



Training methods and owner–dog interactions: Links with dog behaviour and learning ability

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ABSTRACT

The methods by which owners train their pet dogs range widely, with some exclusively using rewards, and others using a combination, or only punishment-based methods. This paper examines links between the way in which owners reported to have trained their dogs and observations of the dogs' subsequent behaviour. It also explores associations between behaviour of owner and dog when tested in their own home. A total of 53 owners were surveyed about their preferred methods for training each of seven common tasks, and were each filmed interacting with their dog in a series of standardised scenarios. Dogs owned by subjects who reported using a higher proportion of punishment were less likely to interact with a stranger, and those dogs whose owners favoured physical punishment tended to be less playful. However, dogs whose owners reported using more rewards tended to perform better in a novel training task. Ability at this novel task was also higher in dogs belonging to owners who were seen to be more playful and who employed a patient approach to training. This study shows clear links between a dog's current behaviour and its owner's reported training history as well as the owner's present behaviour. High levels of punishment may thus have adverse effects upon a dog's behaviour whilst reward based training may improve a dog's subsequent ability to learn.

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1. Introduction

Throughout domestication the dog has been trained to carry out a wide variety of human-directed tasks. Today the majority of domestic dogs are kept as companion animals, but even within this role, most receive at least some rudimentary training from their owners. The methods used vary widely; whilst there is a growing trend towards positive, reward-based methods, there are also many owners who also employ more traditional punishment-based techniques (e.g. Herron et al., 2009). In a recent survey of 364 owners, Hiby et al. (2004) polled the training methods used for seven common training tasks and found that,

although 60% of owners reported using praise rewards for at least one task, when considering specific scenarios such as responding to dogs stealing objects, the proportion using punishment was as high as 84%.

There is ongoing debate as to the relative merits of different training techniques, and several authors argue the value of punishment when applied correctly for specific tasks (e.g. Tortora, 1982; Yeon et al., 1999; Marscark and Baenninger, 2002). However, only recently have studies started to compare techniques empirically. For example, Hiby et al. (2004) saw a link between the number of tasks pet dog owners reported to train using rewards and their reported score for their dog's obedience, whilst Haverbeke et al. (2008) saw an association between performance and less frequent use of aversive stimuli during military dog training. Such studies cannot be taken as evidence of cause and effect, since it is plausible that those dogs which performed poorly are more likely to elicit pun-

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ishing rather than rewarding behaviour in their handlers or owners. But the results do suggest that frequent use of punishment-based training does not result in superior training performance.

In addition to obedience and training performance, numerous other aspects of the dog's behaviour and of the dog-owner relationship, have been linked to choice of training methods. Punishment-based training has been shown to cause stress (Schalke et al., 2007), suffering (Beerda et al., 1997), fearfulness (Schilder and van der Borg, 2004; Blackwell and Casey, 2006), to be associated with higher levels of reported behavioural problems (Hiby et al., 2004), specifically aggression to dogs (Haverbeke et al., 2008; Arhant et al., 2010) and to people (Arhant et al., 2010), increased excitability (Arhant et al., 2010) and distraction (Haverbeke et al., 2008). A survey by Blackwell et al. (2008) saw lower levels of several specific behavioural problems in those dogs trained without punishment.

The majority of these previous studies of training methods have relied upon the owners' reports of their dog's behaviour. Owners' reports of certain aspects of their dog's behaviour can be unreliable (e.g. Rooney, 1999; Stephen and Ledger, 2007). Therefore to further investigate the postulated links, we have carried out a study comparing training methods and dog behaviour, via direct observation.

We predict that in a home environment the type of training methods employed may affect the way in which a dog behaves in numerous situations. For example punishment-based training methods may lead to general anxiety (Blackwell et al., 2008) which may affect a dog's social behaviour towards both its owner and towards other people, or its response to denial of contact or attention from its owner. Training history may also affect the way a dog plays with its owner, since play behaviour is usually only performed when conditions are good (e.g. Jensen et al., 1998) and an animal is relaxed (Berman, 1980) and aspects of play likely reflect the quality of the dog-owner relationship (Rooney and Bradshaw, 2003). The way in which a dog was trained in the past may also affect its future aptitude and motivation to learn (e.g. Marshall-Pescini et al., 2008) and therefore its performance at novel training tasks, as well as its general obedience. To our knowledge, these ideas have never been investigated in pet dogs.

Using a modified version of the questionnaire developed by Hiby et al. (2004) and a sample of established dog-owner partnerships, we examined owners' approaches to training. We quantified the proportion of tasks for which the owner reported using reward, punishment and whether they used physical punishment. We then recorded the behaviour of the dog and the owner in each of five standardised test scenarios and compared this to the training methods advocated by their owner. The behaviour test used in this study was a modified version of that used by Rooney and Bradshaw (2002, 2003) to quantify aspects of the dog-owner relationship, but here shortened to only examine the key interactions hypothesised to be important with the addition of a novel training task. The scenarios used were: relaxed social behaviour towards a novel per-

son and owner, response to being ignored, obedience to basic commands, dog-owner play and response to owner training a novel task.

Within dog-owner partnerships, interactions are numerous and varied with structured training representing only a minority of the daily interaction time. Therefore, it is probable that many subtle aspects of the owner's behaviour affect the dog's response to training, as well as the training approach employed. For example previous studies have found links between the way in which owners play and dimensions of the dog-owner relationship (Rooney and Bradshaw, 2003). Therefore, we have measured variations in the owners' behaviour as well as their training techniques and investigated whether these correlate to aspects of the dogs' behaviour, specifically its obedience score and its response to learning a new task.

Our study aims to investigate the following hypotheses:

- (a) Dogs reported to be trained using different methods exhibit measurable differences in behaviour in a standardised test.
- (b) Measurable differences in owner behaviour correlate to differences in dog behaviour; specifically obedience and performance at a novel task.

2. Methods

2.1. Subjects

A total of 53 volunteer dog owners (35 women and 18 men), ranging in age from 12 to 73 years (median = 46 years) were recruited through veterinary practices and personal communication in Glasgow and Bristol. All participants were the main owners, who had the majority of responsibility for the care of the dog and all had owned their dog for at least three months. If participants owned more than one dog, they randomly selected one to take part. There were 19 male and 34 female dogs, ranging from five months to 14 years of age (median = 4 years). A total of 16 were crossbreeds and 37 were purebreds, and when categorised according to the UK Kennel Club categories (see 'Discover Dogs' at <http://www.the-kennel-club.org.uk>); there were 24 gundogs, six pastoral (traditionally herding breeds), five terriers, one hound and one utility breed.

2.2. Protocol

To avoid the effects of a novel environment, which may vary with the dog's individual level of socialisation, the experimenter (Sarah Cowan) visited each owner and dog in their own home. All the data was collected during a single visit, when owner, dog and experimenter were alone in an enclosed room; the owner's living or sitting room in which two chairs were placed at least 2 m apart. Visits lasted between 19.3 min and 39.4 min (mean = 27.2 min) and were filmed throughout. If other family members or dogs were at home, they were requested not to enter the room. Owners were asked to remove any toys from the room prior to the experimenter's arrival.

Upon arrival, the experimenter placed a video camera on a tripod (maximising the floor area recordable), commenced filming, and then sat on a chair opposite to the owner. She explained the protocol, before commencing the behaviour test, which was composed of five separate subtests, always conducted in the same order (Sections 2.2.1–2.2.5). Owners were instructed before each subtest was undertaken and these instructions were repeated if required.

2.2.1. Subtest A: relaxed social behaviour

This commenced when the experimenter first sat down. If the dog approached the experimenter, it was briefly petted. The owner was instructed not to encourage the dog to approach but to act naturally if it approached of its own accord. The experimenter then conducted the Reported Training Method interview (see Section 2.2.6). Owners were variable in the time they took to complete this interview, ranging from 2.8 to 9.6 min (mean = 5.5 min), so to standardise habituation effects, only the first 2 min of this subtest was analysed.

2.2.2. Subtest B: ignoring

The owner was asked to ignore the dog and the experimenter did the same. The owner was given two written questionnaires to complete, one examining their attitudes towards dogs and the second investigating their responses to pictures of dog behaviour. These were later analysed to explore the effects of attitudes on owner behaviour, but the results are reported elsewhere and do not form part of this paper. This subtest lasted between 5.2 and 15.2 min (mean = 10.6 min) so for standardisation, only the first 5 min were analysed.

2.2.3. Subtest C: obedience

The owner was instructed to ask the dog to “Sit”, to “Lie Down” and then to “Stay”. The owner then took five steps backwards and remained facing the dog until it rose or for a maximum of 30 s. This component was repeated once. It was stressed that the command “Stay” must only be given once and it was not important whether the dog obeyed or not. If the dog was still lying down after 30 s it was called to the owner.

2.2.4. Subtest D: non-object play

The owner was asked to play with their dog without any toys for 2 min. Owners were encouraged to play as they would normally, starting and ending the session in their usual way.

2.2.5. Subtest E: novel training task

We designed a training task which was unique to all dog–owner partnerships. The owner was presented with a 29 cm (width) × 25 cm (depth) × 14 cm (height) wooden block in which there were mounted two 14 cm high wooden spoons. One of the spoons; the target, had a black cross marked on it in ink, whereas the other spoon had an open circle. The owner was asked to start to train the dog to respond to the command “touch it” by touching the correct spoon (the one with a cross) and not the non-target spoon, with its nose. Owners were offered a ball

and a bag of 20 g of small, hard treats (Coachies, Company of Animals), and could use either, neither or both of these rewards. They were given 5 min to attempt to train the dog to perform the task. The experimenter stressed that there was no expectation that the dog would perform perfectly by the end of the time, and the purpose of the exercise was to investigate the variety of methods that people use to train dogs, and the different ways dogs learn.

2.2.6. Reported Training Methods (RTM) interview

The interview was carried out at the same time as Subtest A, and was a modified version of the written questionnaire used by Hiby et al. (2004). Owners were asked 11 questions which included; four general questions (dog’s name, dog’s age, where the dog was obtained from and how long they had owned the dog) and then how they had trained their dog in each of seven common training scenarios:

- (a) toilet training,
- (b) to sit on command,
- (c) to recall,
- (d) to leave objects,
- (e) to walk to heel,
- (f) when the dog had stolen objects,
- (g) when the dog had chewed things.

In the case of dogs that were already trained to perform one or more of the behaviours before the owner obtained them, owners were asked how they would choose to train a dog for that specific task. Owners were asked to highlight the main method used and their responses were transcribed by the experimenter.

2.3. Behavioural analysis and variable generation

2.3.1. Owner behaviour

From the video recorded behaviour test, eleven variables were measured which described the owners’ behaviour throughout three subtests (Table 1). Two of the initial variables were rejected: the frequency of contact (subtest A) was observed to be determined mainly by the dog so was included as a dog behaviour variable (Table 2), and the proportion of positive vocalisations (subtest E) was highly correlated to the proportion of negative vocalisations ($Rho = -0.77$, $P < 0.001$), with neutral vocalisations being very rare. The remaining nine variables each showed considerable variation across the sample. They were inspected for normality and three were transformed to improve data spread.

2.3.2. Dog behaviour

A total of 12 variables were measured to describe the dogs’ behaviour during the five subtests. Two variables were deemed too difficult to score consistently between breeds (tail and ear positions) and one was found to be highly correlated to another variable (Involvement in play (scale 1–5) which correlated to duration of play, Spearman Rank Correlation: $Rho = 0.77$; $P < 0.001$), so these were eliminated leaving nine variables. The spread of each of

Table 1

Variables describing the owner's behaviour during three of the subtests plus transformations necessary to improve data spread.

Subtest	Variable	Description	Units recorded	Transformation
A. Relaxed social behaviour	Command frequency	Number of times owner calls, or orders dog	Frequency	Scale: 0–2, 0 = 0, 1 = <5 and 2 = ≥5
	Total play signal types	Number of different categories of play signal handler uses to initiate and maintain play (Rooney et al., 2001)	Frequency	
D. Non-object play	Rough-and-tumble	Handler plays with dog any game involving wrestling and high levels of contact between the players (Rooney and Bradshaw, 2003)	0/1	
	Owner involvement	Subjective rating of the extent to which the owner was involved or committed to playing (Rooney and Bradshaw, 2003)	Scale: 1–5: 1 = least committed–5 = most committed	
	Total rewards	Number of times owner delivers either ball or treat to the dog	Frequency	
	Patience	Subjective rating of level of tolerance exhibited by the owner over the 5 min session	Scale 1–5: 1 = least patient–5 = most patient	
E. Novel training task	Positive contacts	Proportion of times owner touches the dog in an affectionate way (petting, patting, stroking) as a proportion of the total number of physical contacts made	Proportion	Scale: 0 = 0, 1 = <50, 2 = ≥50 and 3 = 100%
	Negative contacts	Proportion of times owner touches the dog in a potentially aversive way (shoving, hitting, tapping, moving or restraining) as a proportion of the total number of physical contacts made	Proportion	Scale 0 = 0, 1 = <50, 2 = ≥50 and 3 = 100%
	Negative vocalisations	Proportion of the total verbalisations which were intended to rebuke or command the dog	Proportion	

these variables was inspected and those which were not normally distributed were transformed to improve data spread, either by conversion to an ordinal scale or to 0/1 categories (Table 2).

2.3.3. Reported Training Methods (RTM)

Owners' responses to each question in the RTM interview were classified as reward-based, miscellaneous, or punishment-based. We used the categorisation system of Hiby et al. (2004), as a basis although there were also some answers given in this study, not previously listed by Hiby et al. (2004; Table 3). For each owner, the total number of times they mentioned using each method type was calculated, and since some owners mentioned more than one method for each training scenario, the proportion of each method was calculated (proportion reward-based, proportion punishment-based and proportion miscellaneous). Proportion miscellaneous has little biological significance and so was not analysed any further. Proportion reward-based and punishment-based showed only a moderate correlation to one another (Spearman Rank Correlation: $Rho = -0.293$), so both were retained for future analysis. Some owners reported using methods which involved physical punishment, and we hypothesised that these may have different consequences to verbal punishment or aversive stimuli and that could be avoided by the dog (e.g. bad tasting substances used to prevent chewing of furniture). Therefore we recorded an additional categorical variable which described whether each owner ever used any of the techniques described as "physical punishment" (see Table 3).

2.4. Statistical analysis

All statistical analyses were carried out using SPSS 12.0 for Windows (©SPSS Inc.). Many of the variables collected were not normally distributed so nonparametric tests were employed throughout. When testing the relationship between two ordinal variables Spearman's Rank Correlation Tests were used. Mann–Whitney *U*-tests were used to test the relationship between an ordinal and binary variable whilst Chi-Square Tests were used when testing two binary variables.

2.4.1. Demographics

We compared the male and female respondents for their reported training methods, and for each of the owner behaviour variables. Similarly male and female dogs were compared for each of the dog behaviour variables.

2.4.2. Hypothesis testing

2.4.2.1. Comparing training history and current dog behaviour. We explored the associations between both the proportion of reported training methods variables which were reward-based, and the proportion which were punishment-based and each of the nine variables describing dog behaviour. We also compared the behaviour of those dogs which were every trained using physical punishment to those which were not, for each behavioural variable in turn.

2.4.2.2. Comparing owner behaviour and dog training performance. Next we explored links between each of the nine

Table 2
Variables describing the dog's behaviour during each of the five subtests plus transformations necessary to improve data spread.

Subtest	Variable	Description	Units recorded	Transformation
A. Relaxed social behaviour	Experimenter interaction level	Time dog spends in contact with, orientated towards and attending to the novel tester during the 2 min period	Duration: s	Scale: 0=0, 1 = <15 s, 2 = ≥15 s
	Owner interaction level	Time dog spends in contact with, orientated towards and attending to their owner during the 2 min period	Duration: s	Scale: 0=0, 1 = <15 s, 2 = ≥15 s
B. Ignoring	Attention seek owner	Dog attempts to elicit interaction with owner by barking, whining, licking, nuzzling, jumping up or contacting owner with an object	0/1	
	Attention seek experimenter	Dog attempts to elicit interaction with novel tester by barking, whining, licking, nuzzling, jumping up or contacting tester with an object	0/1	
C. Obedience	Total obedience score	Combined score of subjective ratings for dog's level of performance at each of three tasks: sitting, lying down and staying for 30 s. Rating for each task was based on two repeats and was scored on a Scale 1–5: 1 = no apparent recognition of command–5 = perfect performance on both repetitions	Total score: 0–15	
D. Non-object play	Play duration	Time out of 2 min session for which dog is interacting with handler in a playful manner (for definition of play see Rooney, 1999)	Duration: s	Scale: 0=0, 1 = <60 s, 2 = ≥60 s, 3 = 120 s;
	Interactivity	Subjective rating of the degree of reciprocity between the players during the 2 min session	Scale: 1–5 (5 = most reciprocal–1 = least reciprocal; Rooney and Bradshaw, 2003)	
E. Novel training task	Dog's ability	Rating of the extent to which the dog had learnt the task as demonstrated by response to handler's commands during the final 30 s	Scale: 0 = no interest in spoon, 1 = interest in correct spoon, 2 = occasionally touching correct spoon, 3 = usually touching correct spoon	
All subtests	Submissive behaviour	Dog ever displays any of the following behaviour(s): Lip licking, cringing, rolling over, gaze aversion, submissive grin, tail tucked, ears back, licks owner or lifts paw	Frequency	0/1

variables describing owner behaviour in the behaviour test, and the dog's C Total obedience score and E Dog's ability in the novel training task.

3. Results

Table 4 shows the spread of the owner and dog behaviour variables in the sample.

3.1. Demographics

None of the owner behaviour variables, or the reported training methods varied with gender of owner. When comparing dog behaviour variables, one significant difference was found; females were more likely to show submissive

behaviour than were males (Chi-squared test, $\chi^2 = 6.058$, $P = 0.02$); no male dogs showed submissive behaviours, whilst nine out of the 34 (26%) female dogs were recorded to exhibit one or more submissive behaviour.

3.2. Reported training methods

None of the 53 owners reported using exclusively reward-based methods or entirely punishment; all used a combination. The proportion of tasks which owners trained using reward-based methods ranged from 0 to 0.64 (median = 0.22; 25th percentile = 0.09; 75th percentile = 0.44) whilst those using punishment-based methods ranged from 0 to 0.6 (median = 0.25; 25th percentile = 0.013; 75th percentile = 0.35). A total of 38% of

Table 3
Examples of categorisation of reported training techniques into four method types.

Training method category	Examples of training techniques included
Reward-based	Praise reward (e.g. pat, affection, encouragement) Food reward (e.g. treats, chew) Play reward (e.g. ball) Clicker
Punishment-based Just classified as punishment-based	Denial of social contact (e.g. put in cage, sent to bed) Vocal punishment (e.g. tell off) Removal of pleasurable stimuli (e.g. do not feed, take toy out of mouth) Aversive (bad tasting food, throwing tin pot on ground)
Also classified as physical punishment	Choke chain, pinch collar Squirt water in face, rub nose in faeces Yank back, lift using collar Flick on ear, shake dog
Miscellaneous	Ignore mistake Copy other dogs Keep occupied Use long leash, practise and patience

Table 4
Distribution of variables describing owner and dog behaviour in sample of 53 dog–owner partnerships.

Owner or dog variable	Variable	Minimum	Maximum	Median or number of 1's (for 0/1 variables in italics)	25th and 75th percentiles
Owner	Command frequency	0	2	0	0, 1
	Total play signal types	1	15	7	5, 9
	Rough-and-tumble	0	1	15	
	Owner involvement	2	5	3.5	3, 4
	Total rewards	0	19	8	4.5, 10.5
	Patience	2	5	3.5	3, 4
	Positive contacts	0	2	1	0, 1
	Negative contacts	0	2	1	0, 1
Dog	Negative vocalisations	0	77.4	36.1	23.6, 48.1
	Experimenter interaction level	0	2	1	0, 1
	Owner interaction level	0	1	1	0, 1
	Attention seek owner	0	1	9	
	Attention seek experimenter	0	1	19	
	Total obedience score	3	15	10.5	7.75, 12.75
	Play duration	0	3	1	1, 2
	Interactivity	2	5	4	3, 4.5
	Dog's ability	1	3.5	1	1, 2
	Submissive behaviour	0	1	9	

the subjects reported using reward-based training for more tasks than they used punishment, whilst for 49% of owners, punishment-based methods use outweighed reward-based. In all, 34% of owners listed a “physical punishment” method for at least one of the seven tasks.

3.3. Links between reported training methods and dog behaviour

When comparing the three variables describing training history and the dog's behaviour in the test scenario, five significant associations were seen. The proportion of punishment-based training methods reported by the owner was negatively associated with experimenter interaction level during the relaxed social behaviour subtest (Spearman's Rank Correlation Test, $Rho = -0.371$, $N = 51$ (2 missing data points due to dog out of view on video),

$P = 0.007$) and the dog's ability at the novel training task ($Rho = -0.278$, $N = 53$, $P = 0.044$). The proportion of positive training methods reported by the owner was positively correlated to the dog's ability at the novel training task ($Rho = 0.308$, $N = 53$, $P = 0.025$). Owners who reported using physical punishment owned dogs that were less interactive during play (Mann–Whitney U -test, $U = 187.5$, $N = 53$, $P = 0.015$, medians = 3.25 vs. 4), and were less likely to contact and interact with the experimenter ($U = 196$, $N = 51$, $P = 0.03$, medians = 8 vs. 1.5) when compared to dogs whose owners never used these methods.

3.4. Links between general owner behaviour and dog training performance

When testing the relationship between owner behaviour and dog performance at basic obedience

tasks and a novel training task, four significant relationships were found. The dog's Total Obedience Score for basic commands was positively associated with both the owner's Patience when training the novel training task ($Rho = 0.317$, $N = 53$, $P = 0.021$), and to Owner Involvement during play ($Rho = 0.316$, $N = 53$, $P = 0.021$). The Dog's Ability at the novel training task was positively associated with both the Total Rewards delivered ($Rho = 0.468$, $N = 53$, $P < 0.001$), and owner's Patience when training the novel training task ($Rho = 0.300$, $N = 53$, $P = 0.029$).

4. Discussion

4.1. Does training history affect current dog behaviour?

This study is, to our knowledge, the first to examine associations between empirical measures of dog behaviour and their owner's approach to training, although a recent study has reported similar observations of military dog handlers and their dogs (Haverbeke et al., 2008). We have found several significant links between the types of methods owners report to have used in the past and their dog's current human-directed behaviour. This is a relatively small sample size and with multiple statistical testing, one needs to beware that one or more of the significant associations may be due to chance. The subjective ratings for obedience, involvement and interactivity in play, were recorded by the experimenter who had also interviewed the owners, and hence there remains a risk of unconscious bias. However several of the links support findings from larger owner-reported data and hence are likely meaningful, so below we discuss all results significant at $P < 0.05$.

Those owners who chose to use punishment-based methods to train more tasks, tended to have dogs which showed lower levels of interaction with a novel tester within their home. The dogs reported to be trained using physical punishment, overall were less interactive when playing with their owners as well as less likely to approach a new person. In contrast, owners who favoured reward-based methods for more tasks, and those who used fewer punishment-based methods, had dogs which scored higher for ability when trained to perform a novel task.

The association between punishment-based prior training and lack of interaction with the novel tester, may be because punishment can lead a dog to become anxious or fearful towards people, as has previously been seen in dogs trained using electric collars (Schilder and van der Borg, 2004), and hence it may be less confident to approach a novel person within its home. It could also be that punishment based training leads to an insecure attachment which manifests as "clingy" behaviour towards the owner (see Scott and Fuller, 1965, p. 145) which may explain why those dogs trained using these methods were significantly less interactive with a novel person.

There was a significant difference in play behaviour between owner-dog partnerships which reported using physical punishment and those which did not; the use of these methods was associated with lower levels of interactivity during non-object play. Animals only play when their basic needs have been met (Jensen et al., 1998) and

they are sufficiently relaxed (Berman, 1980). Since play was less interactive in partnerships which use some physical punishment, this may suggest that this method of training is associated with a reduced quality of dog-human relationship. This correlation cannot be used as proof that punishment causes a reduction in interactivity, it may equally be that owners who are less interactive or reciprocal in their play with their dog, are also more likely to favour a domineering or punishment-based approach to training. But the association between play quality and dog-owner behaviour supports links previously seen (Rooney and Bradshaw, 2003).

Reported obedience, has previously been shown to be higher in those dogs trained using more positive rewards (Hiby et al., 2004) and more consistent training methods (Arhant et al., 2010) and performance is higher in working dogs trained using less aversive stimuli (Haverbeke et al., 2008). However, in this study, we did not detect a systematic difference in recorded obedience scores when dogs with different training histories performed three standard tasks. This may be because the tasks chosen; sit, lie and stay, only measure the dogs' response to specific commands, which could be very context specific, and not fully representative of a dog's overall obedience. Past research has suggested that the effects of negative and positive training methods are specific to the context in which they are delivered (Blackwell et al., 2008) and hence it may be necessary to examine the training methods used for the precise tasks for which obedience is scored. However, we did detect a significant difference in the dogs' ability at a novel task; owners who reported training more tasks using reward-based methods in the past were more successful when training their dog to perform a new task, in this case to touch a specific wooden spoon. This suggests that a past history of reward-based training increases a dog-owner partnerships' success in future training; possibly by increasing the dog's motivation and aptitude to learn, because it learns to anticipate rewards. Dogs trained using more rewards may be less stressed, and more relaxed in a training scenario than those trained using inconsistent or punishment-based methods as has previously been shown in working dogs (Schilder and van der Borg, 2004). Since high levels of stress can reduce an animals' ability to learn (e.g. Mendl, 1999), this could explain this association. Once again this result is a correlation, and it is impossible to attribute cause and effect. It could equally be that those dogs which show poor learning ability were less likely to instigate a reward-driven training approach in their owners, that owners resort to punishment after reward-based methods have failed, or that owners who reported reward-based training also behaved subtly differently in the training task and thereby enhanced learning. Owners who favour this approach may even have selected dogs of different temperaments at the outset, or be generally keener or more experienced dog trainers. However, even if these alternative explanations are true, this study, shows that a reduction of rewards, or an increase in punishment does not lead to enhanced obedience or future ability to learn, and hence these results support those of Hiby et al. (2004) that higher levels of reward-based methods appear to be beneficial.

4.2. Do measurable differences in owner behaviour correlate to differences in dog behaviour?

When examining correlations between owner behaviour, and the dog's obedience and learning behaviour in a standardised test, several significant associations were seen. Within individual subtests, there were clear associations between the behaviour of each of the partners. For example, owners who scored higher for patience in the training task tended to have dogs which scored higher for ability. Similarly there was a correlation between the number of rewards delivered and the dog's ability at the task, which would be expected since rewards are more likely to be delivered following correct responses. However, there were also several interesting correlations when comparing between subtests. Those owners who were more involved in play tended to have dogs which performed better in the novel training task, and which were more obedient to basic commands. This supports for the idea of playfulness being indicative of a healthy relationship (Rooney and Bradshaw, 2003), since owners who were more playful seemed also to have trained their dogs better. Playful owners may also use play as a reward and thus motivate their dogs to learn quicker since play has been demonstrated to be an efficient reward for the training of many tasks (e.g. Rooney et al., 2004). When interpreting this and the other results however, one must be aware that due to demographics, the majority of the dogs in this sample were gundogs, whose responses may not be typical of all breeds. Since some gundogs breeds are particularly playful (e.g. Labrador Retrievers; Rooney and Bradshaw, 2004), such associations may be less important in a sample of different demographic. It would therefore be advisable to repeat this study with a sample of different breed types.

4.3. Novel training task

The training task developed in this study was an effective way of examining a dog and owners' response to a novel task, and subtle aspects of their communication during training. There was considerable diversity both in the way the owners behaved during the task and in the subsequent ability of their dogs to learn. The owners' behaviour in the novel training task showed links to their dogs' ability to learn that task, and to its general obedience in previously learnt tasks. The dog's behaviour in the task was further linked to their owners' involvement in play in an earlier subtest.

Aspects of owner–dog communication during the training task such as the number of affectionate physical contacts or the frequency of rebuking vocalisations did not appear to significantly affect the dogs' ability at the task being trained, whilst the owner's patience and the frequency with which they rewarded the dog did correlate with the dog's performance. This suggests that subtle aspects of the owner's communication when interacting may affect their dog's performance at a novel task, and in a test scenario these may be better indicators of the owners' natural interaction style as they are possibly less affected by the owner being watched or filmed. One can-

not rule out the possibility that owners predisposed to train in different ways originally selected dogs with differing temperaments and hence receptiveness to differing training techniques. Further studies examining behaviour within non-established dog–human pairing would help to elucidate such subtle effects.

4.4. What affects ability to learn?

Since the behaviour of neither party was controlled, and they are inevitably inter-related, one must be careful in drawing discrete conclusions about either dog or owner from this study. Significant findings are best interpreted as indicative of differences between dog–owner relationships rather than attributed to be cause and effect.

The performance of the dog–owner partnerships when presented with a novel training task was significantly related to a number of measured variables. Those partnerships which performed the best, tended to be those with a reported history of training many tasks using reward-based methods, whilst owners who showed high levels of involvement when engaging in non-object play and those who showed a high level of patience and a high reward frequency when training the task also did well. This supports the popular idea that the best way to build a dog–owner relationship which encourages effective learning is to adopt a reward-based, playful yet patient approach to training (e.g. Bailey, 2008).

5. Conclusion

Despite a growing trend to use reward-based training methods, there continue to be a large number of punishment-based methods in common usage. This study empirically compares the behaviour of dogs trained using a variety of training methods. Different reported methods of training were associated with differing levels of obedience and behavioural problems in past studies (Hiby et al., 2004; Blackwell et al., 2008) and to variations in playfulness, levels of interaction with a novel person, and ability to learn a new task, in the current study.

Although this study uses a relatively small sample of dogs, similar to past research all the significant relationships seen support the benefits of reward-based training methods (Hiby et al., 2004; Blackwell et al., 2008). Whilst the proportion of reward-based methods showed significant associations with benefits such as enhanced ability in a new training task; the proportion of punishment-based methods only showed associations with potential detriments such as reduced interactivity during play and lower levels of interaction with new people. Thus, we conclude that, in support of the questionnaire-based findings of Hiby et al. (2004), this observational study suggests that, for dog owners, the use of reward-based training appears to be the most beneficial for the dog's welfare, since it is linked to enhanced learning and a balanced healthy dog–owner relationship.

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References

- Arhant, C., Bubna-Littitz, H., Bartels, A., Futschik, A., Troxler, J., 2010. Behaviour of smaller and larger dogs: effects of training methods, inconsistency of owner behaviour and level of engagement in activities with the dog. *Appl. Anim. Behav. Sci.* 123, 131–142.
- Bailey, G., 2008. *The Perfect Puppy*. Hamlyn Publisher.
- Beerda, B., Schilder, M.B.H., van Hooff, J.A.R.A.M., de Vries, H.W., 1997. Manifestations of chronic and acute stress in dogs. *Appl. Anim. Behav. Sci.* 52, 307–319.
- Berman, M., 1980. Early agonistic experience and rank acquisition among free ranging infant rhesus monkeys. *J. Primatol.* 1, 153–170.
- Blackwell, E.J., Casey, R.A., 2006. The Use of Shock Collars and their Impact on the Welfare of Dogs: A Review of the Current Literature. Report to the RSPCA. <http://www.rspca.org.uk/servlet/Satellite?blobcol=urlblob&blobheader=application%2Fpdf&blobkey=id&blobtable=RSPCABlob&blobwhere=1138718966544&ssbinary=true> (accessed on 18/02/10).
- Blackwell, E.J., Twells, C., Seawright, A., Casey, R.A., 2008. The relationship between training methods and the occurrence of behavior problems, as reported by owners, in a population of domestic dogs. *J. Vet. Behav.* 3, 201–217.
- Haverbeke, A., Laporte, B., Depiereux, E., Giffroy, J.-M., Diederich, C., 2008. Training methods of military dog handlers and their effects on the team's performances. *Appl. Anim. Behav. Sci.* 113, 63–69.
- Herron, M.E., Shofer, F.S., Reisner, I.R., 2009. Survey of the use and outcome of confrontational and non-confrontational training methods in client-owned dogs showing undesired behaviors. *Appl. Anim. Behav. Sci.* 117, 47–54.
- Hiby, E.F., Rooney, N.J., Bradshaw, J.W.S., 2004. Dog training methods: their use, effectiveness and interaction with behaviour and welfare. *Anim. Welf.* 13 (1), 63–69.
- Jensen, M.B., Vesergaard, K.S., Krohn, C.C., 1998. Play behaviour in dairy calves kept in pens the effect of social contact and space allowance. *Appl. Anim. Behav. Sci.* 56, 97–108.
- Marschark, E.D., Baenninger, R., 2002. Modification of instinctive herding dog behaviour using reinforcement and punishment. *Anthrozoos* 15, 51–68.
- Marshall-Pescini, S., Valsecchi, P., Petak, I., Previde, E.P., 2008. Does training make you smarter? The effects of training on dogs' performance (*Canis familiaris*) in a problem solving task. *Behav. Process.* 78, 449–454.
- Mendl, M., 1999. Performing under pressure: stress and cognitive function. *Appl. Anim. Behav. Sci.* 65, 221–244.
- Rooney, N.J., 1999. Play behaviour of the domestic dog, *Canis familiaris* and its effects on the dog–human relationship. PhD Thesis. University of Southampton.
- Rooney, N.J., Bradshaw, J.W.S., 2002. An experimental study of the effects of play upon the dog–human relationship. *Appl. Anim. Behav. Sci.* 75, 161–176.
- Rooney, N.J., Bradshaw, J.W.S., 2003. The effects of play upon dominance and attachment dimensions of the dog–owner relationship. *J. Appl. Anim. Welf. Sci.* 6, 67–94.
- Rooney, N.J., Bradshaw, J.W.S., 2004. Breed and sex differences in the behavioural attributes of specialist search dogs—a questionnaire survey of trainers and handlers. *Appl. Anim. Behav. Sci.* 86, 123–135.
- Rooney, N.J., Bradshaw, J.W.S., Robinson, I., 2001. Do dogs respond to play signals given by humans? *Anim. Behav.* 61, 715–722.
- Rooney, N.J., Bradshaw, J.W.S., Almney, H., 2004. Attributes of specialist search dogs—a questionnaire survey of UK dog handlers and trainers. *J. Forensic Sci.* 49, 300–306.
- Schalke, E., Stichnoth, J., Ott, S., Jones-Baade, R., 2007. Clinical signs caused by the use of electric training collars on dogs in everyday life situation. *Appl. Anim. Behav. Sci.* 105, 369–380.
- Schilder, M.B.H., van der Borg, J.A.M., 2004. Training dogs with help of the shock collar: short and long term behavioural effects. *Appl. Anim. Behav. Sci.* 85, 319–334.
- Scott, J.P., Fuller, J.L., 1965. *Genetics and Social Behavior of the Dog*. University of Chicago Press, p. 145.
- Stephen, J., Ledger, R., 2007. Relinquishing dog owners' ability to predict behavioural problems in shelter dogs post adoption. *Appl. Anim. Behav. Sci.* 197, 88–99.
- The Kennel Club, 2006. Kennel Club Breed Standards, <http://www.thekennelclub.org.uk/item/210> (accessed 18/02/10).
- Tortora, D.F., 1982. Understanding electronic dog training part 1. *Canine Pract.* 9, 17–22.
- Yeon, S.C., Erb, H.N., Houpt, K.A., 1999. A retrospective study of canine house soiling: diagnosis and treatment. *J. Am. Anim. Hosp. Assoc.* 35 (2), 101–106.