare standards for dogs (Taylor and Mills, 2007; Polgar et al., 2019) and whether the behaviour is due to environment stressors. Evidence in the literature suggests that stress can have an effect on cognitive function, negative emotional state and behaviour (Gronli et al., 2005; Ledoux, J 2007; Dbeic and Ledoux, 2009). This implies that standardised canine BAs, timed incorrectly and used to make decisions about dogs (rehomed, trained or euthanised), may give false information to shelter staff.

Consistent with this possibility, recent studies into the test used to identify food resource guarding found the prevalence of issues post-adoption were low and that removal of the test did not increase the likelihood of food guarding in the new home (Mohan-Gibbons et al. 2010; Mohan-Gibbons et al. 2018). The reason for this result can be identified in the complex aetiology behind food resource guarding. It is defined as the use of avoidance, threatening or aggressive behaviours by a dog to retain control of food or non-food items in the presence of a person or other animal (van der berg 1991). It is not surprising that many dogs are so labelled in a shelter environment, due to the high occurrence of acute stress from sensory overload causing dogs to feel threatened and in turn aggressive. However, outside of the shelter environment, in a non-threatening and predictable

environment, this reaction decreases. In addition, other types of aggression, such as territorial and maternal, remain very difficult to assess in shelters (van der berg et al., 1991; Luescher, 2008).

We advocate that shelters must look for a new approach that allows an improved ability to identify behaviour problems in a more stable environment. One such solution currently implemented in RSPCA Queensland shelters is the use of a foster care system, in which dogs that are unable to cope in the shelter are housed with foster carers until they are able to be adopted. This solution allows dogs to live in a stable environment with minimal exposure to stressors that may otherwise lead to the deterioration of the dog's behaviour thus leading to behaviour problems. Furthermore, it allows shelters to house more dogs able to cope in the shelter environment, as well as individuals requiring behaviour modification and further testing of behaviour problems. In addition, RSPCA Queensland uses a qualified behaviourist to help to understand dogs that are identified in the behaviour assessment as having behavioural issues. The consultant conducts further tests to better identify the behavioural problems and implement behaviour modification programs with the use of qualified dog trainers. The dogs are constantly reviewed and evaluated to monitor progress over time.

However, implementing these solutions requires resources that most shelters do not have. Most shelters have financial, time and staff constraints that hinder them utilising such techniques. The authors understand that no one BA protocol has the ability to accurately predict every future behaviour, but these assessments can be used as one tool in conjunction with continual monitoring of behaviour and health of dogs in shelters, to gain an overview of the dog's behaviour and identify dogs that require further testing or behaviour modification. Additionally, BAs can be used as monitoring tools to identify dogs not coping in the novel shelter environment. This, in conjunction with surrender information, veterinary monitoring and evaluations, in-kennel scoring from staff and volunteers, and behaviour modification should help develop a better system for shelters. To achieve this, continuous improvement and studies into dog behaviour in shelters are required.

Conclusions

Findings from this study suggest that a standardised behaviour assessment protocol used at an Australia shelter is a useful tool to predict some behaviours, mainly, friendly, fearful, arousal and anxious behaviours. However, in the predictability of behaviour problems, such as different categories of aggression or separation anxiety, it appears largely ineffective. This may be a result of the assessments being conducted in a highly stressful/novel environment where dogs experience many stressors in addition to lack of a human–animal bond, and then trying to use that information

to predict home behaviour in a stable environment where supportive social bonds have formed. A thorough review of the protocol is recommended to identify any possible improvements, and care should be taken if the BA is the only tool used to identify a dog's adoption suitability. However, using the BA as one tool in a toolbox of many others, including pre-surrender information, veterinary clinical assessments, monitoring in kennel and responses to training, may provide a more comprehensive picture of behaviour. Behaviour is multifactorial, requiring an in-depth understanding of multiple neurological and physiological processes. Therefore, continuous research and training in shelters together with ongoing support may help gain a better understanding of canine behaviour.

Chapter 5: Review of tests in the standardised RSPCA shelter behaviour assessment: evaluation of test purposes and identification of relationships between tests

"The secret of life, though, is to fall seven times and to get up eight times" *Paulo Coelho, The Alchemist*

Introduction

Behaviour assessments are a common tool used in shelters to identify stable behaviours, adoption suitability and undesirable behaviours. The actual behaviour assessment used differs between shelters depending on what the shelter wants to identify in surrendered dogs, and the available resources. The behaviour assessment can be used in conjunction with continual monitoring of behaviour over time in shelters, or used as a one-off assessment of whether the dog is suitable to be adopted or a risk to society if re-homed. Behaviour assessments can be categorised into two groups according to their methodological approach.   One approach is a qualitative personality assessment e.g. DPQ, C-BARQ, MCPQ, and the second approach is a quantitative behaviour assessment (temperament measured with a battery of tests) that includes Assess-a-pet, BARK, Match up, SAB, and Safer Protocols (Planta et al., 2007; Weiss, 2007; Marder et al., 2013; Mornement et al., 2014; Jacobs et al., 2017; Posluns et al., 2017; Mohan et al., 2018; Jacobs et al., 2019). The qualitative personality assessments reflect the owner's perception of the dog's behaviour in the household and other situations. Quantitative behaviour assessments assess how the dog reacts towards different stimuli in numerous test (Mornement, 2010). In this case, behaviour is measured by using a scaling methodology or behaviour analysis techniques.

However, behaviour assessments have recently come under close scrutiny due to the risk of false positives and negatives (Patronek and Bradley, 2016; Patronek et al., 2019), their inability to accurately predict certain behaviour problems and the nature of their pass/fail methodology. Although numerous studies outline the positives of using behaviour assessment, others outline the ineffectiveness of certain tests. Depending on the assessment used, the number of tests between different assessment can vary between 6 and 54 (Mornement, 2010). Furthermore, the duration of testing procedures can range from 5 to 40 minutes (Mornement et al., 2010). Dog behaviour assessment at shelter level usually comprises most of the following tests: exploration of room, touch sensitivity, play interactions, tag, resource guarding, interactions between strangers and toddlers, time-alone and intraspecific interactions. The major tests under scrutiny in the literature focus on resource guarding, stranger directed aggression, toddler aggression, fear response and time alone as these can identify certain behavioural issues and have the potential to cause problems in a future home.

One major behaviour problem that all shelters wish to accurately identify is aggression. The identification of aggression in these tests has been previously studied (Planta et al., 2007; Marder, 2013; Jacobs et al., 2017; Jacobs et al., 2018; Mohan et al., 2018). Aggressive behaviours in dogs are a serious problem, especially considering the potential for human injury (Cornwell, 1997; Mills

and Levine, 2005). Aggression can be tested in many ways, but normally involves interactions in an unfamiliar setting with an unfamiliar person, a toddler doll, unfamiliar visual or auditory stimuli, an unfamiliar dog, or food and toys (Bennett et al., 2012; Bollen et al., 2008; Planta et al., 2007; Marder, 2013; van der berg et al., 2003; Mohan et al., 2018; Jacobs et al., 2017; 2019; Reimer et al., 2014; Reisner et al.; 2007, 2008). Due to the multifactorial nature of dog behaviours and the many categories of aggression, it is very difficult to characterize dog aggression, particularly at shelter levels and, in determining whether it is due to the shelter environment itself. Although, possessive aggression (commonly referred to as resource guarding), has been identified at shelter level, but post adoption minimal occurrence of this behaviour has been found (Mohan-Gibbons et al., 2012). Therefore, a study by Mohan-Gibbons and others (2018) excluded the test from the assessment to identify any changes in adoption suitability and post-adoption occurrence. Results found no increase in the number of injuries even after removal of the test and no significant difference in return rates of food guarding dogs.

Other tests used in the assessment identify separation related behaviours (Mornement et al., 2014; Blackwell et al., 2013; Marder et al., 2013; Weiss, E 2007), and they belong to protocols that are normally used outside the shelter (Palestrini et al., 2010). Unfortunately, the tests aimed at identifying separation anxiety are largely ineffective in shelters due to the lack of attachment figures and bonds to owners. However, most assessments identify separation related issues or general anxiety which are impacted in shelters by environmental variables (Polgar et a., 2019). One reason cited for continuing the use of these tests is the high occurrence of surrender due to behavioural problems and high instance post adoption of separation related behaviours (Hemy et al., 2017).

In order to ensure the accuracy of assessments, and improve time efficiency and effectiveness, it is necessary to determine the purpose of each test and whether its goal is met. The aim of this chapter is to identify whether the tests are correctly identifying behaviours that each test is aimed to detect (e.g. time alone test for separation related behaviours). Furthermore, it aims to determine if more than one test is assessing similar behaviours and whether it is necessary to continue to use all sub-tests. If it were possible to condense the assessment, this would reduce the time devoted to each assessment without a resultant reduction in accuracy.

Method and Materials

<u>Ethics</u>

The RSPCA Animal Welfare and Ethics Committee approved the use of data both from the previously collected human survey and archived behaviour assessment data collected as part of routine RSPCA Qld procedures.

<u>Location</u>

Data was collected at the RSPCA Qld Animal Shelter at Wacol from 24th of August 2013 to the 6th of July 2014 by RSPCA Qld staff performing their everyday duties following standard protocols.

<u>Human and Animals</u>

The data included in the study were from dogs entering the RSPCA Qld Animal Shelter at Wacol. Before inclusion, dogs were assessed by a veterinarian and only those identified as having no apparent medical problems were included. Upon admission to the RSPCA, behaviour profiles were completed by the owners. Each dog was then evaluated by an RSPCA handler to identify any significant aggressive behaviours towards the handler. Data from 955 dogs were used.

<u>Behaviour assessment</u>

The RSPCA Qld. Behaviour assessments were conducted on all dogs during their stay at the RSPCA by staff (n = 2, one Handler and one Observer/Rater) responsible for evaluating the dog's suitability for re-homing. The behaviour assessments were conducted in a variety of situations to evaluate the following behaviours: room exploration, behaviour when on a leash, sociability, tolerance, play behaviour with toys, tag (run and freeze), possessive behaviours, toddler and stranger interaction, time alone and social interactions with other dogs (RSPCA, 2012; Clay et al., 2019). The assessment comprised 11 different tests performed over a 15 minute period, 10 of which have previously been described in detail (Clay et al., 2019). The additional test 'Response to a fake cat" is outlined in appendix 2. The equipment used followed RSPCA Qld. Behaviour protocol and included a 1.8 meter leash, tennis ball, squeaky toy, rope, plastic hand on an extended pole, bowl, raw hide or bone, combination of wet and dry dog food, and a toddler doll and fake cat. At the conclusion of the behaviour assessment, animals were deemed suitable for re-homing, enrolled in a behaviour modification program or scheduled for euthanasia.

The 11 tests performed as part of the standardised behaviour assessment have previously been described in detail in chapter 4 and (Clay et al., 2019). Behaviour assessments were not repeated, therefore intra-rater reliability assessments were not possible.

<u>Behaviour observations</u>

In each test, one RSPCA assessor rated the behaviour of the dogs using binary occurrence of behavioural states (presence or absence), except for the resource guarding test which relied on a score by the assessor on an 8 point scale (Table 19). An overall score using the 11 tests was determined. Only behavioural states were assessed at the time in each test (friendly/social, anxious, aroused, fearful, and aggressive) (Table 20).

Table 19. Resource Guarding Scoring System aimed at identifying possessive aggression by the dogs in defence of food

Level 1: Stops eating, wags tail loosely, and sniffs hand and looks to handler with soft eyes and relaxed body. Body language indicates no distancing behaviours.

Level 2: Continues eating, soft eyes, wags tail loosely, and body language indicates no distancing behaviours; typically a relaxed body stance / carriage.

Level 3: Continues eating but at a faster rate of intake. Body is slightly tense, particularly on human approaching the dog; tail wagging with an increased speed, especially on interaction with the dog and/or the food / treat. The dog blocks access to the food with their body (head and shoulder over the food and treat).

Level 4: The dog's discomfort and behaviour starts to escalate. The dog glares, lifts its lip in a snarl, and/or produces a low growl. Increases eating speed, or with a treat the dog will whip its head away in an attempt to move it away from handler.

Level 5: Dog will carry the food item under a chair, bed, or into its crate, then growl on approach. If it cannot pick the food/treat up, it pushes the food bowl farther away. Dog freezes (stops eating or chewing), with whale eyes (exhibiting sclera) or direct stare, with or without lifting the lip in a snarl or other type of growl.

Level 6: Dog snaps but with no contact with fake hand. Level 5 behaviour usually continued but dogs move through the behaviors rapidly.

Level 7: Dog's protectiveness increases with one or more rapid bites that touch the fake hand with quick and hard contact.

Level 8: Dog freezes with whale eyes or direct eye contact and biting aimed at the intruder even if they are at the perimeter of the room. At this level, it may be too dangerous to step into the perimeter to determine if the dog will bite or not.

Table 20. Behaviours assessed with in the RSPCA Qld. Behaviour Assessment protocol

Behaviours	Definition
Play	Interacting with toys in social manner, may interact with handlers
Friendly	May jump up on the person / dog licks person, dog nudges hand; play bow
Social	Approaches and looks at assessor; stays with assessor making regular soft eye contact; low tail wagging, body relaxed, when assessor interacts may lower body
Fearful	Cowers; runs away or avoids interaction, may tremble; tail tucked tightly, attempts to hide; at end of taut leash; mouth closed or panting excessively
Anxious	Inability to settle and relax, distressed vocalisation, wide eyes, dilated pupils, excessive panting and licking, yawning and proximity seeking behaviour
Arousal	Medium to hard mouth person; jump up and grab person's clothing or body part; may mount person; inability to calm down; takes little to escalate the arousal levels
Predatory behaviour	Sequence of behaviours that are associated with the catching and killing of another 'animal' for consumption, in this case a fake cat.
Reorientating	Changes direction away from stimulus.
Avoiding stimulus	Moves away from the stimulus.
Unresponsive	No behaviours change due to stimulus.
Aggression	Growls; shows teeth; snaps; directed stare; dilated pupils; attacks; bites
Displacement	The transfer of feelings or behaviour from their original object to a person or thing. Displacement behaviours include self-grooming, touching, stratching, yawning, displayed when an animal has a conflict between two motivations, such as the desire to approach an object while at the same time being fearful of that object.
Attracted to stimulus	Moving all the way to the end of the lead towards a stimulus until it is in full tension
Appeasement	Individual attempts through appeasement displays to avoid injury by a dominant dog or human.
Reactive	Dogs respond with excessive reactions to a stimulus
Separation related behaviours	Behaviours that are associated with being left alone behaviours can include panting, pacing, excessive vocalisation, scratching at doors, excessive jumping, and damage.
Possessive Behaviour	Aggression whilst guarding things (food bowls, rawhides, stolen, or found items, toys).

Statistical analysis was conducted using Minitab 18. Descriptive analyses were performed to identify behaviours associated with each test. The Chi-square test was used to compare the components in each test and the behaviours identified. Spearman's correlations were performed to identify relationships between tests in the standardised behavioural assessment. Results were corrected for false discovery using Benjamini-Hochberg procedure (McDonald, 2014). Multiple logistic regression analysis was performed to compare repeated measures in tests: touch sensitivity, play interactions, tag (run and freeze), food possession (resource guarding), and dog interactions. Backward Stepwise regression was performed to reduce testing to find a reduced model that best explains behaviour in assessment.

Results

Descriptive details

The sample of companion dogs included 955 dogs (Males: 513, Females: 442) who were all between 1 and 13 years. The source of admission included; ambulance (6.38%), council (4.4%), emergency boarding (2.30%), euthanasia request (0.31%), humane officer seized or surrendered (14.24%), lost (2.93%), owner surrendered (31.94%), returns (7.33%), stray (13.72%), and transfer In (16.44%). The major breeds in the study; Staffordshire Bull Terrier (15.5%), Kelpie (6.5%), Border Collie (5.3%), Australian Cattle Dog (5.9%), Bull Arab (5.03%). All other breeds each represented less than 5% of the population of dogs.

Table 21. Percentage of occurrences of behaviours in each test in the Behavioural Assessment of shelter dogs (n = 955)

Behaviours

Test	Component	Repeat	Friendly n	Friendly %	Anxious n	Anxious %	Fear n	Fear %	Arousal n	Arousal %	Appeasement n	Appeasement %	Aggression n	Aggression %	Reorientating n	Reorientating %	No response n	No response %	Displacement n	Displacement %	Play with handler n	Play with handler %	Independent play n	Independent play %	Unable to trade n	Unable to trade %	Attracted to stimulus n	Attracted to stimulus %	Reactive n	Reactive %	Possession n	Possession %	Separation related issues n	Separation related issues %
1	Exploration		499	52.23	168	17.57	31	3.26	39	4.08	0	-	0	-	0	-	81	8.53	116	12.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1	Upon Call		590	61.77	214	22.41	31	3.26	42	4.35	0	-	0	-	0	-	14	1.45	64	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Collar	1	419	-43.84	238	-24.92	27	-2.83	39	-4.04	0	-	0	-	0	-	149	-15.63	84	-8.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Collar	2	503	-52.69	272	-28.43	18	-1.87	30	-3.11	0	-	0	-	0	-	40	-4.15	93	-9.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Collar	3	349	-36.59	327	-34.27	13	-1.41	36	-3.76	0	-	0	-	0	-	58	-6.1	67	-7.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Collar	4	527	-55.2	292	-30.6	10	-1.09	10	-1.09	0	-	0	-	0	-	16	-1.64	99	-10.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Collar	5	487	-51.04	286	-29.9	10	-1.02	34	-3.61	0	-	0	-	0	-	34	-3.61	103	-10.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Stroke	1	425	-44.48	240	-25.08	34	-3.56	41	-4.27	0	-	0	-	0	-	128	-13.44	88	-9.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Stroke	2	484	-50.73	294	-30.77	18	-1.87	60	-6.24	0	-	0	-	0	-	20	-2.08	79	-8.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Stroke	3	491	-51.4	312	-32.68	11	-1.18	65	-6.77	0	-	0	-	0	-	8	-0.8	68	-7.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Stroke	4	459	-48.11	329	-34.44	23	-2.36	54	-5.66	0	-	0	-	0	-	40	-4.24	50	-5.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Stroke	5	444	-46.47	270	-28.29	34	-3.53	101	-10.6	0	-	0	-	0	-	5	-0.5	101	-10.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Touch	1	438	-45.86	240	-25.11	39	-4.13	80	-8.39	0	-	0	-	0	-	47	-4.87	111	-11.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Touch	2	437	-45.76	275	-28.77	22	-2.28	275	-28.77	0	-	0	-	0	-	8	-0.82	103	-10.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Touch	3	429	-44.94	265	-27.7	32	-3.38	116	-12.16	0	-	0	-	0	-	3	-0.34	110	-11.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Startle		354	-37.02	132.554	-13.88	69	-7.25	-	-	-	-	-	-	268	-28.03	48	-5.02	99	-10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Recovery		530	-55.53	254.6985	-26.67	25	-2.67	-	-	-	-	-	-	91	-9.49	0	-	56	-5.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Tennis ball	1	0	-	0	-	0	-	114	-11.94	0	-	0	-	0	-	298	-31.23	0	-	274	-28.7	178.967	-18.74	0	0	-	-	-	-	14	-1.5	-	-
4	Tennis ball	2	0	-	0	-	0	-	131	-13.72	0	-	0	-	0	-	273	-28.62	0	-	296	-30.96	178.776	-18.72	3	-0.32	-	-	-	-	0	0	-	-
4	Squeaky toy	1	0	-	0	-	0	-	114	-11.98	0	-	0	-	0	-	317	-33.15	0	-	232	-24.28	215.066	-22.52	1	-0.16	-	-	-	-	13	-1.36	-	-
4	Squeaky toy	2	0	-	0	-	0	-	130	-13.59	0	-	0	-	0	-	283	-29.62	0	-	262	-27.39	212.8695	-22.29	283	-29.62	-	-	-	-	16	-1.69	-	-
4	Rope	1	0	-	177	-18.56	24	-2.56	112	-11.76	0	-	0	-	0	-	150	-15.73	0	-	389	-40.72	26.4535	-2.77	0	-	-	-	-	-	3	-0.32	-	-
4	Rope	2	0	-	162	-16.94	22	-2.27	129	-13.53	0	-	0	-	0	-	163	-17.02	0	-	387	-40.52	27.886	-2.92	0	-	-	-	-	-	4	-0.42	-	-
5	Startle	1	301	-31.53	141	-14.73	40	-4.19	1	(0.15)	-	-	4	-0.4	44	-4.64	17	-1.82	28	-2.98	-	-	-	-	-	-	-	-	377	-39.51	-	-	-	-
5	Freeze	1	244	-25.58	159	-16.68	19	-2.04	19	-1.96	-	-	40	-4.19	144	-15.13	23	-2.45	80	-8.34	-	-	-	-	-	-	-	-	200	-20.94	-	-	-	-
5	Startle	2	305	-31.98	148	-15.5	30	-3.12	0	0	-	-	8	-0.84	38	-4.01	18	-1.88	32	-3.37	-	-	-	-	-	-	-	-	373	-39.06	-	-	-	-
5	Freeze	2	244	-25.51	160	-16.75	17	-1.81	13	-1.29	-	-	40	-4.15	182	-19.02	21	-2.15	85	-8.91	-	-	-	-	-	-	-	-	190	-19.92	-	-	-	-
5	Startle	3	358	-37.5	119	-12.5	0	-	15	(1.55)	-	-	30	-3.13	0	-	0	-	15	-1.56	-	-	-	-	-	-	-	-	403	-42.19	-	-	-	-
5	Freeze	3	254	-26.6	122	-12.77	0	-	81	-8.51	-	-	102	-10.64	81	-8.5	0	-	61	-6.38	-	-	-	-	-	-	-	-	223	-23.4	-	-	-	-
7	Entry		403	-42.16	100	-10.51	35	-3.65	0	-	-	-	17	-1.74	0	-	34	-3.6	30	-3.15	-	-	-	-	-	-	-	-	-	-	0	-	3	-3.15
7	Approach		441	-46.19	148	-15.47	65	-6.79	26	-2.68	-	-	2	-0.16	74	-7.79	14	-1.47	0	-	-	-	-	-	-	-	42	-4.42	-	-	0	-	-	-
7	Leaving		542	-56.71	0	-	-	-	0	-	-	-	13	-1.31	325	34.04	0	-	76	-7.96	-	-	-	-	-	-	-	-	-	-	0	-	-	-
8	Approach		282	29.51	99	10.41	65	6.82	45	4.74	-	-	3	0.27	83	8.73	11	1.16	56	6.11	-	-	-	-	-	-	-	-	308	32.24	0	0	-	-
8	Leaving		525	53.94	0	-	0	-	0	-	-	-	9	0.9	333	34.91	0	-	81	8.45	-	-	-	-	-	-	-	-	-	-	17.18	0	-	-
9	Approach		524	61.29	-	-	-	-	-	-	-	-	139	16.24	-	-	855	22.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Time alone		-	-	219	22.96	-	-	-	-	-	-	-	-	-	-	237	24.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	499	52.16
11	Walking	1 (no.955)	661	69.19	0	-	0	-	0	-	-	-	39	4.1	-	-	0	-	47	4.96	-	-	-	-	-	-	-	-	60	6.28	98	10.27	-	-
11	Circling	1 (no.955)	690	72.25	45	4.76	16	1.65	64	6.72	-	-	76	7.92	-	-	12	1.23	27	2.8	-	-	-	-	-	-	-	-	0		0		-	-
11	Nose-Nose	1 (no.955)	613	64.22	39	4.12	79	8.31	47	8.31	-	-	42	4.38	-	-	0	-	136	14.21	-	-	-	-	-	-	-	-	0		0		-	-
11	Walking	2 (no. 880)	609	69.19	0	-	0	-	0	-	-	-	30	3.4	-	-	0	-	50	5.68	-	-	-	-	-	-	-	-	0	-	80	9.05	-	-
11	Circling	2 (no. 880)	651	73.98	45	5.12	9	1.06	53	1.06	-	-	70	7.96	-	-	11	1.23	19	2.15	-	-	-	-	-	-	-	-	48	5.47	0		-	-
11	Nose-Nose	2 (no. 880)	604	68.65	37	4.26	70	7.98	48	7.98	-	-	36	4.1	-	-	0	-	123	13.94	-	-	-	-	-	-	-	-	0		0		-	-
11	Walking	3 (no. 24)	17	69.19	0	-	0	-	0	-	-	-	2	7.87	-	-	0	-	1	4.72	-	-	-	-	-	-	-	-	0	-	4	18.11	-	-
11	Circling	3 (no. 24)	15	62.5	1	4.76	0	-	2	8.93	-	-	3	13.39	-	-	1	1.79	1	0.89	-	-	-	-	-	-	-	-	2	8.93	0		-	-
11	Nose-Nose	3 (no. 24)	17	72.38	1	4.26	2	7.62	1	4.12	-	-	2	7.62	-	-	0	-	1	2.86	-	-	-	-	-	-	-	-	0		0		-	-

Behaviour assessment information (Table 21)

Information from the behaviour assessment was transposed into percentage of occurrence in relation to test. Behaviours were classified into friendly/social, anxiousness, arousal, fear, displacement and aggression.

Exploration and socialisation test

In the initial test of exploration of room, behaviours most frequently indicated by assessor were friendliness in 52.2% of dogs, anxiousness (17.5%), displacement behaviour (12.11%) and low levels of non-social behaviour, fearfulness, and arousal. In a later component of the exploration test, upon call, there was high occurrence of sociability (61.77%) and anxiousness (22.41%) compared to in the first component of the test (Table 21). In comparing the two components of the test, the responses to 'upon call' were more likely to include arousal and fear than responses during 'exploration' (Chi square = 75.30, p = 0.001).

Handling tolerance test

Table 21 presents the results from the handling tolerance test. This was made up of three components: collar, stroking interaction and tolerance towards touching feet. Collar and stroking interactions were attempted 5 times and touch 3 times giving dogs several chances to complete the test and display their stable behaviour.

During the collar interaction, there were high occurrences of friendliness across all five repeats in comparison to the other components. The lowest occurrence of friendliness occurred in the third repeat (36.59%). The second most frequent behavioural category was anxiousness (34.27%). As friendliness decreased in the three repeats, anxiousness increased. Whereas fear, arousal and no response decreased over time. Finally, displacement behaviour increased over repeats which would be further linked with the increase in anxiousness over the five repeats. In comparing the five repeats, results suggest that there is a significant association between the five repeats (Chi square = 273.35, p = 0.000).

In the second component, attempted stroking interaction, there were similar high occurrences of friendliness through repeats 1 to 5, with occurrences decreasing after attempts 4 and 5. Furthermore, anxiousness in dogs increased over repeats with similar levels to collar interaction. Fearfulness, no response and displacement decreased with each attempt, but there was high occurrence of displacement on repeat 5. These results align with the arousal level increasing over repeats with

highest occurrence in repeat 5 (Table 21). In comparing the five repeats, results suggest that there is a significant association between the five repeats (Chi square = 349.80, p = 0.000).

Finally, in tolerances towards touching feet, friendliness remained high in all repeats with little change. However, anxiousness did increase over the three repeats with displacement behaviour being highest in comparison to collar and stroke components. Furthermore, there was a high percentage of dogs displaying high arousal in the second repeat of the test in comparison to the first and last repeat, indicating accumulation of arousal over time during the three components and the repeats. In comparing the three repeats, results suggest that there is a significant association between the three repeats (Chi square = 184.09, p = 0.000). In comparing the three components, results suggest that there is a significant association between collar and stroking interactions, and tolerance towards touching feet (Chi square = 523.42, p = 0.25).

Startle response test

In the startle response test, upon implementation of stimulus, there were high occurrences of dogs displaying friendliness (37.02%) and avoidance of stimulus (28.03%), with lower occurrence of anxiousness, fear, freeze, unresponsive, and displacement. However, following the startle test, during the recovery phase, friendliness (55.53%) and anxiousness (26.67%) increased with other behaviours decreasing. In comparing the two components of startle response, results suggest that there is a significant association between the implementation of the stimulus and the recovery phase (Chi square = 192.15, p = 0.000).

Play interactions test

Table 21 presents the results from the play interactions test. This was made up of three parts: tennis ball, squeaky toy, and rope. Each of these were attempted twice, giving dogs the chance to complete the test.

In the test with the tennis ball, playing with the handler increased each repeat, whereas unresponsiveness towards the tennis ball decreased. With squeaky toy, the occurrence of play interactions with the handler increased each repeat and there were higher occurrences of unresponsive behaviour towards the toy in repeats. Dogs that played with the squeaky toy had high levels of inability to trade with handler on repeat two (29.62%). With the rope toy, there were the highest occurrences of play behaviour towards the handler out of all of the components. However, anxiousness increased from not present with the first two components (tennis ball and squeaky toy) to 18.56% with the rope toy. In all components, independence in play remained the same in occurrence except with the rope toy, whereas, arousal increased over repeats with each component.

In comparing repeats with each component of the play interactions there were no significant associations, however, in comparing components there were significant associations between tennis ball, squeaker and rope toys (Chi square = 1793.80, p = 0.000).

Tag (Run and Freeze) test

In the run and freeze interactions, all procedures were repeated three times. Friendliness towards the handler in run interaction increased over the three repeats of the tests, whereas with the freeze component it decreased. Attraction towards the stimulus in the run aspect of the assessment had high occurrence but decreased by 20% in the freeze component. However, there were low occurrences of reorientating away from the stimulus in the run aspects, but higher levels in the freeze aspect. Aggression had low occurrence in repeats one and two of run and freeze, however, it increased to 10.64% on the final repeat of the freeze component. In comparing the three repeats results suggest that there is a significant association between each repeat (Chi square = 352.92, p = 0.000).

Food possession test (Table 22)

In food possession (resource guarding), each component was comprised of wet and dry food, bone, and pig's ear. Across all components of the test, dogs displaying high occurrence of low levels (1-2) of food related aggression and no interest in the food items. However, there was a 66% occurrence of dogs displaying fast eating, lips in snarl, and low growl when handlers approached to remove the food items. There were low occurrences of dogs displaying level 6-8 possessive behaviours towards any food item. In comparing components there were significant associations between wet food, dry food, bones, and pig's ear (Chi square = 599.96, p = 0.000). Low levels of possession were more likely to occur with food, and higher levels of possession with treats.

Table 22. Percentage of occurrences of behaviours in food possession in the Behaviour Assessment of shelter dogs (n = 955)

Component	No. Dogs	Possessive Aggression Level							
		1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	No interest
Wet	743	512 (69.00)	0	112 (15.00)	0	0 (0.00)	0	7 (1.00)	111 (15.00)
Dry	50	13 (26.00)	0	33 (66.00)	0	1 (2.00)	0	1 (2.00)	2 (4.00)
Bone	925	379 (41.00)	0	204 (22.00)	0	46 (5.00)	0	28 (3.00)	268 (29.00)
Pig's ear	284	31 (11.00)	0	20 (7.00)	0	3 (1.00)	0	6 (2.00)	222 (78.00)

Stranger interaction test

In the unfamiliar person test, interactions were scored under the following conditions; entry of stranger, stranger approach/interaction, and stranger exits. In all the components of the test, friendliness towards the stranger had high occurrence in comparison to the other behaviours. There was notable high occurrence of attraction to the stranger as soon as the stranger entered the room, and this decreased dramatically with the other two components. Anxiousness towards the stranger increased in the first two components of the tests and was not identified as the stranger was leaving. Finally, a notable high occurrence of attraction towards the handler upon the stranger exiting the room was observed with identified redirection of attention towards different stimulus. In comparing components there were significant associations between entry, approach and leaving (Chi square = 1735.08, p = 0.000).

Toddler test

In the toddler test, interactions were scored at interaction with the toddler, and exit of the toddler. Major findings in the toddler test were the increased occurrence of friendliness towards the fake toddler doll on interaction compared to during exit of the toddler. However, dogs had a high occurrence of nose contact on approach indicating uncertainty in the novel stimulus. Upon exit of the toddler doll, dogs had high occurrence of being attracted back towards the handler. In comparing the components, there were significant associations between approach and exit (Chi square = 647.98, p = 0.000).

Fake cat test

In the fake cat test, the behaviours frequently observed were dog approached in friendly manner (61.29%) and did not respond (22.46%). There were low occurrences of all other behaviours.

Time alone test

In the time alone test, there were high occurrences of separation related behaviours and anxiousness.

Dog interactions test

In the dog interactions, interactions were repeated three times and split into three components: Parallel walking, circling, and nose to nose interaction. In all repeats of tests there were high occurrences of friendliness towards the other dog. Reactivity towards the other dog only occurred during walking activity, whereas, anxiousness, arousal and fear only occurred in circling and nose to nose interactions. Displacement behaviour had highest occurrence in nose to nose interactions in repeats one and two, however, a low occurrence in final repeat. Aggression towards dogs occurred highest in circling activity with the highest occurrence of dogs displaying it in repeat 3. In comparing the three repeats, results suggest that there is no significant association between each repeat (Chi square = 5.02, p = 0.890).

Correlations between tests and behaviour identification (Tables 23)

Exploration and socialisation test

Behaviours displayed in the exploration and socialisation test showed correlations that were statistically significant but ranged in size from weak to strong. Major behaviours that were statistically significant included anxiousness, high arousal, displacement and fearfulness.

Handling tolerance test

In touch sensitivity, only two behaviours were positively correlated with other tests in the assessment: social/friendly interactions, with moves away from handler and social/friendly interactions in test 3; and fearful behaviour, with displacement behaviour in test 3 and lunges forward towards stranger in test 7.

Table 23. Significant Spearman's Correlation of behaviours between tests in the Behavioural Assessment of shelter dogs (n = 955)

Friendly

Tests	1	2 A	2 B	3	4	5	6	7	8	9	10
1	-	-	-	-	-	-	0.16	-	-	-	-
2	-	0.5	0.52	0.14	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.26	-	0.15	0.17	0.14	-
5	-	-	-	-	-	-	-	0.23	0.19	-	-
6	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	0.32	-	-
8	-	-	-	-	-	-	-	-	-	0.19	-
9	-	-	-	-	-	-	-	-	-	-	0.17
10	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	0.15	-	-	-	-	0.18	0.14	-

Anxious

Tests	1	2 A	2 B	3	4	5	6	7	8	9	10
1	-	-	-	0.31	0.42	0.4	-	0.45	0.42	0.18	-
2	-	0.7	0.68	-	-	-	-	-	-	-	-
3	-	-	-	-	0.24	0.32	-	0.46	0.43	-	0.17
4	-	-	-	-	-	0.48	-	0.39	0.37	-	0.14
5	-	-	-	-	-	-	-	0.43	0.42	-	0.19
6	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	0.63	0.18	0.25
8	-	-	-	-	-	-	-	-	-	-	0.24
9	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-
11	0.17	-	0.17	-	-	-	-	0.2	0.21	-	-

Fearful

Tests	1	2 A	2 B	3	4	5	6	7	8	9	10
1	-	-	-	0.52	0.45	0.35	-	0.35	0.23	-	-
2	-	0.63	0.7	-	-	-	-	-	-	-	-
3	-	-	-	-	0.48	0.31	-	0.36	0.19	-	-
4	-	-	-	-	-	0.47	-	0.48	0.32	-	-
5	-	-	-	-	-	-	-	0.32	0.26	-	-
6	-	-	-	-	-	-	-	-	0.52	-	-
7	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-

Displacement

Tests	1	2 A	2 B	3	4	5	6	7	8	9	10
1	-	-	-	-	-	-	-	-	0.14	-	-
2	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	0.21	0.21	-	0.18	0.6	-	-
4	-	-	-	-	-	0.24	-	0.2	0.14	-	-
5	-	-	-	-	-	-	-	-	0.14	-	-
6	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	0.32	-	-
8	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-

	1	2 A	2 B	3	4	5	6	7	8	9	10
10	-	-	-	-	-	-	-	-	-	-	-
11	0.26	-	-	0.2	0.21	0.26	-	0.2	0.21	-	-

	1	2 A	2 B	3	4	5	6	7	8	9	10
10	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	0.17	-	-	-

Arousal

Tests	1	2		3	4	5	6	7	8	9	10
		A	B								
1	-	-	-	-	-	-	-	0.34	0.16	-	-
2	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	0.13	-	-
6	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	0.32	-	-
8	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-

Aggression

Tests	1	2		3	4	5	6	7	8	9	10
		A	B								
1	-	-	-	-	-	-	-	-	-	-	-
2	-	0.2	0.35	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	0.21	0	0.15	0.16	0.22	-
5	-	-	-	-	-	-	0	0.2	-	0.19	-
6	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	0.18	0.13	-
8	-	-	-	-	-	-	-	-	-	0.13	-
9	-	-	-	-	-	-	-	-	-	-	0.17
10	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	0.16	1	0.19	0.14	0.2	-

A: Collar and tail   B: Collar and feet

Startle response test

In startle response, behaviours that showed positive correlations towards other tests that were statistically significant but ranged from weak to strong included anxious, fearful, and friendly behaviours. Quick recovery times after stimulus showed negative correlations towards anxious behaviours in play and novel stimulus tests, whereas slow recovery times showed positive correlations towards anxious and fear displayed in stranger and toddler test (Table 24).

Table 24. Correlations associated with recovery times between startle response and opposing tests

Behaviour	Behaviour in tests	Test	Correlation
Recovery 11-30 seconds	Anxiousness	7	**0.17**
	Fearfulness	7	**0.17**
	Fearfulness	8	**0.15**
	Displacement behaviour	8	**0.15**
Recovery 0-10 seconds	Anxiousness	4	**-0.23**
	Anxiousness	5	**-0.2**
	Displacement behaviour	4	**-0.17**
	Displacement behaviour	5	**-0.2**
	Reorientation away	8	**-0.17**

Play interaction test

In play interactions, the major findings from the correlations were the positive relationships with anxious, fearful, displacement, and aggressive behaviours with other tests. The major differences compared to other correlations is the relationship between aggression towards a novel stimulus, stranger, toddler doll and fake cat test. Furthermore, a high level of possession towards toys were positively correlated towards high level of possession towards bones in the food possession test.

Tag (Run and Freeze) test

In response to novel stimulus, the results were composed of positive correlations with anxious, fearful, displacement, friendliness, arousal and aggression behaviour with tests of stranger, toddler doll and fake cat.

Food possession test

In food possession (resource guarding), dogs displaying level 3-4 resource guarding in wet food and level 5-6 in dry food positively correlated with predatory response in fake cat test. No interest in food, bones or pig's ear were positively correlated with not engaging with stranger and toddler, and fearful and anxious response in stranger test (Table 25).

Table 25. Spearman's Correlation of behaviours in the food possession vs other tests in the Behavioural Assessment of shelter dogs (n = 955)

Behaviour	Behaviour in tests	Test	Correlation
Possession Level 3-4 of wet food	Predation	9	**0.19**
Possession Level 5-6 of dry food	Predation	9	**0.15**
No interest in dry food	Doesn't engage	7	**0.16**
	Doesn't engage	8	**0.14**
No Interest in bones	Doesn't engage	7	**0.15**
	Doesn't engage	8	**0.17**
	Fearfulness	7	**0.14**
	Anxiousness	7	**0.13**
No interest in pig's ear	Anxiousness	7	**0.14**
	Doesn't engage	8	**0.16**

Stranger interaction test

In the stranger test, the major findings were associated with positive correlations with anxious, fearful, displacement, friendliness, and aggression behaviours in toddler doll, fake cat, and/or time alone.

Fake toddler test

In the fake toddler test, anxious behaviours displayed in the test were positively correlated to time alone. Friendliness and aggression in dogs towards the fake toddler were positively correlated with corresponding behaviours towards the fake cat.

Fake cat test

In the fake cat test, two behaviours were correlated – approaches/interacts in a friendly manner to stay near the door for under 30 seconds in test 10 and, lunges/nose punch/bite with plays with toy in test 10.

Dog interactions test

Dog interactions were correlated separately due to the change in the number of dogs that did a dog-dog interaction (n: 900). Major results that were identified in correlations were positive relationships with dog's displaying the following behaviours towards other dogs and corresponding behaviour in room tests: anxiousness with exploration and socialisation, startle response, stranger, and toddler; fear with exploration and socialisation, startle response, play interactions, run and freeze, stranger,

and toddler; friendly behaviours with startle response, toddler doll and fake cat; and aggressive behaviours with run and freeze, food possession, stranger interactions, toddler doll, and fake cat.

In identifying the relationship between components of the dog interactions (parallel walking, circling and nose to nose interaction) there were positive correlations between anxious, friendly, fearful, reactive, and aggressive behaviours with all components (Table 26).

Table 26. Spearman's Correlation of behaviours in the dog interaction vs other tests in the Behavioural Assessment of shelter dogs (n = 955)

Behaviour	Component 1	Component 2	Correlation
Anxiousness	Circling	Nose to nose interaction	**0.48**
Friendliness	Parallel walking	Circling	**0.4**
	Circling	Nose to nose interaction	**0.41**
Displacement	Circling	Nose to nose interaction	**0.24**
Fearfulness	Circling	Nose to nose interaction	**0.51**
Reactive	Parallel walking	Circling	**0.54**
	Circling	Nose to nose interaction	**0.48**
Aggression	Parallel walking	Circling	**0.45**
	Circling	Nose to nose interaction	**0.4**

Behaviour assessment test reduction on repeated tests

Handling tolerance test

Ordinal logistic regression was used to determine whether repeating the tests for collar, stroke, and feet was necessary in the identification of behaviours. For all dogs, this test was repeated three to five times (Table 27). Behaviours that had high odds of occurring in the first repeats of each test were social/friendly behaviours, fearfulness, anxiousness, aggression, and displacement (Table 27). Fear and aggression had highest odds of occurring in the first test collar hold, where sociability and anxiousness had highest odds of occurring in feet sensitivity. Displacement behaviour only started in the stroke test with the highest odds of occurring and decreased in feet sensitivity (Table 27).

Nominal logistic regression was used to determine the probability of behaviours occurring with each test: Collar, stroke and feet sensitivity. In comparing collar and stroke tests, the model identified that there was little difference of behaviours identified between tests. Major findings indicate that aggressive behaviours are more likely to occur in stroke and feet sensitivity compared to collar hold (Table 28). Friendly and social behaviours were less likely to occur in feet sensitivity than collar hold (Table 28).

Play interaction test

Nominal logistic regression was used to determine the probability of behaviours occurring in each play with ball, squeaky toy, and rope. The major findings were that independent play would more likely occur in squeaky toy play in comparison to ball interactions (Table 28). Engaging in play, displacement, and aggressive behaviour were more likely to occur in rope interactions rather than with ball (Table 28).

Binary logistic regression analysis (Stepwise) was used to determine whether repeating the toy interactions twice for each component was necessary and identifying key behaviours in the test. Major results identified that all relevant behaviours would occur in the initial play with key behaviours in ball and squeaky toy being the same (engaging in play with handler, displacement, and independent play). In contrast, with rope toy, the key behaviours identified were engages in play with handler, displacement, anxiousness, fear and aggressive behaviours (Table 29).

Table 27. Significant relationships between behaviours from the shelter behaviour assessment and the repeats in each test component, analysed by Ordinal Logistic regression

Test	Component	Behaviour	Coef	SE Coef	Z	Ratio	Lower	Upper
Touch sensitivity	Collar	Friendliness	2.05	0.09	23.05	**7.74**	6.50	9.21
		Fearfulness	1.51	0.33	4.60	**4.54**	2.38	8.64
		Aggression	1.22	0.23	5.33	**3.38**	2.16	5.29
	Stroke	Friendliness	1.94	0.10	19.73	**6.97**	5.75	8.46
		Fearfulness	0.81	0.27	3.02	**2.24**	1.33	3.79
		Displacement behaviour	0.59	0.16	3.76	**1.80**	1.32	2.44
	Feet	Friendliness	2.99	0.14	20.96	**19.95**	15.08	26.39
		Anxiousness	0.33	0.13	2.64	**1.40**	1.09	1.79
		Fearfulness	0.98	0.30	3.29	**2.67**	1.49	4.78
		Displacement behaviour	0.37	0.17	2.25	**1.45**	1.05	2.01
Tag	Running	Friendliness	0.65	0.10	6.26	**1.92**	1.56	2.35
		Anxiousness	0.43	0.10	4.32	**1.54**	1.26	1.87
		Fearfulness	1.85	0.21	8.73	**6.34**	4.19	9.59
		Displacement behaviour	0.72	0.21	3.46	**2.06**	1.37	3.09
	Freeze	Friendliness	1.87	0.13	14.21	**6.46**	5.00	8.36
		Anxiousness	0.78	0.09	8.55	**2.18**	1.82	2.61
		Fearfulness	1.03	0.22	4.76	**2.80**	1.84	4.29
		Displacement behaviour	0.49	0.11	4.45	**1.64**	1.32	2.04
		High arousal	-1.01	0.43	-2.37	**0.36**	0.16	0.84

P: 0.00

Table 28. Significant relationships between behaviours scored from the shelter behaviour assessment and the component in each test, analysed by Nominal Logistic regression

Test	Component		Behaviour	Coef	SE Coef	Z	Ratio	Lower	Upper
Touch sensitivity	Stroke	Collar	Aggression	0.32	0.12	2.74	**1.38**	1.10	1.73
	Feet	Collar	Aggression	0.79	0.11	6.97	**2.21**	1.77	2.76
			Friendliness	-0.47	0.06	-7.67	**0.62**	0.55	0.70
Play	Squeaker	Ball	Independent play	0.49	0.13	3.63	**1.63**	1.25	2.12
	Rope	Ball	Engages in play with handler	2.33	0.12	18.90	**10.24**	8.05	13.04
			Displacement behaviour	0.64	0.18	3.50	**1.89**	1.32	2.71
			Aggression	0.87	0.16	5.48	**2.39**	1.75	3.27
			Independent play	-2.91	0.21	-13.76	**0.05**	0.04	0.08
Food possession	Dry	Wet	Possession level 1-2	-5.13	0.29	-17.62	**0.01**	0.00	0.01
			Possession level 3-4	-2.68	0.21	-12.65	**0.07**	0.05	0.10
			Possession level 7-8	-2.84	1.12	-2.53	**0.06**	0.01	0.53
			No interest	-5.49	0.72	-7.65	**0.00**	0.00	0.02
	Pig's ear	Wet	Possession level 1-2	-3.93	0.20	-19.78	**0.02**	0.01	0.03
			Possession level 3-4	-2.84	0.25	-11.32	**0.06**	0.04	0.10
			No interest	-0.48	0.14	-3.41	**0.62**	0.47	0.82
	Bone	Wet	Possession level 1-2	1.66	0.21	8.02	**5.23**	3.49	7.85
			Possession level 3-4	2.54	0.23	11.16	**12.69**	8.13	19.83
			Possession level 7-8	3.61	0.58	6.24	**37.10**	11.92	115.49
			No interest	2.83	0.22	12.58	**16.95**	10.91	26.34

P: 0.00

Table 29. Significant relationships between behaviours scored from the shelter behaviour assessment and the repeats in the component of the test, analysed by Binary Logistic regression

Test	Component	Behaviour	Repeat 1	Repeat 2	Odds	SE Coef
Play interactions	Ball	Engages in play	38.01	30.47	**1.6**	1.30-1.98
		Displacement behaviour	7.43	4.08	**2.27**	1.50-3.44
		Independent play	24.81	18.43	**1.94**	1.51-2.49
	Squeaky Toy	Engages in play	31.83	27.01	**1.29**	1.03-1.62
		Displacement behaviour	5.13	2.3	**2.81**	1.66-4.77
		Independent play	29.52	21.99	**2.26**	1.76-2.92
	Rope toy	Engages in play	81.57	52.35	**4.37**	3.47-5.50
		Displacement behaviour	12.67	6.91	**1.39**	0.97-1.98
		Anxiousness	37.17	21.88	**1.61**	1.28-2.01
		Fearfulness	5.13	2.93	**1.85**	1.09-1.67
		Aggression	23.56	17.48	**1.29**	1.01-1.67
Dog interactions	Parallel Walking	Interact with handler	69.32	60.73	**1.6**	1.27-1.98
		No reaction	71.2	64.81	**1.63**	1.28-2.09
		Attracted to stimulus	47.23	39.47	**1.5**	1.22-1.82
		Reactive	2.51	1.51	**2.2**	1.02-4.75
	Circling	Attracted to stimulus	41.78	34.76	**1.42**	1.17-1.73
		Friendliness	63.35	59.79	**1.31**	1.07-1.60
		Fearfulness	5.03	3.3	**2.01**	1.24-3.27
	Nose to nose	Interact with other dog	84.61	78.63	**1.47**	1.10-2.07
		Friendliness	53.09	48.48	**1.28**	1.03-1.55
		Fearfulness	10.89	7.96	**1.48**	1.10-2.14
		Aggression	20.41	19.37	**1.45**	1.06-1.86
					P: 0.00	

Tag (Run and Freeze) test

Ordinal logistic regression was used to determine whether three repeats of the run and freeze test was necessary to identify behaviours. All relevant behaviours including friendliness, anxiousness, fear, and displacement behaviours were more likely to occur in the first response with only high arousal more likely to occur in the later repeats (Table 27).

Food possession test

Nominal logistic regression was used to determine the probability of the levels of food possession (resource guarding) occurring in each food option: Wet food, dry food, bone and pig's ear. Results indicate that no interest in food, levels 1-2, 3-4, and 7-8 possessive behaviour had decreased odds of occurring in dry food and pig's ear in comparison to using wet food. Whereas, using a bone had increased odds of dogs displaying these behaviours compared to using wet food (Table 28).

Dog interactions test

Binary logistic regression (Step wise to identify useful set of behaviours) using information from the two dogs used in the test was used to identify if all the repeats were necessary for: Parallel walking, circling and nose to nose contact. Results indicate that all key behaviours were more likely to occur with the first dog used in comparison to the second dog. Key behaviours identified in each component were interaction with handler, looking towards other dog with no response, attraction to stimulus, and reactivity in parallel walking; attraction to stimulus, friendliness, and fearful behaviours in circling; friendliness, fearfulness, displacement and unfriendly behaviours in nose to nose interactions (Table 29).

Behaviour assessment test reduction based on adoption suitability

Binary logistic regression analysis (Step wise) was used to identify key behaviours based on adoption suitability in each test's components (Table 30).

Key behaviours suitable for adoption

Results indicate that key behaviours that had increased odds for dogs to be suitable for adoption in each test were friendliness identified in exploration of room, touch sensitivity, run and freeze, stranger interactions, and dog to dog interactions. Furthermore, dog's that had low possessive behaviour (Level 1-2) in food possession test had increased odds of being suitable for adoption.

Key behaviours unsuitable for adoption

Results indicate that key behaviours that decreased the odds of dogs being suitable for adoption were fearfulness outlined in exploration of room, and startle response; anxiousness in touch sensitivity, startle response, play interactions (rope toy), run and freeze, and stranger interactions; high arousal in toy interactions, stranger interactions, and dog interactions (nose to nose); aggression in touch sensitivity (feet), run and freeze, stranger interactions, fake toddler doll, and dog interactions. Finally, as possessive behaviour increased over level 3 in food possession it decreased the odds of the dog being suitable for adoption.

Table 30. Significant relationships between outcomes scored by pass/fail and behaviour scored from the shelter

Test	Component	Behaviour	Pass	Review	Odds	SE Coef
1	Exploration of room	Social/interaction behaviour	14.13	8.62	*2.06*	0.80-5.24
		Fearfulness	5.22	10.34	*0.49*	0.20-1.21
	Upon Call	High Sociability	98.57	93.1	**2.92**	0.82-10.36
2	Collar	Friendliness	25.36	23.81	**1.36**	1.01-1.88
		Anxiousness	14.26	18.41	**0.6**	0.42-0.87
	Stroke	Friendliness	26.31	26.03	**1.45**	1.03-2.03
		Anxiousness	15.23	21.59	**0.5**	0.35-0.72
	Feet	Anxiousness	23.91	35.45	**0.52**	0.37-0.74
		Aggression	8.57	14.81	**0.57**	0.36-0.89
3	Startle	Anxiousness	19.72	38.09	**0.43**	0.25-0.75
		Fearfulness	10.25	20.63	**0.48**	0.25-0.93
	Recovery	Anxiousness	26.94	46.03	**0.47**	0.21-0.78
4	Tennis ball	No interest	34.38	40.16	**0.63**	0.43-0.94
		Arousal	14.08	22.83	**0.45**	0.28-0.73
	Squeaker	Arousal	14.13	20.47	**0.63**	0.40-0.98
	Rope	Anxiousness	28.55	43.31	**0.49**	0.33-0.71
		Arousal	20.02	27.56	**0.49**	0.32-0.76
5	Run	Friendliness	45.49	41.05	**1.37**	1.01-1.87
		Anxiousness	20.8	30	**0.57**	0.41-0.80
		Aggression	0.82	2.63	**0.35**	0.12-0.80
	Freeze	Aggression	7.52	15.79	**0.52**	0.33-0.80
6	Food	Possession level 1-2	25.22	15.29	**1.55**	1.09-2.23
		Possession level 3-4	9.12	17.65	**0.49**	0.35-0.70
		Possession level 5-6	1.2	4.31	**0.28**	0.14-0.59
		Possession level 7-8	0.73	2.35	**0.29**	0.12-0.72
7	Entrance	Arousal	2.36	7.93	**0.28**	0.10-0.82
		Anxiousness	18.52	34.92	**0.41**	0.24-0.71
		Aggression	0.33	3.17	**0.12**	0.01-0.79
	Approach	Displacement behaviour	15.15	7.94	**2.25**	0.88-5.76
		Anxiousness	30.3	38.09	**0.65**	0.39-1.12
	Exit	Friendliness	55.44	41.27	**2.73**	1.44-5.12
8		Displacement behaviour	7.97	3.17	**3.63**	0.85-15.43

	Approach	Aggression	0.34	7.94	**0.04** 0.00-0.17
	Exit	Aggression	0.45	6.35	**0.07** 0.01-0.27
10	Time alone	Jumping at windows	47.92	74.6	**0.34** 0.19-0.62
11	Parallel walking	Friendliness	25.13	14.2	**1.88** 1.10-3.23
		Aggression	3.48	11.93	**0.24** 0.12-0.64
		Predation	0.87	3.98	**0.36** 0.14-0.89
	Circling	Friendliness	45.07	27.27	**2.57** 1.65-4.00
		Aggression	12.64	15.9	**0.34** 0.22-0.53
	Nose to nose	Friendliness	37.26	22.92	**1.8** 1.17-2.79
		Arousal	10.15	11.36	**0.51** 0.29-0.87
		Aggression	9.47	23.29	**0.42** 0.28-0.62

P: 0.00

Discussion

The aim of this paper was to identify whether the individual tests currently used in the standardised RSPCA Qld. behaviour assessment (BA) adequately identify, elicit or predict the specific behaviours of interest. Furthermore, it aims to determine how to condense the behaviour assessment by identifying behavioural similarities between tests used. In general, the ability of the standardised BA protocol to predict the correct behaviours in each test was somewhat effective. However, it does appear that the BA may be repeating tests unnecessarily which increases time taken to complete the assessments. This potentially puts undue stress on the dog. Assessments used in animal shelters all employ similar tests to identify stable behaviours, behavioural problems and adoption suitability. However, there is little literature on the efficiency and effectiveness of these tests to identify the behaviours that designed to investigate. The RSPCA Qld behavioural assessment protocol is similar to previous assessments described in the literature (Netto and Planta, 1997; Marder, 2013; Mornement, 2014). However, all assessments vary in their scoring methodology. Nevertheless, all assessments attempt to identify behaviours that characterise friendliness, fear, anxiousness, hyperactivity, and aggression, with some testing procedures categorising them into behavioural problems e.g. Fear-directed aggression.

<u>Test reductions</u>

The analysis reported here suggests that the current protocol for the RSPCA Qld. behaviour assessment can be dramatically reduced into a more efficient and time effective behaviour assessment tool. Results outline that certain tests should be continued due to the behaviour, and behavioural issues, they have the potential to identify. These tests are: exploration of room, touch sensitivity, play interactions, tag, food possession, stranger and toddler interaction (or reaction to novel stimulus), time alone, and intraspecific interactions. Tests that could potentially be eliminated include the startle response, and fake cat test as results indicate that behaviours seen in these tests can be identified in other tests. Furthermore, tests that are retained could be undertaken at different time intervals after entering shelters or repeated to identify whether (and to what extent) behaviour is influenced by environment versus previous home behaviour e.g. food possession upon entry versus in shelter due to the environmental context behind possession-related behaviours (Mohan-Gibbs, 2018).

With respect to reducing repeating tests, results indicate that in only two instances did three repeats improve the assessment: the third repeat in touch sensitivity and tag test. All other behaviours could be identified in the first run of the test. In the tag test, 'high arousal' had significance at repeat 3 due

to the nature of the test to identify hyperactivity in the dogs. However, a continuous state of 'high arousal' can be identified in the accumulation of all the tests where tag is reduced to one. Further, results indicated that tests that consisted two repeats had all behaviours occurring at high odds in the first repeat rather than the second, therefore play interaction and dog interactions could be reduced to only one interaction.

Tests that used more than one component (e.g. play interactions with ball, squeaker and rope) could be reduced to only one. A further example would be the touch sensitivity components. These could be reduced to just collar and feet sensitivity, with the only behaviour 'aggression' being identifiable in feet sensitivity. One possibility is collar and stroke could be joined to form one component, as all behaviours are reflected in both tests. In play interactions, test components can be reduced to squeaker and rope, with the only behaviour being significant in ball being 'engages in play with handler' which can be identified in the rope component. Finally, in the food possession test, results suggest that components can be reduced to two attributes, wet food and bone as these showed significance in identifying all possession levels, except 'level 5-6' which was outlined in the treat component.

In reducing tests, it allows for a reduction in learning that can occur during testing procedures. If repeats are reduced, it will reduce learning and reconsolidation of memory associated with the assessment and the reinforcement of continuously occurring behaviours i.e. fear (Ledoux, 2007). Further, it decreases the ability of the assessment to increase accumulation of stress for the dogs due to a reduction in time, repeats and tests (Polgar et al., 2019).

Behaviours related to adoption suitability

The results outline the relationship between key behaviours identified in tests and their ability to identify dogs' suitability for adoption. As expected, dogs displaying friendliness identified in exploration, touch sensitivity, startle response, stranger and dog to dog interactions, had increased chance of being suitable for adoption. Whereas fearfulness (exploration, startle response), anxiousness (touch sensitivity, startle response, play interactions, tag, stranger interactions, time alone), high arousal (play interactions, dog to dog interaction), predation (dog to dog interaction) and aggression (touch sensitivity, tag, possession, stranger, toddler, dog to dog interactions) were the key behaviours in relation to decreased adoption suitability.

Revised behaviour assessment protocol (Figure 7)

The authors propose that a behaviour assessment protocol could be reduced to 8 tests: exploration of novel room (exploring room and recall), touch sensitivity (collar and stroke, feet), play interactions (squeaker and rope), tag (tag and recovery), food possession (wet food and bone), novel stimulus (stranger and toddler doll), time alone (2-3 minutes) and dog interactions (one dog). Each test would be conducted once with no repeats as previously discussed. With regard to the retained behaviour tests and the most effective way to implement these, the literature indicates a scaling methodology is best for the identification of behaviours (Goold and Newberry, 2017). However, the identification and categorising of behavioural problems requires a more comprehensive approach. Nonetheless, for time efficiency and effectiveness of shelter staff it is more effective to gather information based on scaling methods. Further testing can be implemented and undertaken by more highly qualified animal behaviourists or veterinary behaviourists in order to classify behavioural problems. Behavioural categories that would use the scaling method would be as follows: Sociability/Friendliness, Fearfulness, Anxiousness, Hyperactivity/arousal, Aggression, and Possession.
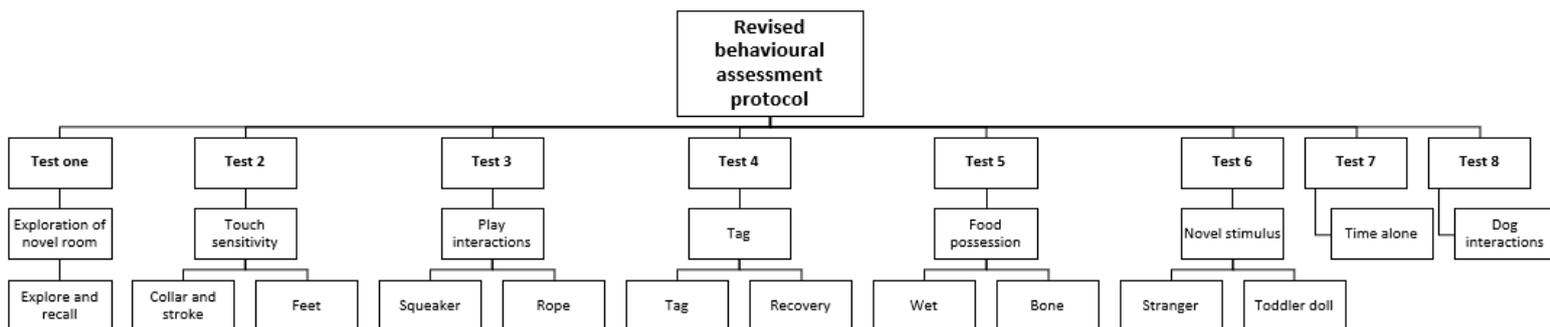

Figure 7. Revised behaviour assessment protocol

The literature outlines the behavioural categories and tests used to identify certain behavioural issues and problems (van der berg et al., 1991; Hennessy et al., 2001; Kroll, 2004; De Palma et al., 2005; Planta et al., 2007; Reisner, 2007; Taylor et al., 2007; Marder, 2013; Mornement et al., 2014; Bennett et al., 2015). Updated procedures would help in the identification of behavioural problems including possessive behaviours, categories of aggression, fear, general anxiety, separation related behaviours, and hyperactivity (Parthasarathy et al., 2006; Luescher and Reisn, 2008; Blackwell et al., 2013; Storengen, et al., 2014; Tiira et al., 2016; Jacobs et al., 2018; Fatjo and Bowen, 2020). Scaling methods would allow quick identification of an issue with individual dogs being tested via general assessors. However, further testing or review by qualified animal behaviourists would be required to determine specific behavioural problems.

The literature suggests that behavioural assessments can and do produce false positives and false negatives in the identification of behavioural problems (Patronek and Bradley, 2016; Patronek et al 2019). However, we argue that assessment should only be used as an information gathering tool for shelters to identify behaviours and implement behavioural modification for dogs that require it. Assessments can be evaluated by trained professionals (Clay et al., 2020) and further testing to identify behavioural problems can be conducted for increased positive predictive value. Furthermore, as outlined previously (Clay et al., 2020), euthanasia for behavioural reasons is a team-based decision with information based on staff and trainers in shelter and professionals in animal behaviour (Behaviour Veterinarian, Veterinary Behaviourist, or Certified Animal Behaviourist). Using a team-based process provides professional, evidence-based and defendable decisions around euthanasia. In addition, this process may contribute to decreased incidence of compassion fatigue, by facilitating transparency and accountability for all decisions.

While the current research contributes to more effective and efficient methods of completing the behaviour assessment for RSPCA Qld, further research into the procedures behind team-based behaviour focussed decision making, and the ability to increase positive predictive values, should be carried out.

Limitations

Undertaking a behaviour study of dogs in a novel environment, in this case a shelter, is complex due to the many uncontrolled features of the environment. These include feeding times, environmental enrichment offered, yard interactions, and interactions with experienced and inexperienced handlers. There are also many other variables with respect to the dogs, such as age, breed, genetics, medical background, and whether the animal is de-sexed. Many of these factors can be accounted for when analysing the data, however, others cannot.

Conclusion

The findings of this study suggest that the behaviour assessment protocol currently used at RSPCA Qld. can be substantially reduced to create a more efficient and effective assessment. Current procedural tests can be reduced in number to prevent excessive stimulus on dogs and in turn facilitate a much more efficient and reliable assessment. Revised procedures outlined above suggest that only exploration of novel room, touch sensitivity, play interactions, tag, food possession, novel stimulus, time alone and dog interactions are necessary in order to achieve the aims of the behaviour assessment. That is, these tests can be used for the identification of behavioural problems and allow monitoring of behavioural change and coping mechanisms over time in shelter and

ultimately, increase adoptability and decrease euthanasia. Furthermore, implementation of behavioural scales as integral to assessment methodology increases effectiveness and accuracy of the assessment and, increases assessors' efficiencies. Overall, these changes may provide positive impacts for shelters, staff and dogs, globally.

Chapter 6 will outline the effectiveness of conducting similar procedures upon entry in comparison to home environment to increase predictability of the RSPCA behaviour assessment protocol.

Chapter 6: Comparison of canine behaviour scored using a shelter behaviour assessment and an owner completed questionnaire, C-BARQ

Contributions: PhD candidate (LC) designed the experiment, collected data, conducted behavioural analysis, analysed the data, drafted and wrote the paper (90%). Supervisory support was offered from (CJCP, MP, GP, PB) for methodological oversight and editing the paper (10%).

"A dog is the only thing on earth that loves you more than he loves himself" *Josh Billings*

Abstract

In shelters, it is usual to conduct a standardised behaviour assessment to identify adoption suitability. The information gathered from the assessment is used to identify the behaviour of the dogs, its suitability for adoption and to match the dog with an ideal home environment. However, numerous studies have demonstrated a lack of predictability in terms of the post-adoption behaviour in these assessments. We investigated if the owners' perception of dogs' behaviour in the home was reflected in the RSPCA Queensland behaviour assessment, conducted on the same dogs during a visit to the shelter. A total of 107 owners and their dogs aged 1–10 years were assessed in-home and in the shelter. The owners of the dogs completed a questionnaire (the Canine Behavioural Assessment and Research Questionnaire (C-BARQ) survey) 1–2 weeks before bringing their dog to the shelter for the standardised behavioural assessment conducted at the RSPCA Queensland. An ordinal logistic regression analysis identified positive correlations for fear, arousal, friendliness and anxiousness, identified in in-home behaviour and the behaviour assessment. Furthermore, the behaviours of friendliness, fearfulness, arousal, anxiousness, and aggression were positively predictive between home behaviour and tests in the behaviour assessment. This research therefore led to a greater understanding of current canine behaviour assessment protocols used at the RSPCA Queensland in regard to the predictability of behaviour, behavioural problems and the efficiency, effectiveness and predictability of current behaviour testing procedures.

Introduction

The Royal Society for the Prevention of Cruelty to Animals (RSPCA) Australia accepted 33, 863 dogs to its shelters during the period 2018-2019 (RSPCA, 2018). Sources of admitted dogs in Queensland include councils, owner surrenders, humane officer admission (employees of the RSPCA with investigative powers under the Queensland Animal Care and Protection Act 2001) and euthanasia requests (Hemy et al, 2017), with age at admission being variable, but with over 74% adult dogs. Dogs are surrendered for numerous reasons: human-related (unwanted, changed circumstances, financial, owner's health, and ex-commercial/racing), or dog-related (medical and behavioural problems) (Jensen et al,. 2020). After surrender, dogs are housed in the shelter until their suitability for adoption is determined, and if suitable, adopted.

The procedures used to identify dogs suitable for adoption include a medical check, behavioural assessment, in-kennel monitoring, and monitoring by shelter staff when interacting with the dog. Behavioural assessments are the preferred method in many shelters to give an overview of the dog's behaviour for potential adopters (Mornement et al., 2014; Mornement et al., 2015). They assess the dog's reactions to diverse novel stimuli typical of everyday life situations and their ability to cope in challenging situations (Haverbeke et al, 2009), usually 3-5 days after entering the shelter (Mornement et al., 2015).

The testing procedures have a risk of both false positives and negatives (Patronek et al., 2016; Patronek et al., 2019), that is, running the risk of falsely identifying a behavioural problem that does not exist or deeming a dog suitable for adoption when it is not. These problems may arise due to the stress experienced by the dog from living in the shelter (Polgar' et al., 2019), and because certain behaviours are multifactorial and a test carried out at a single point in time may not be able to accurately capture this behaviour. Few studies have evaluated the effect of the timing of behaviour assessments, for example immediately on shelter admission (Bennett et al., 2015).

Measurements used in the assessments need to be appropriate and meaningful, providing both quantitative and qualitative data (Taylor et al., 2006). Qualitative measurements include history-taking measures, which provide a reflection of previous home environment and behaviour. Current procedures used by RSPCA Queensland are primarily quantitative measures, which are in line with the behaviour assessments reported in the literature that use a direct measure of behaviour by observing the dog's response to several testing procedures (Mornement et al., 2014; Svartberg et al., 2002; Marder et al., 2013; Planta et al., 2007; Weiss, 2007; Wilsson et al., 2012). Other measures focus on the assessment of behaviours in everyday situations, using a questionnaire for the dog's

owner to complete (Serpell et al., 2001; Ley et al., 2009; Posluns et al., 2017; Walker et al., 2016). A widely used questionnaire is the Canine Behavioural Assessment and Research Questionnaire (C-BARQ), which includes items focusing on behaviour associated with aggression, fear and anxiety, trainability, excitability, separation, attachment, attention-seeking, and chasing (Serpell et al., 2001). It has been extensively evaluated and used to validate quantitative behaviour assessments focusing on areas of behaviour issues and service dogs (Van den berg et al., 2010; Barnard et al., 2012; Duffy et al,. 2012; Dalla Villa et al., 2017; Stellato et al., 2017)

In order to further investigate the accuracy with which behaviour assessments used in shelters identify behaviours exhibited elsewhere, this study adopted a novel approach to help to determine whether previous home behaviours are accurately reflected in these shelter assessments. The study asked owners to complete a validated questionnaire (C-BARQ) about their dog's behaviour and then to bring the dog into a shelter where the dog underwent the standardised behaviour assessment. The aim of this study was to determine if the dogs' behaviour in the home was reflected in the RSPCA Queensland behaviour assessment, conducted on the same dogs during a visit to the shelter.

Materials and Methods

Ethical Approval

This study was conducted with the approval of the University of Queensland's Human and Animal Ethics Committees (approval numbers 2018001353 and SVS/290/18, respectively). The study complies with provisions contained in Australia's National Statement on Ethical Conduct in Human Research and with Queensland regulations governing experimentation on humans.

Subjects

Companion dog owners from the general public (n: 107) were invited via social media to participate in this study. The RSPCA and the University of Queensland media outlets were used to attract participants. Participants had to have owned their current dog for at least 6 months, be over the age of 18 years and be willing to complete a questionnaire and bring their dog into the shelter to undergo a non-invasive behaviour assessment. Participants received an information sheet and, if willing to have their dog participate in the study, they signed a consent form outlining that the testing would be used for research purposes. Each participating dog was allocated a number which was used to tie the C-BARQ and assessments to the same dog. Apart from the consent form, all information was non-identifiable and most of the questions focused on information about the dog, not the owner. Owners of dogs had to complete and submit the C-BARQ questionnaire before an appointment was made for the shelter assessment. C-BARQ focuses on the dog's interactions in

numerous situations. The shelter assessment used was the standardised assessment used on all in-coming dogs.

Dogs

Dogs were required to be older than 6 months and younger than 13 years of age. Any breed was allowed in the study. Dogs were also required to have no medical conditions nor be on any medication that had the potential to influence behaviour. Dogs previously adopted from shelters were allowed in the study and were initially categorised separately to identify any variability. However there were no differences between groups, therefore, separate categories were dropped. All dogs were required to be with the owners for at least 6 months.

Behaviour Assessment

The dogs were brought into the shelter by their owner for the formal behaviour assessment. It was conducted in a room (4.5m x 4.7m) in a separate building, approximately 50m from the shelter offices and kennels to minimise disturbance. The dogs were initially left in the room by themselves for 15 minutes to allow them to acclimatise to the room while the researcher watched their behaviour from the next room via a video link (4 x Go pro Hero 4 Silver positioned an equal distance apart). The owner waited in an adjoining area for the period of acclimatisation and assessment.

The behavioural assessment used in this study was the standard assessment used by the RSPCA Queensland for shelter dogs. The assessments were conducted, recorded and scored by the lead researcher (LC), who was formally trained in the assessment regimen. Reviewed behaviours reviewed included room exploration, leash manners, sociability, tolerance, play behaviour with toys, the response to unusual/unpredictable stimuli , possessive behaviours, toddler and stranger interaction, time alone and social interactions with other dogs (Clay et al., 2019) (Appendix 4). In each test, the dog's behaviours were scored for friendliness, socialisation, fearfulness, arousal and aggressiveness. The assessment comprised nine different tests performed over a 15 minute period. The equipment used was in line with the RSPCA Queensland's protocol and included a 1.8 meter leash, a tennis ball, a plush squeaky toy, rope, plastic hand on an extend pole, bowl, raw hide or bone, and the combination of wet and dry dog food. The details of the RSPCA Queensland assessment tests can be found in Clay et al. (2019). All the tests were recorded by video (Go Pro Hero 4, Model: HERO4 Black, Manufacture: Hong Kong, China) and reviewed later.

Owner Questionnaire, C-BARQ

Owners rated the behaviour of their dog at home based on behavioural interactions in relation to attachment or attention seeking, sociability, touch sensitivity, excitability, chasing, fear, aggression, and separation related behaviours. The owners' information on their dog's behaviour was categorised into predetermined behavioural categories on a score of 0 and 4 (Appendix 5). The C-BARQ questionnaire used had the 102 question format (Duffy et al., 2012) and was scored on a scale between 0 to 4 (aggression: 0, none – 4, serious, separately scored for stranger-, owner-, dog and familiar dog-directed aggression; fear: 0, no fear or anxiety – 4, extreme fear, both stranger, non-social and dog fear; separation-related problems: from 0, never – 4, always; attachment/attention-seeking: from 0, never – 4, always; touch sensitivity: from 0, never – 4, always; excitability: from 0, calm to 4, extremely excitable; chasing, energy, and trainability: from 0, never – 4, always).

Behaviour Scoring

The formal behaviour assessments were scored for dog behaviour during all tests, as described in Clay et al (2019). The ethogram comprised 48 behaviours, determined following the preliminary observation of dogs during the formal behaviour assessment, classified as either long duration behaviours (for which the duration was recorded) or events (for which the number of occurrences was recorded). The behaviours focused on eight components: activities of the mouth, body, tail position, tail movement, ears, eyes, position in room, and movement (Table 31). The descriptions of each behaviour were presented in a previous study (2019). Behaviour recording was assisted by coding software BORIS (Oliver et al., 2016), which recorded the frequency and duration of each behaviour using continuous input from the coder. Two behaviour variables with no or only one occurrence were discarded: squint and whale eyes. From the coded behaviours, using similar principles to our previous articles (Clay et al., 2019; Clay et al., 2020), the proportion of the time and frequency of the five behavioural categories (Anxiety, Fear, Friendliness, Arousal, Aggression) were derived. The descriptions of each behaviour are presented in Table 31 and their connection to behavioural categories (anxiety, fear, friendliness, arousal, aggression) in table 32 are based off the literature described in a previous article (Clay et al., 2019).

Table 31. Behaviours of dogs (n = 107) recorded for each body part, as well as the position in the room and movement types

Mouth	Body	Tail	Tail Movement	Ears	Eyes	Position	Movement
Open/closed	Weight forward	Low	Wagging	Alert	Soft	Front	Pacing
Panting	Weight back	Med	Fast	Back	Hard	Bed	Sit/lay
Mouthing	Balanced	High	Stiff	Forward	Direct	Door	Stand
Lip lick	Relaxed	Tucked	Slow	Open	Squinting	Wall	Still
Snap	Tense		Loose		Whale eyes		
Bite	Lowered				Dilated		
Whining	Play bow				Targeted		
Barking	Jumping up				Diverted		
Growl	Lowered head						
Howling	Piloerect						
	Body curve						

Table 32. The behaviours contributing to the behavioural states Fear, Anxiety, Aggression, Arousal, and Friendliness.

Fear														
Ears back	Lip licking	Lowered body	Lowered head	Shiver	Stiff tail	Tail low	Tail tucked	Tense body posture	Weight back	Yawn				
Anxiety														
High tail	Jumping	Licking	Lip licking	Medium tail	Pacing	Panting	Stiff tail	Tense body	Weight back	Weight forward	Whining			
Aggression														
Ears forward	Growling	High tail	Lip licking	Lowered head	Medium tail	Snapping	Standing	Stiff tail	Still tail	Targeting	Vertical lip raise			
Arousal														
Diverting gaze	Fast tail	High tail	Jumping up	Jump off	Licking	Medium tail	Mouthing	Pacing	Panting	Weight forward	Whining			
Friendliness														
Body curve	Direct eye	Ears forward	Ears open	Fast tail	Handler interaction	Jump	Medium tail	Play	Relaxed body	Slow tail	Sniff	Soft eye	Tail loose	Walking

Statistical analysis was conducted using Minitab 18. Behaviours were analysed as the percentage of the total observation time (long duration behaviours) or the percentage of the frequency of occurrence (events) during the overall behaviour assessment and within the individual tests. The C-BARQ questionnaire has predetermined categories that were calculated after the 102 questions were complete. Descriptive analysis was used for behaviour in assessments.

Spearman's rank order correlations were computed between C-BARQ and the formal behaviour assessment variables. As comparisons with 79 other behaviours were made for each behaviour in each test of the behaviour assessment, results were corrected for false discovery using the Benjamini-Hochberg procedure (Mcdonald, 2014). The Bonferroni correction was rejected as it assumes the independence of the individual tests. The Benjamini-Hochberg procedure ranks the P values for each test and compares the P values to critical values [(rank/no. tests) x false discovery rate (selected as 0.20 as recommended by McDonald, 2014)]. All P values up to the critical one were considered to indicate a significant difference (Mcdonald, 2014).

Ordinal logistic regression was used to compare the temperament/behavioural information from owner-reported temperament/behaviour with derived behaviours from the shelter assessment, both overall and within the different tests. The Benjamini-Hochberg was used to correct for false discovery as with Spearman rank correlations.

Results

Descriptive details

The sample included 107 companion dogs (males: 52, females 57, desexed: 103, intact: 6) who were over the age of 6 months and under 13 years (mean: 5 years 3 months). Sources of the dogs included: shelters (44.9%), breeders (23.8%), other (online, private sales, or did not disclose) (11.9%), neighbour, friend, or relative (10.1%), and under 5% were from pet stores or were stray dogs.

A variety of breeds were included in the study, determined by the C-BARQ questionnaire completed by the owners; mixed breeds (19.3%), Border collie (10.1%), Kelpie (8.3%), Staffordshire bull terrier (8.3%), German shepherd (5.5%), Australian cattle dog (3.7%), and Rottweiler (3.7%). All other breeds represented less than 3% of the population of dogs. Mean weight of the dogs was 21.8 $\pm$ 1.06 kg.

With respect to the household environment, 64.2% had other dogs in the household; 35.8% were single dog homes. Of the total population, 69.7% of the households had no children and 30.28% had children living in the home. With regard to the living arrangements for the dogs, 80.7% were classified as inside/outside, 12.8% were only inside, 4.6% were only outside and 1.8% had no classification.

Owner questionnaire

All owners completed the C-BARQ questionnaire (107 participants). Many owners indicated that their dogs displayed no signs of fear (score 0) in situations with other unknown dogs (46%), strangers (68%) and non-social interactions (56%), with the second highest occurrence being the dog' displaying minimal signs of fear (score 1) in the above situations (Appendix 6). When owners did report that some fear was displayed, it was most likely to be dog directed, then non-social and least likely to be stranger directed.

It was mostly reported that little aggression was observed. In particular, owner-directed aggression was very rare, only 5% of owners reported this, and stranger-directed aggression was also quite rare, with only 28% of owners reporting this, and mostly at low levels. However, dog-related aggression (unfamiliar dogs) was relatively common, reported by 60% of owners, but less towards familiar dogs (34% of owners). Separation-related behaviours were even less common, reported by 23% of owners, but attention-seeking, chasing, excitable and energetic behaviours were relatively common, with most owners reporting some occurrence. Touch sensitivity was less common, with most owners reporting that it was never or seldom seen. Dogs were reported to be trainable most of the time, but never always.

Formal behaviour assessment

In the overall formal behaviour assessment, dogs spent 41.2% of their time in friendly behaviours, 28.4% displaying fear, 14.3% in a state of high arousal, 13.5% displaying anxiousness, and 2.5% in aggression. Considering the frequency of the behaviours, there was a mean of 37.6% incidents of friendly behaviours, 30.3% incidents of fear-related behaviours, 15.4% incidents of high arousal behaviours, 13.7% incidents of anxiety-related behaviours, and 3.5% incidents of aggressive behaviours.

In individual tests, the major behaviours that had the highest occurrences were friendly and fearful, whereas anxiousness, arousal and aggression had lower instances (Appendix 7). However, there were higher instances of arousal in the toy interaction test which reflects the purpose of the test.

Relationships between Owner-Reported Dogs' Behaviour in the Home and Behaviours Derived from the Formal Behaviour Assessment in the Shelter

All correlations were corrected using Bonferroni correction and varied in strength. Considering the overall behaviour assessment, there were positive Spearman rank correlations between the fear displayed in the assessment and the fear in non-social situations and stranger situations reported by the owner (Table 33). A friendly classification in the shelter assessment correlated negatively with stranger-directed fear reports by the owner. Aggression in the shelter correlated positively with touch sensitivity reports by the owner, both in the overall assessment and in the touch sensitivity test. In the latter test, friendliness correlated with the non-social fear reports by the owner

Table 33. Significant (P < 0.01) Spearman Rank Correlations between the owner-reported dogs' temperament/behaviour in the home and the behaviours derived from the formal behaviour assessment at the shelter

Behaviour assessment test	Shelter behaviours	Owner-reported temperament in the home (C-BARQ)	Correlation coefficient
Overall	Fear	Stranger-directed fear	0.34
		Non-social fear	0.36
	Friendliness	Stranger-directed fear	-0.32
	Aggression	Touch sensitivity	0.31
Touch sensitivity	Aggression	Touch sensitivity	0.27
	Friendliness	Non-social fear	-0.25
Play interactions	Fear	Stranger-directed fear	0.45
		Stranger-directed aggression	0.29
		Non-social fear	0.32
	Friendliness	Stranger-directed fear	-0.42
Response to Unusual/unpredictable stimulus	Fear	Stranger-directed fear	0.32
	Friendliness	Stranger-directed fear	-0.31
Food possession	Friendliness	Stranger-directed fear	-0.32
Toddler doll	Fear	Non-social fear	0.32
	Aggression	Touch sensitivity	0.32

P < 0.01

In the Play interactions test in the shelter, fear correlated positively with stranger-directed and non-social fear and aggression in the home. Friendliness in this test correlated negatively with stranger-directed fear reports by the owner. In the Response to unusual/unpredictable stimuli test in the shelter, fear correlated positively with stranger-directed fear reports by the owner, which also correlated negatively with friendliness in the behaviour assessment. In the Food possession test in the shelter, friendliness correlated negatively with stranger-directed fear, and in the Toddler doll test, fear correlated positively with non-social fear reports by the owner, and aggression correlated with touch sensitivity reports by the owner.

Predictability of Behaviour Assessment

In the home environment, dogs whose owners reported low levels of stranger-directed fear had high levels of friendliness in the Overall shelter test and in the Response to Unusual/Unpredictable Stimulus, Food Possession, Stranger, and Toddler doll tests (Table 34). High levels of stranger-directed fear related positively to aggression in the Overall, Play interaction, Response to Unusual/Unpredictable Stimulus and Food Possession tests, to fearfulness in the Touch Sensitivity test and negatively to high arousal in the Toddler doll test. Owner-reported non-social fear and fear in the Exploration of room, Touch sensitivity and Response to unusual stimulus tests were related. Stranger-directed aggression reported by the owner was also related to fearfulness in the Touch sensitivity test. Owner-directed and reported aggression was negatively related to friendliness, fearfulness and high arousal in the Stranger test, and positively related to aggression in that test and the Toddler doll test. Familiar dog aggression reported by the owner was negatively related to friendliness, fearfulness and high arousal in the Toddler doll test and positively related to aggression in that test.

Touch sensitivity reported by the owner was negatively related with friendliness (Overall assessment, Response to unusual stimulus, Toddler doll, Time alone, Dog-to-dog interaction), high arousal (Overall assessment, Toddler doll, Touch sensitivity, Time alone), fearfulness (Touch sensitivity, Dog-to-dog interactions), and anxiety (Response to unusual stimulus, Toddler doll, Dog-to-dog interaction). There was a positive relationship between those related with aggression (Overall assessment, Touch sensitivity, Play interaction, Response to unusual stimulus, Toddler doll tests).

Attachment/attention seeking reported by the owner related negatively with friendliness (Response to unusual stimulus, Toddler doll), fearfulness (Overall assessment, Response to unusual stimulus, Toddler doll, Time alone), high arousal (Overall assessment, Play interaction, Response to unusual

stimulus, Toddler doll), anxiety (Response to unusual stimulus, Toddler doll, Time alone). It related positively with aggression (Overall, Response to unusual stimulus, Toddler doll, Dog-to-dog interaction tests).

Excitability related negatively to fearfulness in Touch sensitivity, high arousal in Touch sensitivity, and it related positively to anxiousness in the Exploration of room, high arousal in the Exploration of room, and Time alone tests.

Energetic behaviour was related positively to high arousal in the Exploration of room, and aggression in Dog-to-dog interaction and negatively to friendliness in the Dog-to-dog interaction. Chasing was related negatively to anxiousness in the Toddler doll test.

Table 34. Significant (P<0.01) relationships between the owner-reported temperament/behaviour and the behaviours derived from the overall behaviour assessment and individual tests, conducted in the shelter, determined by ordinal logistic regression

Owner-reported temperament/behaviour	Behaviour in behaviour assessment in shelter	Coef	Odds Ratio	Lower CI	Upper CI
	Overall				
Stranger-direct fear	Friendliness	0.20	1.22	1.07	1.41
	Aggression	-0.13	0.88	0.78	0.99
Touch sensitivity	Friendliness	0.16	1.17	1.03	1.33
	High arousal	0.12	1.13	0.99	1.30
	Aggression	-0.14	0.87	0.77	0.98
Attachment/attention-seeking	Fearfulness	0.13	1.14	1.01	1.30
	High arousal	0.17	1.19	1.03	1.36
	Aggression	-0.13	0.88	0.78	0.99
	Exploration of room				
Non-social fear	Fearfulness	-0.04	0.96	0.93	0.99
Excitability	Anxiousness	-0.06	0.94	0.89	1.00
	High arousal	-0.05	0.95	0.91	0.99
Energetic	High arousal	-0.04	0.96	0.92	1.00
	Touch sensitivity				
Stranger-direct fear	Fearfulness	-0.04	0.96	0.93	0.99
Non-social fear	Fearfulness	-0.03	0.97	0.94	0.99
Stranger-direct aggression	Fearfulness	-0.04	0.96	0.93	0.99
Touch sensitivity	Fearfulness	0.15	1.16	1.03	1.30
	Anxiousness	0.17	1.18	1.03	1.35
	High arousal	0.15	1.16	1.02	1.32
		-0.10	0.91	0.83	0.99
Excitability	Fearfulness	0.15	1.16	1.03	1.30
	High arousal	0.15	1.17	1.02	1.33
	Aggression	0.15	1.17	1.02	1.33
	Play interactions				
Stranger-direct fear	Friendliness	0.15	1.16	1.05	1.27
	Aggression	-0.12	0.88	0.81	0.97
Touch sensitivity	Aggression	-0.12	0.89	0.81	0.97
Attachment/attention-seeking	High arousal	0.12	1.13	1.02	1.25
	Response to unusual/unpredictable stimulus				
Stranger-direct fear	Friendliness	0.13	1.13	1.04	1.24
	Fearfulness	-0.04	0.96	0.94	0.99
	Aggression	-0.09	0.91	0.84	0.99
Non-social fear	Fearfulness	-0.03	0.97	0.95	1.00
Separation related behaviours	Aggression	-0.08	0.92	0.85	1.00

	Friendliness	0.09	1.09	1.01	1.19
Attachment/attention-seeking	Friendliness	0.15	1.16	1.05	1.29
	Fearfulness	0.10	1.10	1.02	1.20
	Anxiousness	0.12	1.13	1.03	1.23
	High arousal	0.11	1.12	1.02	1.23
	Aggression	-0.09	0.91	0.84	0.99
Touch sensitivity	Friendliness	0.10	1.11	1.02	1.20
	Anxiousness	0.13	1.14	1.02	1.27
	Aggression	-0.09	0.91	0.84	0.99
	Food possession				
Stranger-direct fear	Friendliness	0.13	1.14	1.02	1.28
	Aggression	-0.11	0.89	0.80	0.99
	Stranger				
Stranger-direct fear	Friendliness	0.10	1.10	1.01	1.21
Owner-direct aggression	Friendliness	0.12	1.13	1.02	1.25
	Fearfulness	0.12	1.12	1.02	1.24
	High arousal	0.13	1.13	1.01	1.27
	Aggression	-0.13	0.88	0.80	0.97
	Toddler doll				
Stranger-direct fear	High arousal	0.12	1.13	1.01	1.26
	Friendliness	0.09	1.10	1.00	1.20
Familiar dog aggression	Friendliness	0.12	1.13	1.03	1.24
	Fearfulness	0.11	1.11	1.01	1.22
	High arousal	0.13	1.14	1.03	1.28
	Aggression	-0.12	0.89	0.81	0.98
Owner-direct aggression	Aggression	-0.13	0.88	0.79	0.97
Attachment/attention-seeking	Friendliness	0.11	1.11	1.02	1.21
	Fearfulness	0.12	1.13	1.04	1.24
	Anxiousness	0.17	1.19	1.08	1.32
	High arousal	0.16	1.18	1.07	1.29
	Aggression	-0.12	0.89	0.82	0.97
Touch sensitivity	Friendliness	0.11	1.12	1.03	1.22
	Anxiousness	0.11	1.12	1.01	1.24
	High arousal	0.10	1.10	1.01	1.21
	Aggression	-0.11	0.90	0.83	0.97
Chasing	Anxiousness	0.11	1.11	1.01	1.23
	Time alone				
Attachment/attention-seeking	Fearfulness	0.11	1.12	1.01	1.24
	Anxiousness	0.15	1.17	1.04	1.31
Touch sensitivity	Friendliness	0.11	1.12	1.01	1.24
	High arousal	0.14	1.15	1.02	1.29
Excitability	High arousal	-0.04	0.96	0.92	1.00

	Dog to dog interaction				
Attachment/attention-seeking	Aggression	-0.08	0.93	0.86	1.00
Touch sensitivity	Friendliness	0.09	1.10	1.01	1.19
	Anxiousness	0.13	1.14	1.01	1.29
Energetic	Friendliness	0.09	1.10	1.01	1.20
	Aggression	-0.09	0.92	0.85	0.98

Discussion

Behaviour assessments are used in the RSPCA Australian shelters to identify behavioural problems, determine suitability for adoption and to monitor the behaviour of each dog over time while in the shelter. The use of the behavioural assessment as a tool in combination with surrender information (home environment, in-home behaviour, and behaviour towards other dogs), veterinary history, in kennel observations, and staff feedback is thought to provide some representation of the dog's behaviour. The behavioural assessment is not being used as a pass-fail tool, rather, it is used as one component of a toolbox to collect information over time. It is important to know how valid it is. The aim of this study was to determine if dogs' home behaviour, measured using information provided by owners using the C-BARQ, was accurately reflected in the standardised RSPCA Queensland behaviour assessment. The study was conducted with dogs owned by members of the general public and therefore not dogs potentially negatively affected by stress due to time in the shelter.

Major themes identified in this study are consistent with the previous findings and results reported in previous studies, particularly in relation to fear, arousal, friendliness, and anxiousness (Clay et al., 2019; Clay et al., 2020). The major tests that were most predictive of behaviour in a home environment were the exploration of room, touch sensitivity, and Response to unusual stimulus in regards to non-social fear. Stranger-directed fear was predictive in tests of touch sensitivity, and response to unusual stimulus response. Touch sensitivity was reflected in the corresponding test in the assessment. Owner-directed aggression was predicted in the stranger and toddler doll tests. Stranger-directed aggression was only identified in touch sensitivity in relation to fear. Excitability and energy were predicted in the exploration of room, touch sensitivity, and time alone tests. Finally, attachment was predicted in tests related to response to unusual stimulus, and toddler doll.

Overall friendliness identified during the play interactions, response to unusual stimulus, food possession, stranger, toddler doll and dog to dog interactions tests were reflected in the low scoring of the categories of energetic, fear and aggressive related issues in C-BARQ. Categories of the C-

BARQ that were not predicted in the tests were dog rivalry, dog-directed aggression, separation-related behaviours, trainability, and chasing.

There are few studies on the ability of an assessment to reflect previous home behaviour; rather, most literature looks at predicting future behaviour (Haverbeke et al., 2009; Marder et al., 2013; Mornement et al., 2015; Dalla Villa et al., 2017; Mohan-Gibbons et al., 2018; Flint et al., 2018; Doring et al., 2017; kis et al., 2014; van der berg et al., 1991). In this study, behaviour reported in the home showed a relationship with certain aspects of the behavioural assessment including fear, friendliness, anxiety, arousal and aggression.

The relationship between fear displayed in the assessment and owners' indication of stranger-directed and non-social fear, aligns with previous findings of the predictability of fear (Mornement et al., 2015; Haverbeke et al., 2015). In looking at C-BARQ categories, stranger-directed fear and aggression, and non-social fear in the home were related to fear observed in the exploration of room, touch sensitivity, and response to unusual stimulus. Non-social fear, stranger-directed fear, and aggression in the home were associated with increased odds of fearfulness in dogs in the assessment. This consistency of fear responses is to be expected, since the fear response is a manifestation of a survival response in the brain located in the amygdala, with the behavioural response created being very recognisable and easy to identify in all species (Ledoux, 2007). Furthermore, the consistency of fear responses indicates a similarity of stimulus features and the demonstration of fearful behaviour requires appropriate environmental stimuli. One might expect to observe some consistency of fear responses in the home environment and shelter, even if people cannot categorise the motives/diagnosis of fear.

Mornement and co-authors (2015) argued that general measures of anxiousness and fear measured in the Behaviour assessment for rehoming K9's (B.A.R.K) protocol significantly predicted "Fearful/inappropriate toileting" behaviours post adoption. These results outline the stable predictiveness of fear consistent over a shelter to a post adoption environment and therefore suggests the stability of fear over longitudinal periods. Foyer and co-authors (2014) further reflected this in a study looking at behaviour in the first year of life and in a later temperament test in dogs. Results from the study outlined that dogs scoring high in categories of stranger-directed fear, non-social fear, and dog-directed fear showed a significantly lower rate of success 3 months later in the temperament test due to fear (Foyer et al., 2014). Therefore, it is of no surprise to observe consistency in the fear response seen in this study.

In relation to friendliness displayed in the home environment and behaviour assessment, it is no surprise that it reflects previous findings (Mornement et al., 2015). Mornement and co-authors (2015) found that post adoption, dogs that greeting visitors in a friendly manner could be predicted by friendliness scores in B.A.R.K. However, it did not appear to be a reliable predictor of problem behaviours, such as overall aggression or destructive behaviour in shelters.

Furthermore, the predictability of behavioural problems outlined in the results using the owner information and the behaviour assessment could be due to the timing of the assessment. The assessment was conducted upon arrival, located in a room which was at a considerable distance from the main shelter. The stress of the shelter may cause the normal behavioural repertoire to change in the dog for the purpose of finding the best coping mechanism to deal with acute stress due to changes in the environment. Therefore, the timing of the assessment (currently at a minimum of 3 days after surrender) may cause the predictability of behaviour post adoption to be poorer due to the changes that stress can cause in normal behaviour. If we take human psychology as an example, humans that go into a novel environment which they have never been in before suffer an acute stress response. Humans, like all animals, need to adapt to a new environment; they can find positive and negative coping mechanisms to help with this which is then reflected in their behaviour (Rayment et al., 2015). If positive coping mechanisms are not found, then negative coping mechanisms are used, causing problem behaviours and sometimes addiction. Dogs that have never been in the novel environment before, such as the shelter, respond with an acute stress response due to social isolation from previous family, daily routine changes, disturbed feeding, walking, and socialising, lack of handling and attachment figures, and sensory overstimulation. The dog must adjust to the new environment and if unable to cope effectively, behavioural problems start to occur. Once adopted, however, dogs then need to adjust back to home behaviour, which can be easy for most dogs but other dogs with behavioural problems may find this difficult. This is consistent with the findings of Mornement and co-authors (2015) who indicated a high number of new adopters reporting signs of growling, snapping, and attempting to bite a person.

Not all instances of behaviour seen in the behavioural assessment reflected responses to the C-BARQ questionnaire, including certain categories of aggression (dog-directed, stranger-directed), separation related behaviours and possessive behaviours. Only one category of the C-BARQ, owner-directed aggression, showed consistency with the behaviour assessment tests stranger and toddler doll tests.

One might expect that stranger-directed aggression in these tests would be reported in the C-BARQ but this was not the case. A study by Dalla Villa et al. (2017) outlined the use of the SABS protocol for identifying categories of aggression. The results indicate that only categories of C-BARQ predictive of the SABS were associated with owner-reported aggression towards familiar people and familiar dogs, however, these were not directly measured by any of the SAB subtests. The identification of the category of aggression is difficult as there are numerous such categories (Luescher et al., 2008) and aggression can be multifactorial. Therefore, this could explain the lack of results in the predictability of aggression towards another stimulus e.g. dog-directed and stranger directed. Without thorough examination of the context of aggression, the environment, and a comprehensive understanding of all factors at play, it is very difficult for assessments to correctly identify, let alone predict, categories of aggression.

Separation-related behaviours are difficult for assessments to identify predictably due to the multifactorial nature of the issue. The issue can be easily misclassified due to other underlying problems like attachment-seeking, general anxiety, fears, or phobias (Horwitz and Neilson 2018). Furthermore, differential diagnosis should always be taken of account before outlining that the individual has separation anxiety. Storengen and co-authors' (2014) study into 215 dogs diagnosed with separation anxiety reported that only 18.5% of animals actually had only separation anxiety with no other behavioural problems, whereas 82.8% of the animals had other underlying behavioural problems in addition to separation anxiety, with the most common comorbidity being related to noise sensitivity (43.7%).

Possessive behaviour has been reported in the literature to have a low predictability (Marder et al., 2013; Mornment et al., 2015; Mohan-Gibbons et al., 2018). This may be due to the manifestation of the problem being environmentally based (Marder et al., 2013; Mohan-Gibbons et al., 2018). Possessive aggression is associated with a need to protect a resource from surrounding threats, however, once a threat is no longer present, the behaviour ceases, therefore it is not often seen in post-adoption environments. The study by Marder and co-authors (2013) found that a little over half of the dogs with possessive behaviour in the shelter displayed these issues post adoption, whereas 22% of dogs identified in a shelter with no signs of possessive behaviours exhibited the behaviour post adoption. Furthermore, a study by Mohan-Gibbs (2018) into the removal of the test, identified that there was low risk of injury to handlers, volunteers, staff or adopters and no significant difference in the rate of returns. However, even though it was a low relative risk of occurrence in the home it is

predictive, just not perfectly predictive. Possession aggression, however, can be stimulated by environmental or competition in the environment, therefore, if in a stable environment, such behaviours will decrease or cease. Therefore, in the current study, this could explain the low occurrence of possessive aggression, especially in the home environment.

Numerous possibilities exist that consider discrepancies between the behavioural assessment results and owner reports. A possibility is that the current standardised behaviour assessment may be adequate at identifying overall behaviours, however, unable to correctly identify certain behavioural problems. However, behavioural problems, such as dog directed aggression or separation related behaviours, may be inaccurately identified due to the misinterpretation of the behaviour by the owner in the home. For example, dogs that are reactive to other dogs at a distance could be misclassified as dog-aggressive or offensive aggressive when what is being displayed is built up frustration and hyperactivity towards other dogs. A study that assessed the behaviour of privately owned dogs using the Dutch socially acceptable behaviour test, found that a large portion of aggressive dogs remain undetected and the test was unsuitable for assessing types of aggression apart from fear (van den berg et al., 2010). The current results agree with this, outlining the high degree of detectability of fear.

There are limitations to this study. One limitation is that all dogs in this study had been in a home environment for over 6 months, and therefore, had an attachment figure. Attachment figures have previously been seen to have make a significant impact in inhibitory control, problem solving tasks and social interactions in comparison to dogs that were in shelters with no attachment figure (Barrera et al., 2015; Barrera et al., 2010; Fagnani et al., 2016). Another limitation includes that the study population may not be representative of dogs that end up in shelters.

The results from this novel study suggest the benefit of an upon surrender assessment to increase the understanding of behaviour from the previous home environment. Early recognition of behavioural problems that include fear, anxiousness, arousal, and aggression can help dogs cope in the environment and allows behaviour modification to be implemented before the stressors of the shelters begin to have an effect (Polgar et al., 2019).

Conclusions

This study suggested that the standardised behaviour assessment protocol used at an Australian shelter is a useful tool to reflect home behaviour when conducted upon entry to the shelter as mimicked in this study methodology, with friendliness, fearfulness, anxiousness, high arousal and

certain categories of aggression measured by the C-BARQ being reflected in the assessment. The identification of behaviours of dogs upon entry can help to create a more comprehensive understanding of the dog's behaviours in the home environment and further identify any behavioural issues/ monitored throughout the stay in the shelter plus allow behaviour modification to start upon entry. Information can give a base line for the dogs before entry, thus allowing the longitudinal monitoring of behaviours and behavioural issues. Investigations into longitudinal monitoring from surrender to adoption, and the relationship of individual behavioural change over time, needs to be conducted.

Chapter 7: General Discussion

"Remember that wherever your heart is, there you will find your treasure" *Paulo Coelho, The Alchemist*

The overarching aim of this thesis was to investigate how effective RSPCA Qld canine behaviour assessments in the shelter are at predicting behaviour, recognising behavioural problems, and adoption suitability. Of particular interest was to improve RSPCA Qld. behaviour assessment by developing a more effective and efficient way to conduct the assessment and match dogs to potential owners. While shelters and rescue organisations around the world have existing behaviour assessments used for numerous reasons, they all differ in structure, methodology, and overall purpose. Whist a myriad of studies have been conducted outside of Australia exploring predictability of behaviour post adoption and the lack of sensitivity and specificity in predicting behaviour problems, there still remains valid motive and purpose for using them, especially in Australia. The purpose of behaviour assessments in Australia is not to identify pass/fail, but to identify dogs suitable for adoption and review/test further dogs with behavioural issues. Studies have pushed the view that assessments should not be used due to lack of predictability. However, if assessments are used as one tool amongst others to review a dog's behaviour, then I believe there is benefit. Much evidence suggests low sensitivity and specificity in the use of similar assessment protocols (Marder, 2013, Patronek and Bradley, 2016; Patronek et al. 2019), however most of these assessments are used for pass/fail information. The assessments are not used as one part of a document of information to inform the shelter of current behaviours under certain situations, novel environments, interactions with staff, trainers and volunteers, veterinary check-up information, in-kennel observations, previous history and previous home environment.

Previous studies in Australia outline that assessment procedures have benefits in their ability to identify fearfulness, anxiousness, arousal and friendliness. However, it is harder to identify behavioural problems of separation anxiety, or categories of aggression (Mornement et al. 2014, 2015; Poulson et al. 2009, Rayment et al. 2015). These findings indicate a problem for shelters, due to countless variables that may be influencing behaviours. Therefore, there is as a need to revise current procedures used in Australia to increase efficiency and effectiveness of the behaviour assessment. This 5 series study comprised a review of the positive uses of behaviour assessments, an in-kennel and behaviour assessment study, behaviour assessment and post adoption study, reduction model of behaviour assessment study, and owner questions and behaviour assessment study. These studies explore previously un-researched areas and include a new perception of the use of behaviour assessment protocols currently in place in Australian shelters. The studies identify

the assessments' strengths and weaknesses but focus on how these can be overcome to create a more evidence-based, effective and efficient assessment tool.

In order to attain these findings, baseline information was obtained through a review of current literature (Chapter 2), aimed at understanding the global perspectives in regard to knowledge and uses of behaviour assessment in the industry. To explore current protocols at RSPCA Qld, quantitative research methods were used to evaluate effectiveness and identify ways to increase efficiency, specifically by exploring the relationship between in-kennel behaviour observations over the first five days and behaviour assessment information to identify predictability of behaviour and manifestation of behavioural problems (Chapter 3); predictability of behaviour assessment with post adoption information (Chapter 4); investigating relationships between test information in assessment to increase effectiveness and efficiency (chapter 5); and lastly, investigating the relationship between owner information and an assessment using RSPCA Qld. behaviour assessment protocol in general population dogs to mimic upon surrender assessment (chapter 6).

The implications of this research are discussed below, followed by an outline of limitations and a summary of recommendations for current protocols and future research.

In defence of canine behaviour assessments in shelters: outlining their positive applications

Chapter 2 reviewed current literature on behaviour assessments and their positive applications in shelters. The review was pivotal in assessing the positive and negative aspects behind behaviour assessments that are used in different countries. The use of the behaviour assessments in RSPCA Qld. were employed as a basis for the review and outlined how the process in Australian shelters differs from other countries. The review outlined the use of the various tests in the assessment, and studies previously conducted on predictability of behaviour.

Whilst worldwide behaviour assessment designs, methods and recording are all different and are used for diverse purposes, the key findings in the research were that there was low sensitivity and specificity in identification of behavioural problems, in particular, aggression. This can be due to many reasons: shelter variability, flaws in research design and methods, and knowledge/skill level of trained staff that can correctly identify a behaviour problem. Most studies reviewed reported that assessments were able to correctly identify basic behavioural attributes that can include, fear, friendliness, sociability, anxiousness, and arousal. However, the possibility that this is due to the knowledge and ability of observers and handlers running the tests, must be considered. Even though

previous research indicates good inter-rater reliability between trainers and professionals, this may only be the case for basic behaviours displayed, not multifactorial behavioural problems, such as different categories of aggression. Despite the negatives associated with the predictability of behaviour assessments in the literature, there are a multitude of reasons for using the testing procedures in shelters.

Early recognition of behaviour problems in dogs using in-kennel monitoring over the first five days after admission to a shelter

Chapter 3 aimed to investigate whether the manifestation of behaviour and behaviour problems found in the behaviour assessments can be identified using in kennel behaviour during the first five days of shelter acclimation – to understand if assessments can identify problems that are found after entering the shelter.

This chapter demonstrates that whilst most behaviour assessment work to demonstrate a pass/fail response, using an assessment as a tool to gain information about the dog's behaviour is valuable to maintaining an understanding of how the dog's emotional state is over time. In-kennel behaviour that reflected an increase in fear, anxiety, arousal, over the first five days mirrored some behaviours identified in behaviour assessment. Focusing on individual test exploration and time alone in the assessment, showed that dogs that displayed behaviours associated anxiety, fear and separation anxiety correlated with behaviours found in kennel. Dogs that had increased odds of failing the assessment displayed fear and anxiety behaviours in-kennel and assessment. Furthermore, dogs that failed had decreased odds of friendly and social behaviours. This may allow assessment to be used to indicate how dogs are coping in the shelter rather than depicting which individuals passed or failed. If early signs of behaviours associated with fear, anxiety and arousal are identified early, prevention or behaviour modification can be implemented to assist with and develop coping mechanisms while in shelter.

Do behaviour assessments in a shelter predict the behaviour of dogs post adoption?

This chapter aimed to address the predictability of current RSPCA Qld. behaviour assessment protocols. The aim was to understand if the behaviour displayed during the behaviour assessment tests accurately reflects the behaviour displayed in the home environment, whether it be a stable behavioural repertoires, or behavioural problems.

In gathering information directly from adopters of dogs post adoption, there were behavioural attributes that reflected information found in behaviour assessment: friendliness, fear and anxiousness. However, the identification of behaviour problems such as aggression, food guarding or separation related behaviours were not predicted by the standardised behaviour assessment. The results suggest that due to the complexity of behaviour problems, such as, different categories of aggression and separation anxiety, predictability is less effective. The complex nature and aetiology behind behaviour problems such as numerous categories of aggression: fear- direct aggression, possessive aggression, offensive aggression, or defensive aggression, can only be diagnosed with a specialist and appropriate testing procedures. In addition, whether current protocols in place for assessing shelter dog behaviour are better seen as just one tool used in conjunction with other monitoring tools to assess behaviour over long term, thus allowing increased safety/welfare standards for dogs, shelters and the wider community, is discussed. Dogs identified as having behavioural problems should be reviewed by a specialist so that appropriate plans can be implemented.

As this study reveals similar findings to research in the field relating to predictability of behavioural problems, it is evident that behaviour assessments are able to identify basic behavioural attributes. More so, it reflects the need for professionals to review dogs with serious behavioural problems. Thus, ensuring that best standard of practices is maintained and that behaviour assessments are used as tools for information collection rather than pass/fail tests.

Review of tests in the RSPCA standardised shelter behaviour assessment: evaluation of test purposes and identification of relationships between tests

This chapter further aimed to address the need to create more effective and efficient behaviour assessment protocols at RSPCA Qld. The aim was to compare behaviour assessment test's to recognise whether there are expressions of similar behaviours between each test, thereby, allowing reduction of tests, repeats and scoring of behaviours.

Reviewing current procedures for the behaviour assessment, results suggested that there were excessive repeats in tests and certain tests could be dropped due to duplication in measuring similar behaviours. The results suggest that repeats in the following tests can be removed: touch sensitivity, play, tag, and intraspecific interactions. Whereas, startle response and fake cat tests can be removed from the assessment altogether. Reduction within tests can occur in food possession, touch sensitivity and play interactions.

This chapter demonstrates that whilst most behaviour assessments are used to identify behaviours under multiple situations, there are links between tests and a repetitiveness that can be reduced. Furthermore, dogs can suffer undue stress that is not required to identify aspects of fear, anxiety or arousal. Excessive testing can put dog's under unnecessary stress that may lead to further negative coping mechanisms (e.g. reinforcement of growling in handling tolerance tests) for the dog if the individual is not allowed to display effective coping strategies in the test. Therefore, reduction in the tests and thus allowing dog's the ability to cope is required.

Comparison of canine behaviour scored using a shelter behaviour assessment and an owner completed questionnaire, C-BARQ

This chapter further compared dog behaviour reported by owners and the results of an assessment using the RSPCA Qld behaviour assessment protocol. The aim was to improve behaviour assessments in identifying future behaviours in a new home and in society more generally. Thereby, if the testing procedures reflected accurately the home environment, then an assessment upon entry would be more effective at reflecting home behaviour than the current practice of testing the dogs after 3-5 days.

This chapter demonstrated that whilst the behaviour assessment has a lack of predictability in identifying future behavioural problems, it can at entry, identify behaviours in the previous home environment. Overall, there were relationships between categories of fear, touch sensitivity, and friendliness identified in the home environment and behaviour assessment. Furthermore, there was predictability in behaviours in the home and behaviour assessment associated with friendliness, fearfulness, anxiousness, high arousal and aggression. Therefore, results suggest that an assessment upon entry to shelter would reflect the dogs behaviour in the home environment. However, it would be used to identify general behavioural categories, whereas, categories of behavioural problems can be identified in specialised tests after entry to the shelter. Using general behavioural categories in the behaviour assessments would streamline dogs suitable for adoptions and highlight dogs that require more behaviour modification before adoption. Reduction of the test can be modelled off chapter 5 results, which would reduce time taken to assess, and increase efficiency of assessment at surrender.

Limitations

The thesis had a number of limitations in the implementation of the studies. For instance, recognising that many variables cannot be accounted for due to the unpredictable nature of a shelter

environment. Variables in the shelter environment which are difficult to control for include auditory, olfactory, and visual stimulus. Furthermore, neither the stress that can be evoked by the shelter environment nor individual variations in coping mechanisms can be controlled for. It has been prominently researched that dogs experience a form of social isolation once surrendered to the shelter and this mechanism can affect results dramatically.

In study one, there were limitations associated with the implementation of the behaviour assessment, as it was conducted by multiple handlers and observers. Inter-handler reliability could not be scored due to the assessments being recorded one year before study began. Further, there were no requirements for dogs that entered the study as long as they were owner surrendered to the RSPCA Queensland and the duration of the study was short. Therefore, there was a limited number of dogs compared to previous research in the area.

In study two and three, limitations were associated with the data that was collected over a three-year period. Behaviour assessment data was collected using binary information and scored by multiple observer's across the 955 dataset. Therefore, the behaviour assessment was not standardised in these studies with numerous tests being interpreted differently. Furthermore, the follow-up survey information post adoption had only 125 participants out of 955, with certain survey questions not being fully completed.

In study 4, limitations were minimal as variables in shelter stress were reduced by implementing assessments away from shelter kennelling. Furthermore, before completing assessments all dogs were left in the room with handlers for 20-30 minutes, to make sure the behaviour assessment was not completed while dogs were in a state of acute stress. There were limitations in trying to standardise intraspecific interactions, as the opposing dog was limited to individuals in the RSPCA Qld. shelter population.

Recommendation for future research

The current thesis highlights the need for future research in a number of key areas including: longitudinal studies of individual dogs, implementation of longitudinal monitoring of behaviour using upon entry assessment, daily monitoring, reassessment and post surrender information outlining behavioural change over time, use of best practice for scoring of assessments for different staffing levels, and movement monitoring tools for behavioural patterns. Investigating these aspects will identify best practice methods for behaviour assessments which are more predictive over time and more effective. And ultimately, are most advantageous for the dogs, the shelters and staff. Other areas of research would focus on staff training to increase positive predictive values of

behavioural issues using principles similar to those identified in the TSA research looking at increasing positive predictive values of threats in airport security staff.

Furthermore, future studies should focus on specialised assessments for identification of behavioural problems associated with fear, classifications of aggression, general anxiety, and separation-related behaviours. The use of these assessments can help correctly identify behavioural problems with support from qualified animal behaviourists or behavioural vets. Decision making processes (similar to quality of life tests) for behavioural euthanasia in shelters should be studied to identify best practices. A study should include information based on behavioural consultant reports from qualified professionals, shelter limitations (time, resources, and staffing), reviewing processes and incorporation of a quality of life test.

Cross comparative studies which review behaviour assessment procedures between countries would identify key areas of differences and similarities in hopes of findings the best practice for shelter behaviour assessments across the world should be undertaken. Development of these areas could see improvements in the perceived lack of evidence to support use of behaviour assessments, increase positive predictive values, identify stable behaviour problems over time, and facilitate the use of behaviour assessments as one of many tools used to identify behaviour and behavioural problems of dogs in shelters.

Conclusion

Behaviour assessments are used all over the world for different purposes and goals, and it is predominantly used in shelters for the purpose of predicting behaviour, identifying behavioural problems, and assessing adoption suitability. Current procedures see the RSPCA Qld. shelter use the behaviour assessment not as a pass/fail test as is the case with USA counterparts, but as one tool used in conjunction with numerous other feedback tools to monitor behaviour over time. Behaviour assessments currently used at RSPCA Qld. identified categories of behaviours that include friendliness, fearfulness, anxiousness, arousal and aggression. Current findings suggest that the use of the assessment can be effective in identifying behaviours and certain behavioural issues.

A noteworthy point from this thesis was the recurrent expression of behavioural categories outlined above. However, to identify certain behavioural problems is the behaviour assessment was less effective due to the multifactorial nature of aggression and separation related behaviours. The thesis provides tangible evidence to support the use of the behaviour assessment in a more effective and efficient manner, to help identify behaviours compatible with adoption, behavioural issues and to monitor behaviour over time.

The many behaviour assessments used around the world are still very much under review due to the potential for false positives and negatives associated with the predictability of behavioural problems like aggression. However, this thesis recommends using the assessment as one tool in conjunction with other methods that help create a better understanding of the dogs behaviour over time. For example, taking history, daily monitoring form staff and volunteers, veterinary checks, behavioural modification and reassessment. Assessment should never be used as a singular tool to identify a dog suitable for adoption or suitable for euthanasia.

Future studies should include programs associated with behaviour assessments, specialised assessments for behavioural problems and behaviour modification techniques. The research would help further justify the use of behaviour assessments and cement its significant contribution to a greater pool of assessment in order to help shelter dogs, assists human understanding of behaviour and the effects of shelter environments and, assist in effectively monitoring behaviour in shelter dogs.

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Appendices

Appendix 1. Dog surrender Profile

RSPCA — Dog Surrender Profile — V1 20140120

OWNER'S DETAILS

Mr / Ms / Miss / Mrs   Given Names: Surname:

DOB: Home Phone: Mobile:

Street Address:

Suburb: Postcode:

DOG'S DETAILS

Dog's Name: Age: Breed:

Sex: ☐ Male   ☐ Female   Desexed: ☐ Yes   ☐ No   ☐ Unsure

Microchipped: ☐ Yes   ☐ No   ☐ Unsure   Microchip Number:

Is your dog registered with Council?   ☐ Yes   ☐ No   ☐ Unsure

Where did you get your dog?

How old was the dog when you acquired him/her?

Are you surrendering your dog because you can't afford vet treatment?   ☐ Yes   ☐ No

If no, why are you surrendering your dog?

LIFESTYLE & HOME LIFE

Is your dog allowed inside?   ☐ Yes   ☐ No   ☐ Sometimes

Is your dog allowed outside?   ☐ Yes   ☐ No   ☐ Sometimes

Where does your dog prefer to spend most of its time?   ☐ Indoors   ☐ Outdoors

When no one is home where is your dog kept?

What does your dog do as you leave the house?

What does your dog do when left home alone?

What does your dog do when you return home?

Where does your dog sleep at night?

How much time does your dog spend on his/her own?

Does your dog follow you from room to room when you are home?   ☐ Yes   ☐ No   ☐ Sometimes

Do you have any other dogs?   ☐ Yes   ☐ No   Cats?   ☐ Yes   ☐ No   Other pets?

How does your dog interact with these other pets?

Which pet arrived in your household first?

SOCIAL INTERACTIONS

How would you describe your household? ☐ Quiet ☐ Busy ☐ In between

How many adults live in your household?

How many children live in the household? Ages:

Do any of the children play with the dog? ☐ Yes ☐ No

If yes, does the dog: ☐ Tolerate them ☐ Ignore them ☐ Walk away ☐ Hide from ☐ Other

Details:

Does the dog need to be taught to be gentler when he/she plays with children? ☐ Yes ☐ No

How often does the dog require 'time out' from the children?

Has your dog met...

Many children?	☐ Yes	☐ No	☐ Unsure
Many adults?	☐ Yes	☐ No	☐ Unsure
Many dogs?	☐ Yes	☐ No	☐ Unsure
Many other animals?	☐ Yes	☐ No	☐ Unsure

Describe any unpleasant situations with...

Children -

Adults -

Dogs -

Other animals -

How does your react when people/strangers come to the house? ☐ Excited/playful ☐ Ignores ☐ Growls/barks ☐ Hides

How long does it take him/her to calm down?

Does your dog have access to visitors? ☐ Yes ☐ No

Do you need to restrain him/her, or is he/she free to interact? ☐ Restrained ☐ Free

Is your dog happy to be touched/handled by visitors / strangers? ☐ Yes ☐ No

If no, how does your dog react?

Are there any parts of his/her body that your dog doesn't like being touched by visitors/strangers (e.g. paws, head)? ☐ Yes ☐ No

If yes, what body part(s)?

TICK ALL THAT APPLY -

How does your dog react to unfamiliar men? ☐ Friendly ☐ Barks at ☐ Growls ☐ Snaps at ☐ Avoids ☐ Not interested ☐ Hides ☐ Other _____

How does your dog react to unfamiliar ☐ Friendly ☐ Barks at ☐ Growls ☐ Snaps at ☐ Avoids

women?	☐ Not interested ǀ Hides ǀ Other _____
How does your dog react to younger children?	☐ Friendly ☐ Barks at ☐ Growls ☐ Snaps at ☐ Avoids ☐ Not interested ☐ Hides ☐ Other _____
How does your dog react to older children?	☐ Friendly ☐ Barks at ☐ Growls ☐ Snaps at ☐ Avoids ☐ Not interested ☐ Hides ☐ Other _____
How does your dog react to other dogs?	☐ Friendly ☐ Barks at ☐ Growls ☐ Snaps at ☐ Avoids ☐ Not interested ǀ Hides ǀ Other _____
How does your dog react to cats?	☐ Friendly ǀ Barks at ǀ Growls ǀ Snaps at ǀ Avoids ☐ Not interested ǀ Hides ǀ Other _____

BEHAVIOUR & TEMPERAMENT

How active is your dog?	☐ Very ☐ Moderately ☐ Not very ☐ Unsure
How playful is your dog?	☐ Very ☐ Moderately ☐ Not very ☐ Unsure
How affectionate is your dog?	☐ Very ☐ Moderately ☐ Not very ☐ Unsure
Does your dog like to hunt or chase prey?	☐ A lot ☐ Sometimes ☐ No ☐ Unsure
Does your dog like to be patted/touched?	☐ A lot ☐ Sometimes ☐ No ☐ Unsure
Is your dog outgoing and interactive?	☐ Very ☐ Sometimes ☐ No ☐ Unsure
Is your dog shy and likes to be left alone?	☐ Very ☐ Sometimes ☐ No ☐ Unsure
Does your dog enjoy being picked up/handled?	☐ A lot ☐ Sometimes ☐ No ☐ Unsure

Has your dog ever scratched anyone (even if whilst playing)? ☐ Yes ☐ No

If yes, details:

Has your dog ever bitten anyone (even if whilst playing)? ☐ Yes ☐ No

If yes, details:

Has your dog ever been in a fight with another dog? ☐ Yes ☐ No

If yes, what was the fight over? How old was your dog at the time?

Has your dog ever needed to be muzzled for any reason? ☐ Yes ☐ No

If yes, under what circumstances?

Does your dog travel well? ☐ Yes ☐ No

Does your dog vocalise excessively? ☐ Yes ☐ No

If yes, when and why?

Is there anything that may cause your dog to be nervous or fearful? ☐ Yes ☐ No

Please circle appropriate responses

Page 3 of 6

Storms Fireworks Loud noises Camera flashes Other dogs Other animals _____ If yes, how does your dog react?

_____

FOOD & FEEDING

What do you feed your dog?

How many times a day is your dog fed?

At what time of day is your dog fed?

Is your dog comfortable with people being around when he/she is fed? ☐ Yes ☐ No

If no, what does the dog do in this situation?

Is your dog comfortable with other animals being around when he/she is fed? ☐ Yes ☐ No

If no, what does the dog do in this situation?

Can you easily take food, bones, toys from your dog? ☐ Yes ☐ No ☐ Never tried

If no, what is your dog's reaction when you try to take such items?

_____

TRAINING

Has your dog attended training or puppy classes? ☐ Yes ☐ No

If yes, what classes? How long ago? Where? What methods were used? For example, treat training, check chain

What cues/commands does your dog respond to?	☐ Sit ☐ Stay ☐ Other _____
Does your dog come when called?	☐ Yes ☐ No ☐ Sometimes
How well does your dog walk when on leash?	☐ Walks well ☐ Pulls sometimes
	☐ Not well - pulls constantly ☐ Won't walk
Do you use any walking equipment?	☐ Head halter ☐ Body harness
	☐ Choker ☐ Flat collar

Does your dog enjoy being picked up/handled? ☐ A lot ☐ Sometimes ☐ No ☐ Unsure

HEALTH

Has your dog ever had any vaccinations? ☐ Yes ☐ No ☐ Unsure

If yes, approximately when?

If yes, is a vaccination certificate being provided to the RSPCA? ☐ Yes ☐ No

What is the name of your current vet?

What are the contact details for your current vet?

How does your dog behave at the vet?

_____

When and why was the last time you took your dog to the vet?

Does your dog have any medical conditions/history that you are aware of? (Include visits to the vet for dog fights, illnesses and accidents)   ☐ Yes ☐ No

If yes, details:

Is your dog currently on any medication, including heartworm preventative?   ☐ Yes ☐ No

If yes, details:

EXERCISE & PLAY

How often is your dog walked?	☐ Daily ☐ Weekly ☐ Monthly ☐ Never
How long does a walk last?	
Where do you take your dog when you walk him/her?	

Describe your dog's reaction when he/she sees another dog whilst walking:

Do you regularly exercise your dog off-leash?	☐ Yes ☐ No
Do you let your dog sniff/play with other dogs (outside the home)?	☐ Yes ☐ No
Does your dog have a best friend/doggy playmate?	☐ Yes ☐ No
Details of playmate (lives in same household? breed, sex, age etc.):	
What are your dog's favourite kinds of games to play?	
What are your dog's favourite kinds of toys?	
Is your dog rough/mouthy in play?	☐ Yes ☐ No
If yes, please describe:	

GROOMING

How often do you bath your dog?	☐ Daily ☐ Weekly ☐ Monthly ☐ Never
How often do you brush your dog?	☐ Daily ☐ Weekly ☐ Monthly ☐ Never
How does your dog behave when groomed?	☐ Compliant ☐ Fusses but can control ☐ Scared ☐ Panics and cannot control ☐ Becomes aggressive ☐ Never tried
Has your dog ever been professionally groomed?	☐ Yes ☐ No
Can you easily trim your dog's claws?	☐ Yes ☐ No

OTHER

List three words that would describe your dog? (e.g.: active, affectionate, food motivated)

List three things that make your dog happy:

What sort of home / family would suit your dog?

Are there any quirks or habits you are not fond of in your dog?

RSPCA Use Only		
Date Received:	Surrender Accepted:	Reference Number:

Appendix 2. RSPCA Standardised Behavioural Assessment (Clay, et al. 2019)

Test 1: Exploration of Room

Exploring the Room

The assessor entered the room, dropped the lead attached to the dog, and sat in the centre on a chair. Then, the observer started a timer and waited for 1 min without any interaction with the dog by either person.

Sociability to Assessor

At the end of exploring the room, the assessor called the dog to them in a friendly voice, remaining in the chair with no other body movement. If there was no response, a second attempt was made, and if still no response the assessor clapped their hands on their lap and said 'come here' in the direction of the dog, trying at least three times to call the dog to them. When the dog came (at the first, second, or third call), the assessor picked up the leash and then stroked the dog from the base of neck to tail three times. If the dog did not respond to the first, second, or third call the assessor approached the dog, picked up the leash, and gave the dog three strokes from the base of neck to tail. Following each stroke, the observer and assessor counted 10 s, with behaviours exhibited noted.

Test 2: Tolerance to Handling

There were three components to the test, touch sensitivity to collar, stroke, and feet. The assessor dropped the leash and held the dog's collar. After 3 seconds, handler stroked the dog from head to tail. With the dog standing, the other assessor (in the standing position, or crouching if a small breed of dog) picked up the dog's rear inside foot, then the front inside foot, then reached over its back to pick up its rear outside foot, and finally the front outside foot. Each foot was held for 2 s. After picking up all four paws in this manner, the assessor stood for 10 s with no dog interaction and finally removed the dog's leash.

Test 3: Startle Response

There were two components: Startle response and recovery to stimulus. At the end of Test 2, the assessor created a loud sound using a book on a bench or desk (Startle response). Assessors recorded recovery.

Test 4: Toy Interactions

Three toys were used in this testing procedure: tennis ball, squeaky toy, and tugging rope. A tennis ball was shown to the dog and gently thrown across the room, and the assessor verbally engaged the dog in play. If the dog picked up the ball, the assessor waited to see if it returned to the assessor without encouragement. If it did not, the assessor encouraged the dog to bring the ball back by calling his/her name and saying "come". If the dog still did not return, the assessor went to the dog.

In both situations, the assessor waited 10 s to see if the dog dropped the ball. If it did not, he/she asked the dog to "drop it". If the dog did not respond, then a second command was given, "give", and if necessary, a third attempt, "out", was tried. If the dog did not respond to these commands, the assessor approached the dog carefully and removed the ball from the dog's mouth. These steps were repeated for a second throw and, after completion, the assessor waited 10 s with no interaction before moving on to the next toy, the squeaky toy, and after that the tugging rope. The same sequence was used for each toy. After completing all three toys, the assessor moved on to the next test.

Test 5: Response to Unusual/Unpredictable Stimulus

The assessor gently moved the dog to the opposite end of the room and left it standing against the wall. Then, he gently moved one hand over its head, down toward the back to gently tap the rump area, and then ran across the room, laughing and waving arms, followed by suddenly stopping, folding his arms, and ignoring the dog. The tap, run, and freeze series was repeated a second time. The assessor waited for 10 s after the run and freeze, ignoring the dog, before moving onto the next test. The dog was then placed back on the leash.

Test 6: Resource Guarding

There were four components to the test: Wet food, dry kibble/biscuits, pig's ear and bone. The assessor tethered the dog to the wall for safety reasons, and proceeded to show the dog wet canned food, smeared in a bowl. The bowl was then placed near the dog at the end of the leash perimeter, allowing the dog to begin eating for 2 s. The assessor then proceeded with a plastic hand, walking to the side of the dog while it was eating. Using the fake hand, the assessor patted the dog on the head, continuing to stroke down its back and body twice. The fake hand was then placed 5 cm in front of the bowl and moved around in a semi-circle. The hand was then placed on the inside edge of the bowl and moved around the edge of the bowl next to the dog's face, without touching it. Finally, the bowl was pulled away from the dog using the fake hand. The bowl was then returned to the dog, which was observed for 10 s.

The assessor then gave the dog a pig's ear or bone, depending on the dog's food interest, and it was allowed to chew it for 30 s. The steps above with wet food were repeated; then, the assessor attempted to retrieve the food, asking the dog to "drop it", "leave it", or "give" before attempting to retrieve it by offering a new food that is novel.

Test 7: Stranger Interaction

There were three components to the test: entry, approach and exit of stranger. The assessor placed the dog on a leash as the observer exited the room and returned dressed in a reflective vest, large brimmed hat and using a walking stick. The observer entered the room, and bent down to extend an open flat hand as if to pat the dog on the head. The observer then talked to the dog normally and stopped for 3 s, allowing the dog to approach. If the dog approached, the observer patted the dog on the top of its head for 3 s. If the dog did not approach, it was observed for 10 s, with an emphasis on any interaction between the assessor and/or the observer.

Test 8: Fake Toddler Interaction

There were two components of the test: approach of the toddler doll and exit/removal of toddler doll. The assessor stood and held the dog's leash while the observer exited the area and returned carrying a toddler doll simulating a small child. Once the toddler was within the leash perimeter from the dog, the observer placed the doll on the floor facing the dog, with the doll's arm extended toward the dog. The assessor allowed the dog to approach if it desired. If the dog did not approach the observer, it was observed for 20 s. After this, the assessor picked up the toddler doll and walked back out of the room. The assessor allowed the dog to follow to the door or move away from stimulus.

Test 9: Fake Cat

The assessor stood and held the dog's leash while the observer exited the area and returned carrying a fake cat as if it were a "real" cat. Once the fake cake was within the leash perimeter from the dog, the observer placed the fake cate on the floor facing the dog. The assessor allowed the dog to approach if he/she wanted to. However, if the dog did not approach the observer, the dog was observed for 20 s with the fake cat present.

Test 10: Time Alone

The assessor and observer removed the leash from the dog and left the room for 2 min, with a video camera in the front of the room monitoring behaviour and vocalisations. Then, the assessor and observer re-entered through the same door.

Test 11: Behaviour with Another Dog

There were three components to the test: walking parellel, circling activity, and nose to nose interaction. This test was conducted in a yard (10−20 m), allowing adequate space between the test dog and another dog. Each dog had an assessor, who interacted with their dog by giving treats and ignoring the other assessor and dog. The assessor had a short, 1 m, leash, so that the dog walked close to the assessor. At the start, both assessors walked parallel to each other, 5 m apart, with the dogs on the outside. If one or both dogs were reactive and pulled toward each other, the distance between the assessors was increased. If both dogs were relaxed and focused on their assessor, the assessors moved the dogs to an exercise circle. If the dogs did not breach a minimum distance of 5 m between them, they were introduced on opposite sides of a fence. There followed a circling activity, which required one assessor to stand still with their dog on no more than 1.5 m of leash while the other assessor and their dog completed a circle around the assessor. Assessors then swapped places and repeated the circling activity. If no adverse behaviours were displayed, the assessor in the middle of the circle remained at that location, ensuring that the only tension on the leash was from the dog. The other assessor identified the leash threshold of the dog in the centre and moved close enough to allow the dogs to be nose to nose, also ensuring that the only tension on their leads was caused by the dog pulling, not them pulling against the dog. Once the leads became loose, and the dogs stopped pulling against the assessor, the assessors took a step closer to each other, allowing the dogs to interact if they chose. Leashes remained loose. If there were signs of adverse reactions or aggression, dogs were separated by increasing the threshold.

Appendix 3. Telephone Survey Script for Adopter

<u>Introduction:</u>

Hello, my name is .... from the RSPCA – you recently adopted .... from our Wacol Animal Care Campus and you might remember we asked if you would mind completing a survey <u>on how</u> ....is settling into your home. The information you are able to provide us will be really valuable to help us improve our current procedures. We anticipate the survey to <u>take xxx</u> minutes - is now a convenient time?

If No – Thank you.. would there be a more convenient day / time that might work better for you?

If Yes – Thank you! Most questions are yes or no, and then some clarifying multiple choice options that I will provide you. I would be happy to repeat them for you as needed. Are you ready?

If they say yes continue.

1. Do you still have ....? Y N
   a. If no, may I ask what happened?
      i. Returned to RSPCA
      ii. Surrendered to other shelter
      iii. Gave away to a known person
      iv. Gave away to an unfamiliar person
      v. Escaped
      vi. Lost
      vii. Deceased
      viii. Other
2. If returned or gave away – can I ask the reason? Type reason in comment box
3. How long did you have xxxx in the home?

If longer than two weeks continue with survey if less than two weeks thank them for their time and offer any assistance in the future.

If they still have the dog, or had dog longer than two weeks continue:

I am going to continue with the interview questions and provide you with some options – could you tell me which best describes their behaviour please?

4. Is your new dog
   a. Mainly indoors
   b. Mainly outdoor
   c. Indoor / Outdoor

5. How does the dog respond to your attention?

   a. No response
   b. Moves, leans or looks away
   c. Moves towards you in a playful manner
   d. Moves or leans away in a manner that concerns you
   e. Moves towards you in a way that concerns you

   If d, what do they do? (text box)
6. Do you have children? (Or do children visit the home) Y   N
   a. Under 5 years
   b. Between 5-10 years
   c. Between 10-16 years
7. How does the dog respond to them?

   d. No response
   e. Moves, leans or looks away
   f. Moves towards them in a playful manner
   g. Moves or leans away in a manner that concerns you
   h. Moves towards them in a way that concerns you

   If d, what do they do? (text box)
8. Has anyone tried to play a running game around/with your new dog?   Y N
      If so, how do they play?

      f.   No response
      g. Moves, leans or looks away
      h. Moves towards them in a playful manner
      i.   Moves or leans away in a manner that concerns you
      j.   Moves towards them in a way that concerns you

     If d, what do they do? (text box)
9. How do they respond to unfamiliar adult visitors at home?
a.   No response
b.   Moves, leans or looks away
c.   Moves towards them in a playful manner
d.   Moves or leans away in a manner that concerns you
e.   Moves towards them in a way that concerns you

     If d, what do they do? (text box)
10. How do they respond to unfamiliar children at home?

      k.   No response
      l.   Moves, leans or looks away
      m. Moves towards them in a playful manner
      n.   Moves or leans away in a manner that concerns you
      o.   Moves towards them in a way that concerns you

     If d, what do they do? (text box)
11. We gave you a handout on introducing your new dog to the children did you find it useful?   Y   N   did not read

12. Do you have another dog?   Y N

13. Can you tell us about how your new dog behaved when they first met?

      p.   No response
      q. Moved, leaned or looked away
      r.   Moved towards them in a playful manner
      s.   Moves or leans away in a manner that concerns you
      t.   Moved towards them in a way that concerned you

     If d, what did they do? (text box)

14. Can you tell us about how your existing dog behaved when they first met?

      u.   No response
      v.   Moved, leaned or looked away
      w. Moved towards them in a playful manner
      x.   Moves or leans away in a manner that concerns you
      y.   Moved towards them in a way that concerned you

     If d, what did they do? (text box)
15. We gave you a handout on introducing your new dog to your existing dog was it useful?   Y   N   did not read

16. How does your dog behave if they see an unknown dog outside your home?

      z.   No response
      aa. Moves, leans or looks away
      bb. Moves towards them in a playful manner
      cc. Moves or leans away in a manner that concerns you
      dd. Moves towards them in a way that concerns you

     If d, what do they do? (text box)
17. Are you concerned about your dog's behaviour around their food

If yes can you tell me what happens (text box)

18. Are you concerned about your dog's behaviour around food toys
      If yes can you tell me what happens (text box)

19. Are you concerned about your dog's behaviour around human food
      If yes can you tell me what happens (text box)

20. Do you have a cat?   Y   N
21. If yes how would you describe your new dog's initial behaviour towards the cat?
      a. No response
      b. Moved, leaned or looked away
      c. Moved towards them in a playful manner
      d. Moves or leans away in a manner that concerns you
      e. Moved towards them in a way that concerned you

  If d, what did they do? (text box)

22. Did you find the informational handout on introducing your new dog to your cat useful?
      a. Yes
      b. No
      c. Did not read
23. If the new dog hears a loud noise or something startles them, do they
      a. Ignore it (No response)
      b. Mild startle
      c. Pronounced startle
      d. Run and hide
      e. Other (text box)
24. Afterwards do they settle down again?
      a. Immediately
      b. Within a few seconds
      c. 5-10 seconds
      d. Longer
      e. They don't settle
      f. They continue to avoid the location of the sound / startle
      g. Other

25. Have you ever left your new dog alone?   Y   N
26. If yes, where did you leave him alone?
      a. Inside the house
      b. in a crate
      c. In the laundry or garage
      d. Outside in the yard
      e. Other
27. How long did you leave the new dog alone for?
      a. Less than an hour
      b. 1-4 hours
      c. 5-8 hours
      d. 9-12 hours
      e. Other
28. How did they behave when you were preparing to leave?
      a. No change in behaviour
      b. Change in behaviour – please describe (text box)

          Was their behaviour while you were away a concern?
          If yes, why (text box)
29. Did you find the information on teaching your dog to stay home alone that we gave you useful? Y N
    Did not read

    Thank you for participating in the study. If we at the RSPCA can assist you in the future please let us
know.

Appendix 4. Standardised Behavioural Assessment

Appendix A.1. Test 1: Exploration of Room

Appendix A.1.1. Exploring the Room

The assessor entered the room, dropped the lead attached to the dog, and sat in the centre on a chair. Then, the observer started a timer and waited for 1 min without any interaction with the dog by either person.

Appendix A.1.2. Sociability to Assessor

At the end of exploring the room, the assessor called the dog to them in a friendly voice, remaining in the chair with no other body movement. If there was no response, a second attempt was made, and if still no response the assessor clapped their hands on their lap and said 'come here' in the direction of the dog, trying at least three times to call the dog to them. When the dog came (at the first, second, or third call), the assessor picked up the leash and then stroked the dog from the base of the neck to the tail three times. If the dog did not respond to the first, second, or third call, the assessor approached the dog, picked up the leash, and gave the dog three strokes from the base of the neck to the tail. Following each stroke, the observer and assessor counted 10 s, with the behaviours exhibited noted.

Appendix A.2. Test 2: Tolerance to Handling

There were three components to the test, namely touch sensitivity to collar, stroke, and feet. The assessor dropped the leash and held the dog's collar. After 3 s, the handler stroked the dog from head to tail. With the dog standing, the other assessor (in the standing position, or crouching if a small breed of dog) picked up the dog's rear inside foot, then the front inside foot, then reached over its back to pick up its rear outside foot, and finally the front outside foot. Each foot was held for 2 s. After picking up all four paws in this manner, the assessor stood for 10 s with no dog interaction and finally removed the dog's leash.

Appendix A.3. Test 3: Startle Response

There were two components: startle response and recovery to stimulus. At the end of Test 2, the assessor created a loud sound using a book on a bench or a desk (startle response). The assessors recorded recovery.

Appendix A.4. Test 4: Toy Interactions

Three toys were used in this testing procedure: tennis ball, squeaky toy, and tugging rope. A tennis ball was shown to the dog and gently thrown across the room, and the assessor verbally engaged the dog in play. If the dog picked up the ball, the assessor waited to see if it returned to the assessor without encouragement. If it did not, the assessor encouraged the dog to bring the ball back by calling his/her name and saying "come". If the dog still did not return, the assessor went to the dog.

In both situations, the assessor waited 10 s to see if the dog dropped the ball. If it did not, they asked the dog to "drop it". If the dog did not respond, then a second command was given, "give", and if necessary, a third attempt, "out", was tried. If the dog did not respond to these commands, the assessor approached the dog carefully and removed the ball from the dog's mouth. These steps were repeated for a second throw and after completion, the assessor waited 10 s with no interaction before moving on to the next toy, the squeaky toy, and after that, the tugging rope. The same sequence was used for each toy. After completing all three toys, the assessor moved on to the next test.

Appendix A.5. Test 5: Response to Unusual/Unpredictable Stimulus

The assessor gently moved the dog to the opposite end of the room and left it standing against the wall. Then, they gently moved one hand over its head, down toward the back to gently tap the rump area, and then ran across the room, laughing and waving arms, followed by suddenly stopping, folding their arms, and ignoring the dog. The tap, run, and freeze series was repeated a second time. The assessor waited for 10 s after the run and freeze, ignoring the dog, before moving onto the next test. The dog was then placed back on the leash.

Appendix A.6. Test 6: Resource Guarding

There were four components to the test: wet food, dry kibble/biscuits, pig's ear and bone. The assessor tethered the dog to the wall for safety reasons, and proceeded to show the dog wet canned food, smeared in a bowl. The bowl was then placed near the dog at the end of the leash perimeter, allowing the dog to begin eating for 2 s. The assessor then proceeded with a plastic hand, walking to the side of the dog while it was eating. Using the fake hand, the assessor patted the dog on the head, continuing to stroke down its back and body twice. The fake hand was then placed 5 cm in front of the bowl and moved around in a semi-circle. The hand was then placed on the inside edge of the bowl and moved around the edge of the bowl next to the dog's face, without touching it. Finally, the bowl was pulled away from the dog using the fake hand. The bowl was then returned to the dog, which was observed for 10 s.

The assessor then gave the dog a pig's ear or bone, depending on the dog's food interest, and it was allowed to chew it for 30 s. The steps above with wet food were repeated; then, the assessor attempted to retrieve the food, asking the dog to "drop it", "leave it", or "give" before attempting to retrieve it by offering a new food that is novel.

Appendix A.7. Test 7: Stranger Interaction

There were three components to the test: the entry, approach and exit of a stranger. The assessor placed the dog on a leash as the observer exited the room and returned dressed in a reflective vest, large brimmed hat and using a walking stick. The observer entered the room, and bent down to extend an open flat hand as if to pat the dog on the head. The observer then talked to the dog normally and stopped for 3 s, allowing the dog to approach. If the dog approached, the observer patted the dog on the top of its head for 3 s. If the dog did not approach, it was observed for 10 s, with an emphasis on any interaction between the assessor and/or the observer.

Appendix A.8. Test 8: Fake Toddler Interaction

There were two components of the test: the approach of the toddler doll and the exit/removal of the toddler doll. The assessor stood and held the dog's leash while the observer exited the area and returned carrying a toddler doll simulating a small child. Once the toddler was within the leash perimeter from the dog, the observer placed the doll on the floor facing the dog, with the doll's arm extended toward the dog. The assessor allowed the dog to approach if it desired. If the dog did not approach the observer, it was observed for 20 s. After this, the assessor picked up the toddler doll and walked back out of the room. The assessor allowed the dog to follow to the door or move away from stimulus.

Appendix A.9. Test 9: Fake Cat

The assessor stood and held the dog's leash while the observer exited the area and returned carrying a fake cat as if it were a "real" cat. Once the fake cake was within the leash perimeter from the dog, the observer placed the fake cate on the floor facing the dog. The assessor allowed the dog to approach if he/she wanted to. However, if the dog did not approach the observer, the dog was observed for 20 s with the fake cat present.

Appendix A.10. Test 10: Time Alone

The assessor and observer removed the leash from the dog and left the room for 2 min, with a video camera in the front of the room monitoring behaviour and vocalisations. Then, the assessor and observer re-entered through the same door.

Appendix A.11. Test 11: Behaviour with Another Dog

There were three components to the test: walking parellel, circling activity, and nose-to-nose interaction. This test was conducted in a yard (10–20 m), allowing adequate space between the test dog and another dog. Each dog had an assessor, who interacted with their dog by giving treats and ignoring the other assessor and dog. The assessor had a short, 1 m leash, so that the dog walked close to the assessor. At the start, both assessors walked parallel to each other, 5 m apart, with the dogs on the outside. If one or both dogs were reactive and pulled toward each other, the distance between the assessors was increased. If both dogs were relaxed and focused on their assessor, the assessors moved the dogs to an exercise circle. If the dogs did not breach a minimum distance of 5 m between them, they were introduced on opposite sides of a fence. Then followed a circling activity, which required one assessor to stand still with their dog on no more than 1.5 m of leash while the other assessor and their dog completed a circle around the assessor. The assessors then swapped places and repeated the circling activity. If no adverse behaviours were displayed, the assessor in the middle of the circle remained at that location, ensuring that the only tension on the leash was from the dog. The other assessor identified the leash threshold of the dog in the centre and moved close enough to allow the dogs to be nose to nose, also ensuring that the only tension on their leads was caused by the dog pulling, not them pulling against the dog. Once the leads became loose, and the dogs stopped pulling against the assessor, the assessors took a step closer to each other, allowing the dogs to interact if they chose. Leashes remained loose. If there were signs of adverse reactions or aggression, the dogs were separated by increasing the threshold.

Appendix 5. C-BARQ Categories and Descriptions

C-BARQ Categories		Description
Stranger-directed aggression	Dog acts aggressively	When approached directly by an unfamiliar male adult while being walked or exercised on a leash
		When approached directly by an unfamiliar female adult while being walked or exercised on a leash
		When approached directly by an unfamiliar child while being walked or exercised on a leash
		Toward unfamiliar persons approaching the dog while it is in the owner's car
		When an unfamiliar person approaches the owner or a member of the owner's family at home
		When an unfamiliar person approaches the owner or a member of the owner's family away from home
		When mailmen or other delivery workers approach the home
		When strangers walk past the home while the dog is in the yard
		When joggers, cyclists, roller skaters, or skateboarders pass the home while the dog is in the yard
		Toward unfamiliar persons visiting the home
Owner-directed aggression	Dog acts aggressively	When verbally corrected or punished by a member of the household
		When toys, bones, or other objects are taken away by a member of the household
		When bathed or groomed by a member of the household
		When approached directly by a member of the household while it is eating
		When food is taken away by a member of the household
		When stared at directly by a member of the household
		When stepped over by a member of the household
		When a member of the household retrieves food or objects stolen by the dog
Stranger-directed fear	Dog acts anxious or fearful	When approached directly by an unfamiliar male adult while away from the home
		When approached directly by an unfamiliar female adult while away from the home
		When approached directly by an unfamiliar child while away from the home
		When unfamiliar persons visit the home
Non social fear	Dog acts anxious or fearful	In response to sudden or loud noises
		In heavy traffic
		In response to strange or unfamiliar objects on or near the sidewalk
		During thunderstorms firework displays, or similar
		When first exposed to unfamiliar situations
		In response to wind or wind-blown objects
Dog Rivalry	Dog acts aggressively	Towards another (familiar) dog in your household.
		When approached at a favorite resting/sleeping place by another household dog
		When approached while eating by another household dog
		When approached while playing with/chewing a favorite toy, bone, object by another household dog
Dog-directed aggression	Dog acts aggressively	When approached directly by an unfamiliar male dog while being walked or exercised on a leash
		When approached directly by an unfamiliar female dog while being walked or exercised on a leash
		Toward unfamiliar dogs visiting the home
		When barked, growled or lunged at by an unfamiliar dog
Dog-directed fear	Dog acts anxious or fearful	When unfamiliar dogs visit the home
		When barked, growled or lunged at by an unfamiliar dog
		When approached directly by an unfamiliar dog of the same or larger size
		When approached directly by an unfamiliar dog of a smaller size
Separation-related behavior	Dog displays	Shaking, shivering, or trembling when left or about to be left on its own
		Excessive salivation when left or about to be left on its own
		Restlessness, agitation, or pacing when left or about to be left on its own
		Whining when left or about to be left on its own
		Barking when left or about to be left on its own
		Howling when left or about to be left on its own
		Chewing or scratching at doors, floor, windows, and curtains when left or about to be left on its own
		Loss of appetite when left or about to be left on its own
Attachment or attention-seeking behavior	Dog	Displays a strong attachment for a particular member of the household
		Tends to follow a member of household from room to room about the house.
		Tends to sit close to or in contact with a member of the household when that individual is sitting down
		Tends to nudge, nuzzle, or paw a member of the household for attention when that individual is sitting down
		Becomes agitated when a member of the household shows affection for another person
		Becomes agitated when a member of the household shows affection for another dog or animal
Trainability	Dog	Returns immediately when called while off leash
		Obeys a sit command immediately
		Obeys a stay command immediately
		Will fetch or attempt to fetch sticks, balls, and other objects
		Seems to attend to or listen closely to everything the owner says or does
		Is slow to respond to correction or punishment

		Is slow to learn new tricks or tasks
		Is easily distracted by interesting sights, sounds, or smells
Chasing	Dog	Acts aggressively toward cats, squirrels, and other animals entering its yard
		Chases cats if given the chance
		Chases birds if given the chance
		Chases squirrels and other small animals if given the chance
Excitability	Dog overreacts or is excitable	When a member of the household returns home after a brief absence
		When playing with a member of the household
		When the doorbell rings
		Just before being taken for a walk
		Just before being taken on a car trip
		When visitors arrive at its home
Touch sensitivity	Dog acts anxious or fearful	When examined or treated by a veterinarian
		When having its claws clipped by a household member
		When having feet toweled by a household member
		When groomed or bathed by a household member
Energy	Dog	Dog is playful, puppyish, and boisterous
		Dog is active, energetic, and always on the go

Appendix 6. Number (and %) of respondents (n:107) classifying their dogs in each of five levels on a scale of increasing intensity of behaviour exhibited at home, using the C-BARQ Categories.

Behaviour	Target of Behaviour	Scale [+]									
		0		1		2		3		4	
Fear	Stranger-direct	73	(68.2)	25	(23.4)	5	(4.67)	2	(1.86)	2	(1.86)
	Non Social	60	(56.1)	33	(30.8)	12	(11.2)	1	(0.93)	1	(0.93)
	Dog directed	49	(45.8)	36	(33.6)	13	(12.1)	8	(7.47)	1	(0.93)
Aggression	Stranger-directed	77	(72.0)	24	(22.4)	5	(4.67)	1	(0.93)	0	(0.00)
	Owner-directed	101	(94.4)	2	(1.87)	4	(3.73)	0	(0.00)	0	(0.00)
	Dog directed	36	(33.6)	25	(23.0)	27	(25.2)	11	(10.3)	2	(1.86)
	Familiar dog	71	(66.3)	24	(22.4)	8	(7.47)	4	(3.73)	0	(0.00)
Separation related problems		82	(76.6)	21	(19.6)	3	(2.80)	1	(0.93)	0	(0.00)
Attention-seeking		1	(0.93)	33	(30.8)	52	(48.6)	18	(16.8)	2	(1.86)
Touch sensitivity		60	(56.1)	33	(30.8)	12	(11.2)	1	(0.93)	1	(0.93)
Chasing behaviour		27	(25.2)	16	(15.0)	28	(26.2)	32	(29.9)	4	(3.73)
Excitability		1	(0.93)	33	(30.8)	46	(43.0)	23	(21.5)	4	(3.73)
Energetic		9	(8.41)	32	(29.9)	45	(42.1)	17	(15.9)	4	(3.73)
Trainability		1	(0.93)	7	(6.54)	68	(63.6)	31	(29.0)	0	(0.00)

[+] Fear, 0 no fear or anxiety—4 extreme fear, both stranger, non-social and dog fear; aggression, 0 none—4 serious, separately scored for stranger-, owner-, dog and familiar dog-directed; separation-related problems, from 0 never—4 always; attachment/attention-seeking, from 0 never—4 always; touch sensitivity, from 0 never—4 always; excitability, from 0 calm to 4 extremely excitable; chasing, energy, and trainability, from 0 never—4 always.

Appendix 7. Percentage of coded durations and frequencies of the five behavioural categories (friendliness, fear, anxiety, arousal and aggression) during each subtest in the standardised behaviour assessment.

Test	Friendliness		Fear		Anxiety		Arousal		Aggression	
	F	D	F	D	F	D	F	D	F	D
Exploration	30.6	38.5	19.8	32.5	24.8	15.7	21.0	11.8	3.8	1.5
Tolerance to Handling	31.8	37.5	30.7	39.4	19.1	13.8	9.6	6.8	8.9	2.5
Toy interaction	46.6	44.3	16.3	18.8	16.3	14.8	16.9	19.9	3.9	2.3
Response to stimulus	35.2	37.1	22.3	27.4	20.5	16.9	18.2	15.9	3.8	2.7
Resource guarding	41.0	45.6	26.1	30.3	15.7	11.0	12.9	11.7	4.3	1.5
Stranger	37.0	40.9	25.0	27.1	16.4	13.6	15.4	15.4	6.1	3.0
Toddler doll	38.2	40.8	25.8	27.1	14.4	13.0	14.4	15.3	7.2	3.8
Time alone	26.3	39.3	13.8	29.6	28.8	16.6	28.6	12.5	2.4	2.0
Dog to Dog	35.5	47.2	21.2	25.1	19.2	12.6	17.4	11.5	6.6	3.5

Ethics

Chapter 3: Animals Ethics

THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

UQ Research and Innovation
Director, Research Management Office
Nicole Thompson

Animal Ethics Approval Certificate

25-Nov-2014

Please check all details below and inform the Animal Welfare Unit within 10 working days if anything is incorrect.

Activity Details

Chief Investigator:	Mr Andrew Tribe, Agriculture and Food Sciences
Title:	Cortisol Levels in Dogs Surrendered to the RSPCA Animal Shelter at Wacol.
AEC Approval Number:	SAFS/325/14/RSPCA
Previous AEC Number:	
Approval Duration:	19-Nov-2014 to 19-Nov-2015
Funding Body:	
Group:	Production and Companion Animal
Other Staff/Students:	Mandy Paterson, Samantha Kempster, Liam Clay
Location(s):	Other Queensland Location

Summary

Subspecies	Strain	Class	Gender	Source	Approved	Remaining
Dogs		Adults	Mix	Pound/Refuge	88	88

Permits

Provisos

Logbook Proviso:
The CI is required to keep a logbook of all RSPCA volunteers who will be participating in this protocol, with this information provided to the AEC as required.

Approval Details

Description	Amount	Balance
Dogs (Mix, Adults, Pound/Refuge)		
19 Nov 2014 Initial approval	88	88

Chapter 4: Human Ethics

THE UNIVERSITY OF QUEENSLAND

Institutional Human Research Ethics Approval

Project Title:	Comparison of Behavioural Assessments and Post Adoption Surveys in Shelter Dogs
Chief Investigator:	Prof Clive Phillips
Supervisor:	Dr Clive Phillips, Dr Mandy Paterson
Co-Investigator(s):	Mr Liam Clay
School(s):	School of Veterinary Science
Approval Number:	2017000044
Granting Agency/Degree:	
Duration:	31st July 2017

Comments/Conditions:

Expedited Review - Low Risk

- HREA Application, 16/01/2017
- Letter to Adopter, 16/01/2017
- Telephone Survey Script for Adopters, 16/01/2017
- RSPCA Letter of Research Approval, 09/12/2016

Note: if this approval is for amendments to an already approved protocol for which a UQ Clinical Trials Protection/Insurance Form was originally submitted, then the researchers must directly notify the UQ Insurance Office of any changes to that Form and Participant Information Sheets & Consent Forms as a result of the amendments, before action.

Name of responsible Committee:
University of Queensland Human Research Ethics Committee B
This project complies with the provisions contained in the *National Statement on Ethical Conduct in Human Research* and complies with the regulations governing experimentation on humans.

Name of Ethics Committee representative:
Dr. Frederick Khafagi
Chairperson
University of Queensland Human Research Ethics Committee B
Registration: EC00457

10/03/2017

Signature _____   Date _____

THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

Office of Research Ethics
Director
Nicole Shively

Animal Ethics Approval Certificate

25-Jul-2018

Please check all details below and inform the Animal Ethics Unit within 10 working days if anything is incorrect.

Activity Details

Chief Investigator:	Professor Clive Phillips, Animal Welfare and Ethics
Title:	Comparing dog behaviour reported by owners and an assessment using RSPCA Qld assessment protocols.
AEC Approval Number:	SVS/290/18
Previous AEC Number:	
Approval Duration:	26-Jul-2018 to 26-Jul-2020
Funding Body:	
Group:	Native and exotic wildlife and marine animals
Other Staff/Students:	Liam Clay, Mandy Paterson
Location(s):	Other Queensland Location

Summary

Subspecies	Strain	Class	Gender	Source	Approved	Remaining
Dogs	Canis lupus familiaris	Adults	Mix	Other	200	200

Permits

Provisos

The CI is required to ensure that they have appropriate Human Ethics Approval in place before commencing work on this protocol.

Mandy Paterson is listed as a participant on this project. According to our records, we have not received a response regarding this nomination. This participant cannot work on an approved project until they have confirmed involvement via electronic signature or, via email notification being sent to the Animal Ethics Unit Administration Officer awu.aec.newma@research.uq.edu.au.

Approval Details

Description	Amount	Balance
Dogs (Canis lupus familiaris, Mix, Adults, Other)		
26 Jul 2018 Initial approval	200	200

THE UNIVERSITY OF QUEENSLAND

Institutional Human Research Ethics Approval

Project Title:	Dog behaviour as reported by owners and an assessment following RSPCA Qld assessment protocols
Chief Investigator:	Professor Clive Phillips
Supervisor:	Professor Clive Phillips, Dr Mandy Paterson, Dr Pauleen Bennett, Gaille Perry
Co-Investigator(s):	Mr Liam Clay
School(s):	School of Veterinary Science, The University of Queensland
Approval Number:	2018001353
Granting Agency/Degree:	RSPCA Queensland; PhD
Duration:	31st March 2019

Comments/Conditions:

- HREA Form, 27/07/2018
- C-BARQ-Written2, 25/07/2018
- Dog information C-BARQ, 28/06/2018
- RSPCA behavioural assessment and owner questionnaires, 25/07/2018
- Participant Informed Consent Form, 25/07/2018
- Participant Information sheet(Updated), 25/07/2018

Note: if this approval is for amendments to an already approved protocol for which a UQ Clinical Trials Protection/Insurance Form was originally submitted, then the researchers must directly notify the UQ Insurance Office of any changes to that Form and Participant Information Sheets & Consent Forms as a result of the amendments, before action.

Name of responsible Sub-Committee:
University of Queensland Science, Low & Negligible Risk Ethics Sub-Committee
This project complies with the provisions contained in the *National Statement on Ethical Conduct in Human Research* and complies with the regulations governing experimentation on humans.

Name of Ethics Sub-Committee representative:
Dr Karen McNamara
Chairperson
University of Queensland Science, Low & Negligible Risk Ethics Sub-Committee

Signature _Karen McNamara_   Date **30/07/2018**