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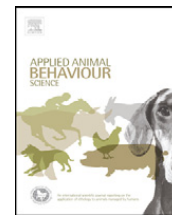
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The efficacy of systematic desensitization for treating the separation-related problem behaviour of domestic dogs

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ABSTRACT

The evaluation of systematic desensitization to treat separation-related problem behaviours, such as destruction of property, excessive barking, or house-soiling, has tended to rely on single case-studies. Eight dogs exhibiting separation-related behaviour, and their owners, participated in a controlled experiment using a within-subjects design to evaluate the efficacy of a combination of systematic desensitization and counter-conditioning. Treatment produced significant reductions in both the frequency ($T(9)=0.0$, $P=0.008$) and the severity ($T(9)=0.0$, $P=0.008$) of separation-related behaviours compared to baseline. Six dogs, for which follow-up data were obtained three months after treatment ended, showed almost complete elimination of the problem behaviour. The use of counter-conditioning, and other behavioural advice, did not appear to be related to the success of the treatment, suggesting that systematic desensitization was the critical element. Speed of progress and final success was not related to the consistency with which the owners applied systematic desensitization, indicating that even when owners apply systematic desensitization haphazardly, it can still be successful in treating separation-related behaviour in dogs.

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1. Introduction

Separation anxiety is a common behaviour problem encountered by practitioners in the field of canine behaviour (Borchelt and Voith, 1982; Hothersall and Tuber, 1979; Takeuchi et al., 2001). Bradshaw et al.'s (2002) longitudinal study suggested that separation-related problem behaviour is even more prevalent than the 15% of the dog population estimated by veterinarians. Whining, barking, house-soiling, and destructiveness during the owner's absence are the most commonly-cited symptoms (Hart and Hart, 1985; Palestrini et al., 2010), and are common reasons for relinquishing dogs to animal shelters (Diesel et al., 2010; New et al., 1999). Indications of stress, such as pacing,

whining, or trembling, can be apparent before the owner's departure (Horwitz, 2000; Overall, 1998; Turner, 1997), and animals may abstain from eating or drinking during the owner's absence (Hothersall and Tuber, 1979).

There are several techniques for treating separation-related behaviour, including punishment, confinement, pharmacological interventions, and systematic desensitization. While pharmacological interventions can reduce the symptoms of separation-related behaviour (King et al., 2000), sometimes they do not (Podberscek et al., 1999). Pharmacological interventions also do not address the modification of the dog's behaviour (Schwartz, 2003), meaning that the dog will continue to require medication for long periods, and pharmacological interventions may have adverse side effects (Horwitz, 2000). Additionally, some dog owners may oppose the use of drugs, or find the cost prohibitive (Takeuchi et al., 2000).

Systematic desensitization is a technique widely used in human behaviour modification for the treatment of

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phobias or fear/anxiety responses to a particular stimulus (Cooper et al., 1987; Wolpe, 1962). It involves the gradual and progressive introduction of the stimulus eliciting the phobia (in this case, the absence of the dog's owner). The rationale is that very mild versions of the stimulus will not elicit anxiety. If those mild versions are presented repeatedly, their lack of effect will generalise to somewhat more severe versions, which may themselves then be presented as training stimuli. Over time, it should be possible to 'fade in' progressively more severe stimuli (here, longer absences) until reaching the severity which elicited the phobia before treatment, but without generating anxiety.

Case-study evidence suggests that systematic desensitization can be an effective approach (Borchelt and Voith, 1982; Hothersall and Tuber, 1979; Lem, 2002; Overall, 1998). Few studies, however, have used controlled methods to determine the efficacy of systematic desensitization. Takeuchi et al. (2000) interviewed dog owners by telephone 6 months or more after they had received advice via a behavioural consultation for separation-related behaviour problems. The dog owners were given a wide range of instructions, including systematic desensitization in most cases. More than half (62%) of owners reported an improvement in their dog's behaviour, but the degree of compliance with the instructions and degree of behavioural improvement was based entirely on the subjective reporting of the owner. Given the low rate of self-reported compliance with the systematic desensitization component of the instructions (43% of owners), and the wide range of instructions with which they could have complied, it is difficult to determine the efficacy of any one of the techniques in isolation.

Cottman et al. (2008) gave behavioural advice to dog owners, either in person, or in writing, on the treatment of separation-related behaviours using systematic desensitization. They reported a 40% average improvement in the dogs' problem behaviour. However, the behavioural intervention was not monitored, or observed, and improvement was measured via questionnaire only. Podberscek et al. (1999) similarly provided dog owners with behavioural modification advice, in a study in which some dogs also received pharmacological interventions. The behavioural treatment in isolation was found to be highly effective, but all behaviour, including at baseline, was measured via questionnaires, with no independent observations. Thus, the owners' compliance with, and extent of use of, systematic desensitization is not known. Nor it is known whether there was any objective improvement in the dogs' behaviour.

In human behaviour modification, the effectiveness of systematic desensitization can often be increased by the simultaneous use of counter-conditioning (Cooper et al., 1987; Davison, 1968), in which a behaviour incompatible with anxiety is explicitly trained when the anxiety-provoking stimulus is introduced. In the present study, counter-conditioning was implemented by arranging food delivery during the owners' pre-departure activity contingent upon the absence of separation-related problem behaviours, and was combined with systematic desensitization, to measure the effectiveness of this combined approach to treating separation-related behaviour in dogs.

In summary, our study was designed to measure the progress of a behavioural intervention for the treatment of separation-related problems exhibited by eight dogs. The behavioural intervention focused on systematic desensitization of the dogs to separations of approximately increasing length, and also included counter-conditioning, the cessation of punishment, stay training, and implementation of a minimum exercise regime. The severity and frequency of separation-related behaviours were recorded repeatedly before treatment (baseline), during treatment, and between three and six months after the end of the treatment period.

2. Materials and methods

2.1. Subjects

Eight dogs were obtained from veterinary referrals and responses to a newspaper article. Interviews with the owners were carried out for the collection of data pertaining to owner characteristics that might be relevant to the cause and maintenance of the problem behaviour. In order to be accepted for the study, dogs had to display any or all of the following behaviours only in the *absence* of the owner: destructiveness, inappropriate urination or defecation, and vocalisation. Dogs with separation-related problem behaviour typically do not eliminate, chew, dig, or bark excessively while at home with their owner (McCrave, 1991).

The destructiveness demonstrated by the dogs in the present study was unlikely to have been caused by boredom because the dogs were usually alone for short periods only, during which the destruction occurred. Destruction never occurred for any dog while the owner was home.

Vocalisation could potentially arise from territorial behaviour, that is, dogs barking at passersby, or other outside disturbance, rather than from separation anxiety. Vocalisation that occurred exclusively from territorial behaviour was identified through analysis of tape-recordings, and neighbour reports.

None of the dogs in the present study soiled inappropriately in their owner's absence. If any dog had demonstrated an elimination problem, we would have, firstly, ruled out any medical problem (McCrave, 1991). Then, we would have assessed whether the dog soiled exclusively in the owner's absence. A dog that soils inappropriately due to poor house training might be expected to soil in the owner's presence, even with access to suitable toileting areas, as well as in their absence. Inappropriate elimination could also be due to fear, excitement, submission, or greeting upon the owner's return, or marking (McCrave, 1991). In the case that elimination is due to factors other than separation from the owner, a diagnosis other than separation anxiety may be reached if the dog exhibits the behaviour in the owner's presence, rather than in their absence, and in response to fear-eliciting stimuli (McCrave, 1991). McCrave (1991) further documented the criteria for diagnosing elimination, destruction, and vocalisation as separation-related behaviour problems.

A summary of each subject's history and clinical findings is in Table 1.

Table 1
Summary of subject characteristics.

Subject	Dog 1	Dog 2	Dog 3	Dog 4	Dog 5	Dog 6	Dog 7	Dog 8
Breed	Staffordshire Bull Terrier	Border Collie cross	German Shepherd cross	Labrador	German Shepherd	Dachshund cross	English Springer Spaniel	Miniature Schnauzer
Sex	M	F	M	F	F	F	M	M
Desexed	Y	Y	Y	Y	N	Y	Y	Y
Age (months)	17	18	120 (est. ^a)	12	12	14	7	12
Age acquired (months)	12	2	120 (est.)	2	4	3	3	5
Duration of problem	Since acquired	Since acquired	Since acquired	Since acquired	Since acquired	5 months	5 months	Since acquired
Problem behaviour	Destructive	Destructive	Vocalisation	Destructive	Vocalisation and destructive	Destructive	Destructive	Destructive
Problem location	Car	Inside home and car	Yard	Inside home and yard	Inside home, yard, and car	Inside home	Inside home and yard	Inside home and yard
Duration of owner absence	2–3 h most days	<2 h most days	7–8 h daily	2–4 h most days	0.5–2 h most days	2 h most days	4 h daily	1–3 h most days
Owner's reaction to behaviour	Punishment	Punishment	None	Punishment	Confinement during absence	Punishment	Punishment	Punishment
Occurrence when owner present	Never	Never	Never	Never	Whenever owner out of sight	Never	Never	Never
Access to owner as a puppy	Continuous	Continuous	Unknown	Continuous	Continuous	Continuous	Continuous	Continuous
Access to owner at home now	Continuous	Continuous	Never allowed inside	Continuous	Continuous	Continuous	Most of the time	Continuous

^a Estimated by veterinarian as dog was a stray.

2.2. Data recording and analysis

2.2.1. Owner ratings

A four-step rating scale (1 = very good, 2 = good, 3 = bad, and 4 = very bad) was used to measure the owner's subjective rating of the severity of the separation-related behaviours during baseline and treatment separations. A rating of one indicated that no separation-related behaviours were displayed during the owner's absence. This rating scale was adopted, rather than a measure of *amount* of damage, to allow a better match to the owners' perception of the problem. For example, a dog may do a great deal of damage to insignificant objects, or a small amount of damage to a valuable item. Destructive behaviour was rated upon the owner's return to the house. Owners were provided with a camera to photograph evidence of destructiveness. Owners subjectively rated the severity of destructive separation-related behaviour, but the importance of maintaining consistent ratings over time was stressed. Thus, while ratings may not be comparable across dogs, ratings for individual dogs are comparable over time. All vocalization ratings were undertaken by the first author from tape-recordings made in the owner's absence.

Dog owners were provided with blank recording sheets to record the detail of each baseline and treatment separation: date, separation number, departure time, arrival time, location, rating of separation-related behaviour, departure reward, and arrival reward. Additionally, the owners were asked to tick a box to indicate whether exercise and stay training had been conducted on each day of treatment.

Reliability checks on ratings were performed during baseline, treatment, and follow-up phases. The frequency of these checks is shown in Fig. 1 (open and closed circles). These were carried out by an independent observer, such as another family member, neighbour, or the first author. Observers were privy to the dogs' baseline levels of separation-related behaviour and therefore were able to base their ratings on comparisons with the most severe levels of the behaviour, in a similar way as were the owners. Owners were always absent when the observer rated the severity of destruction and it was made clear to the owner that it was important that they not discuss the ratings with the observer prior to obtaining the pair of ratings, to ensure the ratings remained independent.

2.2.2. Statistical analysis

All statistical tests were conducted using Statistica[®]. The curve fits were nonlinear least-squares fits obtained using the iterative Marquardt–Levenberg (Marquardt, 1963) algorithm provided in SigmaPlot[®].

Owner ratings of the severity of the problem behaviours were converted to a mean for each dog for baseline. These mean ratings of severity during baseline were compared to a mean rating obtained from the same number of separations at the end of the treatment phase to enable comparison using equal numbers of separations in both phases. The frequency of the occurrence of problem behaviours was measured by counting the occurrence of any rating greater than one at baseline, and in the equivalent number of separations at the end of the treatment phase, to enable comparison using equal numbers

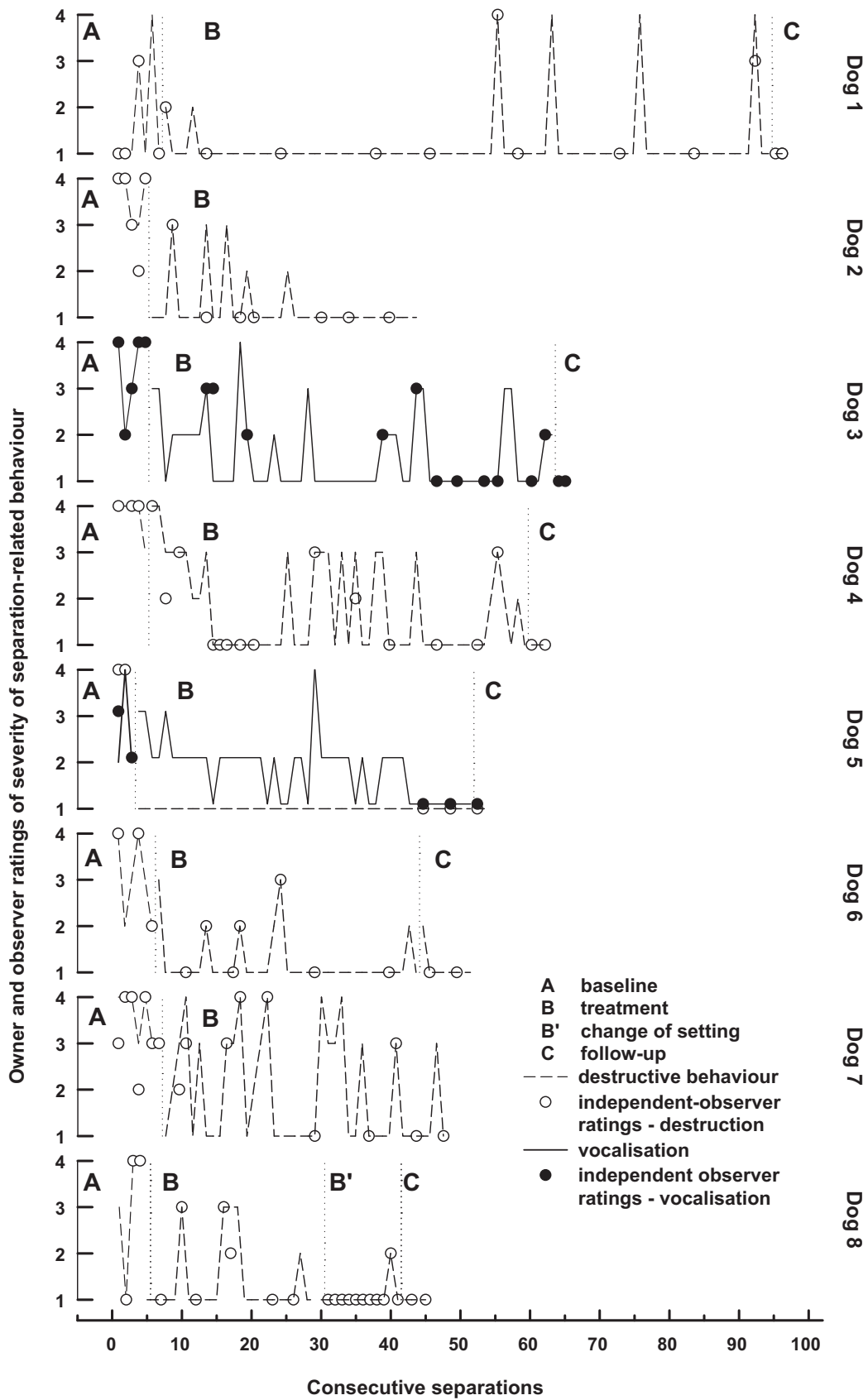


Fig. 1. Owner (lines) and observer (circles) ratings of the severity of separation-related behaviour following the return to the dog after each separation. Broken lines and unfilled circles indicate ratings of destructive behaviour. Solid lines and filled circles indicate ratings of vocalization. Vertical dotted lines show changes in phase. Note that there are two lines of data for Dog 5 (solid and dashed) as this dog exhibited both vocalization and destructive behaviour.

of separations in both phases. A rating of one indicated the complete absence of problem behaviour, thus the frequency ratings counted behaviours of all severities (any rating greater than one).

Mean ratings of severity and frequency of problem behaviours in baseline and treatment for each dog were compared statistically using Wilcoxon matched-pairs signed-rank tests, because we did not wish to make the assumption of normality required by the parametric *t*-test for matched pairs.

In the treatment phase, decreasing exponential functions ($y = a \exp^{-bx}$) were fitted to owner ratings across sequential separations. Increasing exponential functions ($y = ab^x$) were fitted to the durations of consecutive separations during treatment. The resulting goodness-of-fit values (R^2) were used as estimates of the variability in ratings and lengths of separation across the treatment phase. Thus, if ratings of the severity of the separation-related behaviour declined gradually across the treatment period, the exponential decay functions could be expected to fit the data better, and therefore produce higher R^2 values, than if ratings varied unsystematically. Similarly, if the length of the separations increased gradually across the treatment phase, increasing exponential functions could be expected to fit the data better, and produce higher R^2 values, than if the length of separation varied unsystematically. Our interest was not in the parameters of each exponential function, and we did not expect the functions to fit well, or to have any theoretical import. Rather, we wanted to explore the relationship between how systematically behaviour changed during treatment and whether that behavioural change was related to how systematically the owner lengthened the separations.

Spearman correlations were used to calculate whether R^2 values for duration were related to R^2 values for ratings or to the mean ratings over the last five separations. If it were the case that systematic increases in the length of separation (high R^2 values for duration) were related to more gradual reductions in problem behaviour (high R^2 values for ratings), we would expect a positive correlation between R^2 values for duration and R^2 values for ratings. Additionally, if more gradual increases in the length of separation (high R^2 values for duration) resulted in better final outcomes in terms of mean ratings of the severity of the problem behaviour, we would expect a negative correlation between R^2 values for duration and the mean ratings for the last five separations.

2.3. Research design

A within-subjects ABC research design was adopted. In the first phase (A), baseline measurements of the target behaviours were taken for between three (Dog 5) and seven (Dog 7) separations before treatment began (between 4 and 17 days). In the treatment phase (B), the combined systematic desensitization and counter-conditioning treatment was implemented for between 39 (Dog 6) and 91 (Dog 1) separations (between 2 and 8 weeks in length). The second treatment phase (B') for Dog 8 involved a relocation of the dog to a different setting. In the last condition (C), follow-up data were collected between 1 and 6 months

Table 2

Number of separations for each dog in each condition.

	Dog 1	Dog 2	Dog 3	Dog 4	Dog 5	Dog 6	Dog 7	Dog 8
A	7	5	5	5	3	6	7	4
B	90	40	60	56	50	39	42	37
C	3	0	2	3	2	8	0	4

after the end of Phase B for six of the eight dogs. The number of separations experienced by each dog in each condition is shown in Table 2.

2.4. Treatment

Progress checks were made by the first author every 2 weeks during treatment. All participants were invited to phone for advice during treatment.

2.4.1. Systematic desensitization

Treatment was largely based on the anecdotal guidelines of Borchelt and Voith (1982). Owners carried out the treatment themselves following instructions provided. Owners were instructed to place their dog in isolation with food treats 3–4 times per day, with a minimum of 1 h between isolation periods. Starting with a 5-min separation period, owners were instructed to increase gradually and variably the period of separation in increments of 5 min until a period of 30–90 min was reached without recurrence of separation-related behaviour. After reaching that point, isolation durations were increased more rapidly. If the dog displayed evidence of separation-related behaviour, owners were instructed to return to the longest period not previously associated with separation-related behaviour and to proceed more gradually. Owners were advised to avoid lengthy separations outside treatment protocol as much as possible.

Dog 3 received treatment by both the owner and the first author. As this dog had a vocalisation problem, it was necessary to remove the dog from its home during the day to prevent its removal by authorities. Dog 3, therefore, was housed at the first author's home during the day. However, treatment was undertaken at the dog's home by either the first author, or the owner.

2.4.2. Counter-conditioning and punishment

Owners were instructed to deliver food during pre-departure activity, immediately before leaving the dog, and immediately after the owner returned. Delivering food before departure was an attempt to extinguish pre-departure anxiety through counter-conditioning by associating the fear-producing response with the incompatible emotional response associated with eating (Davison, 1968). Delivering food after the owners' return was intended as a reinforcer for the absence of separation-related behaviour.

Food delivery was contingent upon the absence of separation-related behaviour. If the dog had engaged in destructive behaviour during the owner's absence, the dog was ignored for 30 min after the owner returned. While the application of negative punishment here (removal of attention and withholding a food reward) was temporally delayed from the problem behaviour, delayed punishment

has been found to have some success, if less than immediate punishment (Azrin, 1956). Additionally, as owners were instructed to begin with short treatment separations, the delay between separation-related behaviour and its contingent punishment should have been initially short, and increased with increasing length of absence.

Because evidence of vocalization during the owner's absence was identified by tape-recordings, the 30-min timeout could not be applied to vocalising dogs.

Dog owners were instructed to cease delivery of positive punishment (verbal or physical) for separation-related problem behaviours.

2.4.3. Exercise and stay training

All dog owners were instructed to exercise their dog for at least 15 min every day. Owners also received instructions on how to train their dogs to “stay”, using positive reinforcement for lying calmly when given the “stay” command, in neutral settings (e.g. while the owner was watching television or cooking) and then during pre-departure activity. Owners were instructed to reward calm behaviour around the house (e.g. sitting, lying down), to ignore excited behaviour, and to prevent the dog from following the owner around the house by shutting doors.

2.5. Animal ethics

This research complied with the ethics and welfare provisions of the New Zealand Animals Protection Act (1960) and the International Guiding Principles for Biomedical Research Involving Animals as issued by the Council for the International Organizations of Medical Sciences. At the time the study was conducted, New Zealand law did not require formal approval by an Ethics Committee. Advice from the current Chair of the University of Auckland Animal Ethics Committee confirms this.

3. Results

The owners', and independent-observers', subjective ratings of severity of separation-related behaviour, which were made when the owners returned after a period of isolation from their dog, are plotted in Fig. 1 for baseline, treatment, and follow-up for each dog. Independent observers gave the same ratings as owners on 114 of a total of 137 reliability checks, giving an overall agreement of 83%, so the owners' ratings were taken as reliable measures of behaviour. All disagreements between owner and independent observer spanned only one step of the rating scale, with owners most often rating the problem behaviour as slightly more severe.

Fig. 1 shows that the severity of separation-related behaviours decreased for most dogs during treatment, compared to baseline ratings. Dogs 1 and 7 still produced occasional severe separation-related behaviours, but also experienced many more problem-free separations than in baseline. The severity of destructive separation-related behaviours, measured by comparing the mean rating for baseline separations with the mean of an equivalent number of separations at the end of the treatment phase, decreased by 17, 72, 53, 75, 61, 64, and 58% for Dogs 1, 2, 4,

5, 6, 7, and 8, respectively. Note that there are two lines of data for Dog 5 in Fig. 1, the solid line representing vocalization behaviour, and the dashed line destructive behaviour. The severity of vocalisation behaviours decreased by 59 and 63% for Dogs 3 and 5, respectively. The mean reduction in severity of all problem behaviours across all dogs was significant according to a Wilcoxon matched-pairs signed-rank test ($T(9)=0.00, P=0.008$).

The frequency of destructive separation-related behaviour (defined as any occurrence of a rating above one for baseline separations and the equivalent number of separations at the end of the treatment phase) decreased for Dogs 1, 2, 4, 5, 6, 7, and 8 by 50, 100, 40, 100, 83, 86, and 67%, and for vocalisation behaviours for Dogs 3 and 5 by 60 and 100%, respectively. The reduction in frequency of all problem behaviours across all dogs was significant according to a Wilcoxon matched-pairs signed-rank test ($T(9)=0.00, P=0.008$).

Follow-up ratings obtained three months after the end of the treatment phase from six of the eight dogs showed almost complete elimination of the problem behaviour (21 of the 22 follow-up separations showed zero separation-related behaviours). Informal reports from the owners of the two dogs whose behaviour was not measured in a follow-up (Dogs 2 and 7) confirmed that those owners were satisfied with the outcome of the treatment.

The effect of treatment generalized to longer durations of separation than the dogs had experienced during baseline. (Fig. 2 shows the duration of all separations for seven of the eight dogs. The mean increase in separation duration for each dog for follow-up compared to baseline separations was 11, 370, 153, 11, and 79 min for Dogs 1, 3, 4, 6, and 8 (for whom duration records were complete), respectively.

Although treatment was eventually successful for all dogs, there was considerable individual variation in both rapidity and variability of progress. Fig. 2 shows the duration of consecutive separations for each dog, in each condition, except for Dog 5 (whose owner did not keep records).

The durations of separations were generally longer, and more variable, during baseline (A) than at the start of treatment. Exceptions were displayed by Dog 3, who, after an initially long separation, experienced a series of short baseline separations, and Dog 7, whose treatment separations were as long and variable as those during baseline.

Treatment separation durations are shown in Panel B of Fig. 2, which shows that some owners increased the length of consecutive separations more gradually than did others. Exponential functions ($y=ab^x$) fitted to the data in Fig. 2 (Panel B) produced R^2 values of 0.18, 0.02, 0.45, 0.03, 0.28, 0.01, and 0.10 for Dogs 1, 2, 3, 4, 6, 7, and 8, respectively. These values can be considered to indicate the degree of variability of separation length across treatment. High R^2 values show that separation durations were increased gradually and that there were few deviant separation lengths. The R^2 values indicate that the owners of Dogs 1, 3, 6, and 8 were the most consistent in increasing the length of separations during treatment. Exponential decay functions ($y=a \exp^{-bx}$) were fitted to the consecutive ratings during treatment (B in Fig. 1). The R^2 values from those fits (0, 0.08, 0.05, 0.12, 0.39, 0.04, and 0.00

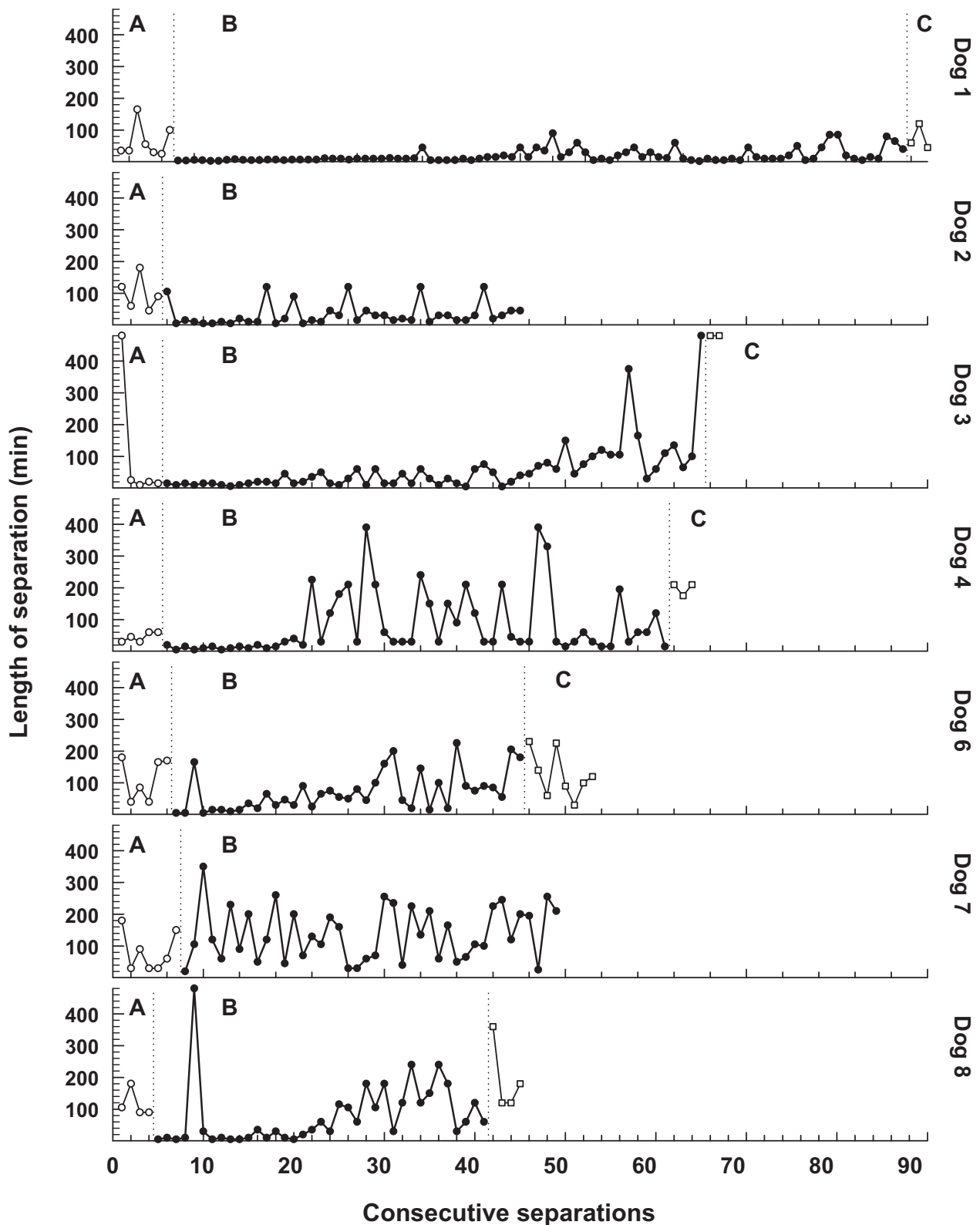


Fig. 2. Length of consecutive separations (min) for all dogs except Dog 5.

for Dogs 1, 2, 3, 4, 6, 7, and 8, respectively) indicate the variability in rating scores across treatment. Smooth and gradual decreases in rating scores should produce better fits to the curve, and thus higher R^2 values. Goodness-of-fit values (R^2) for duration were not significantly correlated with R^2 for ratings ($r_s = -0.32, P = 0.48$) or with mean ratings

over the last five separations ($r_s = 0.07, P = 0.88$), showing that the consistency with which the owners increased the length of separation during treatment was not related to either the variability of progress (R^2 of fits to ratings during treatment) or the overall success of the treatment (mean of the ratings of the last five separations).

A series of correlation coefficients was calculated for the seven dogs for which there were data on the separation durations, to assess the relationship between the ratings of severity of separation-related behaviour and the length of the separation across all separations. Only one of these correlations was significant (Dog 1, $r=0.278$, $P=0.005$), suggesting that separation-related behaviour is not related to the length of absence of the owner for most dogs.

The role played by counter-conditioning in successful treatment is unclear. The owners of Dogs 3, 4, and 6 implemented counter-conditioning correctly, using food reinforcers. While the owners of Dogs 7 and 8 implemented counter-conditioning, they used non-food reinforcers such as social praise and access to toys. Dogs 1 and 5 did not receive counter-conditioning, and its absence in their treatment did not appear to affect the speed of progress relative to those dogs who did receive counter-conditioning. Dog 2 received no counter-conditioning until Separation 14 of treatment, which appears to have coincided with an improvement in her separation-related behaviour.

In addition to systematic desensitization, and counter-conditioning, owners were advised to conduct “stay” training and to exercise their dog for a minimum of 15 min each day. Owners of Dogs 5, 6, and 8 incorporated a high amount of stay training in their dog’s treatment programme, owners of Dogs 4, and 7 a small amount of stay training, and owners of Dogs 1, 2, and 3 did not conduct stay training at all. It is difficult to assess the contribution of stay training in the present results, but Fig. 1 shows that the complete absence of stay training did not hamper the progress of Dog 1, 2, or 3 in comparison to Dogs 5, 6, and 8 that received high levels of stay training.

The owners of Dogs 6 and 8 incorporated a high level of exercise into their dogs’ treatment programme, while Dog 3 enjoyed a medium amount of exercise, Dogs 4 and 7 a small amount, and Dogs 1, 2, and 5 received no exercise at all during the treatment phase. Again, Fig. 1 shows that the presence of high levels of exercise (Dogs 6 and 8) did not appear to result in an advantage over the dogs that experienced lower levels of exercise.

The comparison of Table 1 with Fig. 1 did not suggest any subject variables which might predict differences in the speed of progress.

4. Discussion

The application of systematic desensitization was successful in reducing both the severity and the frequency of separation-related behaviours by the end of treatment or follow-up for all eight dogs. The result is consistent with previous studies showing that owner-led behavioural interventions for the treatment of separation-related problem behaviour can be successful (Cottman et al., 2008; Podberscek et al., 1999; Takeuchi et al., 2000). The present study included many more objective measurement tools compared with past research, such as independent observer ratings, and photographed evidence of destruction. The effectiveness of treatment in this case, therefore, did not rely on the subjective ratings of dog owners. Counter-conditioning was not reliably related to success, and we tentatively suggest that it is the habituation to

owner absences which is the critical component of the treatment.

We used a small-N, within-subjects design rather than the more common between-subjects comparison of experimental and control groups. In our study, the target behaviour was measured repeatedly for each subject under baseline conditions (i.e. before treatment) and during, and after treatment. This research strategy is standard practice in applied behaviour analysis with human participants (e.g., Horner et al., 2005; Kazdin, 1982), because it has several advantages. Firstly, because each subject is used as its own control, inter-subject variability may be ignored. This means that it is possible to demonstrate an effect with a smaller number of subjects than if the comparison were between the means of groups. Secondly, none of the subjects needs to be assigned to an untreated control group, which avoids distress for owners of non-treated dogs. Thirdly, through repeated measures, the stability of the behaviour over time may be assessed. Finally, and in contrast to group comparisons, the individual subject characteristics correlated with success or failure can be evaluated, providing more useful information than does a group percentage success figure to a practitioner considering using the treatment with a presenting client.

There was no significant relationship between the gradualness of the increase in separation length and the speed or final success in reducing the frequency and severity of separation-related behaviour. Therefore, consistent with Borchelt and Voith’s (1982) conclusions from case-study research, treatment was successful even when the length of separation was variable. This is an important finding because it suggests that owners may be trusted to apply the method of systematic desensitization themselves, as consistency of application is not critical to success.

The length of separation across all treatment separations was correlated with severity of separation-related behaviours for only one of seven dogs. The present results, therefore, suggest that, as the length of absence was independent of separation-related behaviour for 86% of the dogs, if destructive or vocal behaviour had not begun shortly after the owner departed, it was not likely to begin after a longer period of absence. This result suggests that, consistent with Borchelt and Voith’s (1982) findings, separation-related problems are usually fully resolved once the owner has reached 30–90 min of absence without recurrence of the problem behaviour. Once the dog can be left by the owner for short periods with no recurrence of the problem behaviour, the absence of separation-related behaviour will be maintained for much longer periods. For Dog 1, long absences were correlated with reoccurrences of separation-related problem behaviour. Therefore, it may be that some dogs are more sensitive to separation length than others.

Prior to treatment, six of the eight owners reacted to the problem behaviour with positive punishment (Table 1), either physical or verbal, on their return. It has been suggested that punishment can exacerbate separation anxiety by increasing the dog’s emotional dependency on its owner (Borchelt and Voith, 1982), or by contributing to the dog’s general level of anxiety (O’Farrell, 1986). It may therefore

be that the decreases in problem behaviour resulted simply from the removal of punishment.

Specific events can trigger separation problems (Lund and Jørgensen, 1999). Three dogs (Dogs 3, 4, and 7) had experienced sudden changes in the routine of owner absences from the home. For one of the three dogs (Dog 7), the change in routine coincided with the onset of the problem. Dogs 3 and 4 had been exhibiting separation-related problem behaviour since acquisition, although the change in routine may have exacerbated their problem behaviour.

Three dogs (Dogs 1, 2, and 6) had experienced traumatic separation events. Dog 1 was left in a car for 4 h, Dog 2 was left alone in a bathroom for 8 h which flooded with hot water, and the owners of Dog 6 were away for two weeks away for two weeks, during which time the dog was kept tied up in the laundry by its caregivers. Dogs 1 and 2 had been experiencing separation-related problem behaviours since acquisition, although the traumatic events may have exacerbated their problems. Separation-related problem behaviour commenced following the traumatic event for Dog 6.

Although the reason for onset of separation-related behaviour for most dogs is unknown, the onset seemed most likely to have been caused, or exacerbated, by a traumatic separation, or a change in routine. Thus, although previous exposure to punishment is unknown, the problem behaviour did not appear to have been caused by punishment. The cessation of punishment can also not be a factor in the improvement of the behaviour of Dogs 3 and 5 who were not punished before beginning treatment. So, while the cessation of punishment may have contributed to the improvement in the dogs' behaviour, there is not enough evidence to assume it was the main contributor. Arhant et al. (2010) found that owner reports of dog anxiety were associated with punishment of small dogs, but not of large dogs. Six of the eight dogs in our study were larger breeds, who were presumably less susceptible to punishment-related anxiety. We, therefore, tentatively suggest that the cessation of punishment was not a major contributor to the reduction of separation-related problem behaviours for the dogs in our study. Further research is needed to determine the effect of cessation of punishment separately from other interventions.

Dog 8 experienced a change in location during the treatment phase, which is a possible confounding variable, as a change in home environment could potentially reduce the separation-related problem if the behaviour is associated with a specific context (home and owners). It is unlikely, however, that the problem behaviour was associated with either the owners, or the context, as this dog had exhibited separation-related problem behaviour since acquisition. Fig. 1 also indicates that the problem behaviour had been largely eliminated prior to the change in location. Another variation on the owner-led intervention was the additional assistance provided to the owner of Dog 3. The separations for Dog 3 were sometimes supervised by the first author, potentially improving the result for this dog.

To recruit participants to our study, dog owners were offered the opportunity to treat their dogs' problematic behaviour. We therefore offered comprehensive assistance

to treat the separation-related problem behaviour, and did not attempt to test each aspect of the treatment separately. We acknowledge that the effects of different aspects of the behavioural programme would have been easier to separate had the study been conducted on a larger scale, presenting one intervention at a time. However, despite the fact that some dogs owners completely ignored the supplementary aspects of the behavioural advice (e.g. Dog 1 received no counter-conditioning, no exercise, and no stay training), the problem behaviour was significantly reduced for all dogs by the end of the treatment phase. Future investigations should attempt to isolate aspects of our behavioural intervention to determine more clearly the effectiveness of each component.

Nearly all owners shared a history of providing constant companionship (Table 1), always allowing their dogs close physical proximity while home, as a way of 'making up' for their absences. In effect, the owner's behaviour was likely to exacerbate the symptoms of separation-related behaviour through the clearly discriminable contrast between constant presence and occasional lengthy absences. Although case-study evidence has suggested that separation-related behaviour may be caused by a lack of, or infrequent, experiences of separation during the critical period, the present data suggest that it is not lack of experience per se that predicts future separation-related behaviour problems. Rather, the problem lies in the lack of habituation to short durations of separation.

The opportunity to eliminate unnecessary instructions to owners of dogs exhibiting separation-related behaviour is important, as Takeuchi et al. (2000) found that when more than five instructions were given, dogs were significantly less likely to show improvement than when owners received fewer than five instructions. The results of the present study suggest that advice to dog owners should focus on systematic desensitization. If instructions are clear and simple, owners may feel less confused or overwhelmed, and be more likely to comply with the suggestions (Takeuchi et al., 2000).

To those with a background in behaviour analysis, like ourselves, it is pleasing and historically satisfying to see that systematic desensitization, which grew out of Pavlov's original experimental work using dogs, and then became the treatment of choice for phobias in humans, has proved its worth in increasing the well-being of the very species whose contribution made its development possible.

5. Conclusion

Eight dogs exhibiting separation-related behaviours such as destruction of property and vocalisation were subject to an owner-applied treatment consisting mainly of systematic desensitization and counter-conditioning. The frequency and severity of the problem behaviours were reduced for all eight dogs, and the problem behaviour almost completely eliminated. While there were several possible confounding factors, systematic desensitization was a consistent factor in the improvement of separation-related problem behaviour for the dogs in this study. The consistency with which systematic desensitization was applied did not predict the speed of progress or final suc-

cess, suggesting that, even when applied by owners rather than behaviour modification professionals, and even when applied haphazardly, systematic desensitization is successful in treating separation-related behaviour in dogs.

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