Assessing the impact of different persuasive messages on the intentions and behaviour of cat owners: A randomised control trial

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ABSTRACT

Owners of free-ranging domestic cats (Felis catus) are under increasing pressure to keep their pet contained within their house or yard, in an effort to reduce adverse impacts on cat welfare, ecosystem biodiversity and neighbourhoods. We conducted a randomised online experiment to assess the effectiveness of two persuasive messages to encourage cat owners to contain their pets. A total of 512 Australian cat owners, who currently do not contain their cats, were randomly assigned to view one of three short video messages: one framed to highlight the negative impact of cats' on wildlife and biodiversity ('wildlife protection' frame), one framed to highlight the health and safety benefits of keeping cats contained ('cat benefit' frame), and a control message focused on general information about cats ('neutral' frame). We assessed the impact of these video messages on two post-treatment outcome variables: (1) the intention of owners to contain their cat; and (2) the adoption of containment practices, based on a 4-week follow-up survey. Mediation analysis revealed both the 'wildlife protection' and 'cat benefit' messages increased owners' motivation to contain their cat and their beliefs that they could effectively contain their cat to achieve the desired outcomes (response efficacy). In turn, higher levels of motivation and response efficacy predicted increased cat containment intentions and increased adoption of cat containment. In addition, the response efficacy effects of the 'cat benefit' message were strengthened by the cat owner's bond to their pet, suggesting audience segmentation may improve the effectiveness of interventions. Implications for future intervention development are discussed.

1. Introduction

Free-roaming domestic cats (Felis catus) are increasingly recognised as a public nuisance and a threat to biodiversity (Loyd et al., 2013; Dickman, 2014). Although many studies have highlighted the health benefits of human-cat companionship (e.g. Headey and Krause, 1999; Friedmann and Son, 2009), mounting evidence indicates that free-roaming cats create substantial negative ecological impacts through predation and competition, which threaten the existence of many wildlife species in Australia and worldwide (e.g. Brickner-Braun et al., 2007; Dickman, 2009; Morgan et al., 2009; Blancher, 2013; Loyd et al., 2013). Free-roaming cats can also transmit diseases to humans and native animals and livestock, either directly (Dabritz and Conrad, 2010) or through faecal contamination of pastures (e.g. Buxton, 1998; Fancourt and Jackson, 2014) and waterways (Dabritz et al., 2006).

Owners who let their cats roam freely also put the health and well-being of their pets at risk. Free-roaming cats face many hazards, including threats from vehicles, angry neighbours, other animals, and cat-specific diseases (e.g. Courchamp et al., 2000; Olsen and Allen, 2001; Rochlitz, 2004; Levy et al., 2006). Together, these concerns have led the call for improved management of pet cats including the controverisal proposal that owners must keep their pet cats contained within their property (as is the case for pet dogs) (Grayson and Calver, 2004; Denny and Dickman, 2010). Opponents argue that mandatory containment may also put the health and well-being of cats at risk, through reduced opportunities for physical activity and the expression of natural behaviours (e.g. Jongman, 2007; Slingerland et al., 2009; Rowe et al., 2015).

In recent years several jurisdictions within Australia have introduced legislation requiring mandatory containment of pet cats (ACT: Domestic Animals Act 2000; Western Australia: Cat Act 2011), while others have tried to encourage voluntary containment using educational campaigns and behaviour change interventions (e.g. South Australian Dog and Cat Management Board: GoodCatSA.com). A large number of these campaigns have used wildlife protection messages to motivate cat owner action (McLeod et al., in press). Recent research suggests that campaigns to encourage pet cat containment may be more

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successful if they concentrate on the benefits to cats' welfare rather than wildlife protection (Toukhsati et al., 2012; McLeod et al., 2015a; Hall et al., 2016).

1.1. Designing effective behaviour change interventions

Changing human behaviour is rarely a simple, straightforward process. Interventions that increase awareness or provide general educational content often fail to produce significant behaviour change (Andreasen, 1995; Hini et al., 1995; Kollmuss and Agyeman, 2002). Human behavioural sciences have produced a substantial body of knowledge relevant to informing the design of behaviour change interventions across many disciplines and contexts, including: pro-environmental behaviour (e.g. recycling), human health (e.g. prevention of dog-bite injuries), animal welfare, and managing invasive animals (Schultz, 1999; Canine Aggression Taskforce, 2001; Lakoff, 2004; Darnton, 2008; McLeod et al., 2015b; Weary et al., 2016; Elsheikha, 2016).

Effective interventions need to be designed with a clear understanding of the target audience and the context in which the desired behaviour is to be performed, and be informed by the drivers of and barriers to this desired behaviour (e.g. McKenzie-Mohr, 2011; Michie et al., 2014). Researchers have identified a range of drivers of and barriers to cat containment, including: (1) owners' confidence that they can effectively contain their cat; (2) the possession of relevant knowledge and skills to keep their cat contained; (3) owner's belief that containment will improve, or at least not diminish their cat's quality of life; (4) owner's belief that cats' physical and psychological needs can be met in a contained space; and (5) perceived financial capacity to implement containment (particularly important for outdoor containment strategies) (Toukhsati et al., 2012; MacDonald et al., 2015; McLeod et al., 2015a; McLeod, unpublished data).

Persuasive communication is a potentially effective strategy that can be used to target the aforementioned barriers. Persuasive communication goes beyond providing information about a problem, and its solutions, but aims to build efficacy and shape people's views and motivate them to change a specific behaviour (Pelletier and Sharp, 2008; Michie et al., 2011). It employs techniques such as message framing, tailoring, story-telling, social norms, prompts and commitments to engage with its audience and influence their actions (Pelletier and Sharp, 2008; Hine et al., 2015).

1.2. Current study

In the current study we used a randomised control experiment to extend the cat management literature in two main ways. First, we investigated the effectiveness of two differently framed persuasive cat containment messages ('wildlife protection' frame and 'cat-benefit' frame, both compared to a neutral control message) on: (1) the intention of cat owners to engage in containment behaviour and, (2) self-reported containment action adopted 4-weeks following exposure to the message. We also explored whether our differently framed messages exerted different effects on cat owners according to the strength of their bond with their pet.

Second, we aimed to determine the mechanism by which the messages exerted their effect using mediation analyses. Rather than assuming a direct causal relationship between the independent (treatment) variable and the dependent (outcome) variable, a mediation model proposes that the independent variable influences the mediator variable, which in turn influences the dependent variable. Thus, the mediator variable serves as the mechanism by which an independent variable (in our study − type of video message) influences one or more dependent variables (cat containment intentions and behaviour) (MacKinnon et al., 2007).

Motivational influence and perceived response efficacy constitute two important emotional and cognitive mediators of persuasive messages (Pelletier and Sharp, 2008; Lewis et al., 2010). Motivational influence is the extent the owners are engaged and feel compelled to take action by the information presented within the message to contain their cat, and response efficacy is the extent to which cat owners' believed the message provided useful information on how cat containment will lead to the desired results (i.e. to protect wildlife, or improve cat well-being). We predicted that both the 'wildlife protection' and 'cat benefit' messages, which were designed using persuasive communication techniques, should increase both the motivation and response efficacy of the recipients (relative to the 'neutral' message), leading to the increased likelihood that these cat owners would (1) express stronger intentions to contain their cats, and (2) be more likely to adopt cat containment behaviour.

Previous research suggests there is a statistically reliable positive relationship between the strength of the human-pet bond and a range of responsible pet ownership and health care behaviours, such as training, microchipping, seeking veterinary assistance and practising preventative care (Lue et al., 2007; Rohlf et al., 2010, 2012). The human-pet bond has also been found to moderate (that is, influence the strength of) people's responses to stress (Allen et al., 1991) and cardiovascular rehabilitation (Herrald et al., 2002). We predicted that the strength of the persuasive 'cat benefit' message on motivation and response efficacy would be greater for those owners who had a closer bond with their pet cat. We also predicted that strength of the human-pet bond would not moderate the strength of the impact of the 'wildlife protection' framed message on containment intentions and behaviour given that the focus of this message was not directly related to the welfare of the cat.

2. Material and methods

2.1. Participants

A total of 521 Australian cat owners completed the initial online survey (message exposure) in October 2016, and just over half of these initial respondents ($n = 268$, 51%) completed the follow-up survey four weeks later in November 2016. The respondents were recruited from a large consumer online research panel administered by the Online Research Unit (ORU). The ORU has access to an Australian general population database of more than 10,000 people, profiled across a wide range of criteria (e.g. demographics, consumption, technology channels). They use a mixed incentive scheme to engage their participants, offering points for survey completion which can be redeemed for vouchers, entry into prize drawers or direct incentives. To be eligible for our survey, panel members had to be over the age of 18 years, and own at least one cat that was not currently contained within their house or yard at all times (i.e. their cat was allowed to wander with no restriction when outdoors). The survey itself was developed and hosted on the Qualtrics online platform and survey building software (Snow, 2012).

2.2. Procedure

Prior to experimental manipulation, respondents completed questions relating to their demographics, current cat management behaviour, and relationship with their cat. They were then randomly assigned to one of three experimental conditions using the computer-generated randomiser function in the Qualtrics online survey software: (1) 'neutral' frame (control message), (2) 'wildlife protection' framing and, (3) 'cat benefit' framing. Respondents then viewed a 3 min video containing a specific message designed for their condition, and afterwards completed questions assessing the extent to which the messages caused them to engage or disengage with the topic of cat containment, as well as their intent to implement any of the cat containment behaviours. All videos were professionally produced, narrated by the same person, used the same background music, and similar images of cats.

The video for the control condition ('neutral' frame) contained general information about the history of cat domestication ("*the domestic cat is thought to have evolved from the African wild cat*") and cat ownership in Australia ("*there are 3.3 million pet cats in Australia*"). It described the spread of the cat across the world and its introduction to Australia as an attempt to control rodents and rabbits. Current facts about cat ownership ("*29% of Australian households own a cat*"), the type of cats kept ("*the Moggie is the most popular house pet*"), and the health benefits of keeping a cat are explained ("*cats can make wonderful companions, with many health and psychological benefits*"). The video can be found at https://youtu.be/p6vIJnVTsqM

The 'wildlife protection' video contained messages around the negative impact of cats on wildlife. It comprised information on these impacts ("*domestic cats have played a part in the extinction of 33 species around the world*"), and misconceptions about cat behaviour ("*many owners believe that if their cat isn't bringing dead animals home it can't be hunting much*"), along with suggested methods to reduce these impacts ("*the key to reducing the impact of pet cats is to confine them during the day and at night time*", "*you can build a cat enclosure*"). The video can be found at https://youtu.be/1UdFjU3lYto

The 'cat benefit' video contained messages around the advantages of containment for the health and well-being of cats and their owners ("*cats are happiest when they're at home*", "*roaming out into the big bad world puts your cat in a state of stress*"). This message contained behavioural instruction describing what other cat owners where doing ("*fellow cat carers typically do one of two things to keep their cat safe and happy*", "*households in your area practice night safety*"), and included cues to prompt behaviour ("*use the cat's dinner time as a reminder to close the house up*"). The video can be found at https://youtu.be/0IRQlHrakzg

Four weeks following the initial survey, all of the respondents were asked to complete a second online survey. This survey contained a range of questions assessing any actions the respondents had taken toward cat containment since the initial contact.

2.3. Measures

Gender, age, education levels, locality and current cat ownership behaviours were all assessed using single questions for each item. Pet relationship (human-pet bond) was assessed using a modified Pet Attitude Scale (PAS) (Templer et al., 1981). Nine items, consisting of both positively and negatively worded questions measuring 'love and interaction', 'pets in the home' and 'joy of pet ownership' were measured using 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

After viewing the messages, respondents evaluated each message in terms of their perceived response efficacy and motivational influence. All responses were assessed on 5-point Likert scales. Perceived motivational influence was assessed by four items gauging the extent to which respondents perceived the containment message to be important, and motivated them to take action and seek out more information. Responses to these four items were highly correlated indicating high internal consistency, and were combined for the analysis (Cronbach's α = 0.91). Response efficacy was assessed by two items gauging the extent to which the message provided them with useful information to either contain their cat or keep their cat happy when it was contained. These items showed high internal consistency (Cronbach's α = 0.92),

and were also combined. Intention to act was assessed by three items that measured the likelihood of the respondents to engage in either indoor containment, construction of an outdoor enclosure, or cat-proofing their existing yard (Cronbach's α = 0.85).

After four weeks, respondents were asked to complete a follow-up survey. This survey assessed the extent to which the messages presented during the initial survey had stimulated owners to take concrete actions to contain their cats. Respondents were asked if they had changed their cat containment behaviour, or had they taken any action towards any of the containment behaviours; that is, (1) were they now keeping their cat indoors all the time, (2) had they constructed an enclosure for their cat, or (3) had they cat-proofed their yard, or (4) were they keeping their cat indoors for longer periods, (5) had they purchased materials to construct an enclosure, or (6) had they purchased materials to cat-proof their yard. Adoption behaviour was assessed as (1) having changed their containment behaviour (positive response to either questions 1, 2 or 3), (2) taken action towards containment behaviour (positive response to either questions 4, 5 or 6) or (3) taken no action (negative response to all questions).

2.4. Statistical analyses

All statistic procedures were conducted using SPSS (Version 22, IBM, Armonk, NY, USA). Following the common practice in medical and psychological research, we treated data from Likert scales as interval data and used parametric tests (Sullivan and Artino, 2013). Data was initially tested for compliance to the assumptions for parametric statistical analyses: normality, outliers, multicollinearity, non-linearity, homoscedasticity and non-independence assumptions. Differences between means for all variables and containment profiles were tested using ANOVA F-Test, with the exception of gender which was tested using Pearson's chi-squared test.

Mediation and moderation analyses were conducted using the PROCESS macro within SPSS (Hayes, 2012). The PROCESS macro uses a series of linear regression equations to evaluate the effects of variables that mediate and moderate relationships between dependent and independent variables. Model 4 within the PROCESS macro was used for conducting the initial mediation analysis to determine whether: (1) the containment message treatment increased either the intention to act or self-reported action adopted after four weeks, and (2) the motivational influence and perceived response efficacy mediated the impact of the experimental treatment. This particular model evaluates the strength of the mediating variables (i.e. motivation and response efficacy) to explain the relationship between independent (treatment) variables ('cat benefit' or 'wildlife protection' messages) and dependent (outcome) variables (i.e. intention to contain or self-reported adoption). Model 7 within the PROCESS macro was used to further explore whether this mediation impact was moderated by the respondent's bond with their cat. The conceptual model for this analysis is illustrated in Fig. 1. In all mediation and moderation analyses, 90% confidence intervals (equivalent to one-tailed significance tests) were used given that we had pre-specified directional hypotheses (Hayes, 2012).
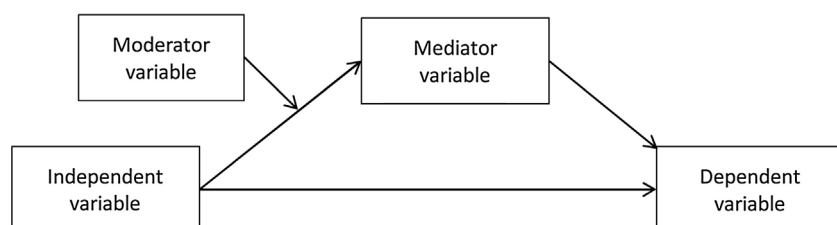

Fig. 1. Conceptual model for moderated mediation analysis (Hayes, 2012). For our analysis the independent (treatment) variables tested were the 'wildlife protection' and 'cat benefit' messages, the dependent (outcome) variables tested were intention to contain, and adoption of containment behaviour, the mediator variables tested were motivational influence and response efficacy, and the moderator variables tested included demographic variables and the cat owner's bond to their pet.

Table 1
Breakdown of demographic and pet attitude scale scores by experimental treatment for the initial and follow-up surveys.

	Initial survey (n = 521)			Follow-up survey (n = 268)		
	Wildlife protection message (n = 177)	Cat benefit message (n = 176)	Control message (n = 168)	Wildlife protection message (n = 99)	Cat benefit message (n = 80)	Control message (n = 89)
Average age	49.1 (SD 15.3)	48.7 (SD 16.0)	50.1 (SD 15.8)	48.6 (SD 15.7)	51.1 (13.6)	50.6 (SD 14.9)
Gender:						
Male	78 (44%)	76 (43%)	67 (40%)	43 (43%)	40 (50%)	38 (43%)
Female	99 (56%)	100 (57%)	101 (60%)	56 (57%)	40 (50%)	51 (57%)
Locality:						
City	48 (27%)	32 (18%)	43 (26%)	22 (22%)	13 (16%)	22 (25%)
Suburban	92 (52%)	108 (61%)	91 (54%)	51 (52%)	51 (64%)	51 (57%)
Country town	21 (12%)	14 (8%)	19 (11%)	15 (15%)	3 (4%)	3 (3%)
Rural residential	9 (5%)	14 (8%)	4 (2%)	6 (6%)	7 (9%)	7 (8%)
Rural	7 (4%)	8 (5%)	11 (7%)	5 (5%)	6 (8%)	6 (7%)
Education:						
Year 10 or less	20 (11%)	17 (10%)	11 (7%)	7 (7%)	10 (13%)	7 (8%)
Year 11–12	32 (18%)	31 (18%)	25 (15%)	18 (18%)	13 (16%)	14 (16%)
Trade qualification	13 (7%)	24 (14%)	22 (13%)	9 (9%)	13 (16%)	14 (16%)
Undergrad./college	76 (43%)	82 (47%)	80 (48%)	42 (43%)	33 (41%)	39 (44%)
Higher degree	36 (20%)	22 (13%)	30 (18%)	23 (23%)	11 (14%)	15 (17%)
Pet attitude scale average score	17.8 (SD 5.9)	16.8 (SD 5.9)	17.1 (SD 5.5)	17.7 (SD 5.6)	16.8 (5.8)	16.7 (SD 5.5)

SD = standard deviation. Pet attitude scores ranged between 9 and 45; the lower the score, the stronger the bond between owner and their pet cat.

3. Results

3.1. Descriptive statistics and preliminary analysis

Of the total sample (n = 521), 177 were randomly assigned to the 'wildlife protection' frame message, 176 viewed the 'cat benefit' message, and 168 viewed the 'neutral' control message. In the follow-up survey (n = 268), 99 had viewed the 'wildlife protection' frame message, 80 had viewed the 'cat benefit' message, and 89 had viewed the 'neutral' control message (X^2 (2) = 2.17, p = 0.34). Demographics of the respondents in each of the treatment groups for either survey, and across both surveys were similar, with no significant differences detected (Table 1).

On closer inspection of the data nine 'flat-line' responses (i.e. where the same value has been repetitively selected) for questions measuring motivation and response efficacy assessments were detected and removed, leaving a final sample size of 512 for the initial survey (control 165, 'wildlife protection' 175, 'cat benefit' 172). Only four 'flat-line' responses needed to be removed for the analysis of the follow-up survey, leaving a final sample size of 264 (control 88, 'wildlife protection' 97, 'cat benefit'; 79). Preliminary analyses revealed that the data met all required assumptions for the parametric statistical analyses performed. No univariate and multivariate outliers were detected, and tolerance values were below 0.10 indicating no problem with multicollinearity. Residuals passed the normality, non-linearity, homoscedasticity and non-independence assumptions (Cochran and Cox, 1992).

Means for all the variables, broken down by experimental treatment, are presented in Table 2. Tukey's B post-hoc tests revealed that both the 'wildlife protection' and the 'cat benefit' framed messages elicited significantly greater motivation and response efficacy compared to the 'neutral' framed control. Also their influence approached significance for intentions to contain, and was significant for the adoption of containment practices compared to the 'neutral' framed control.

3.2. Mediation analysis

To further explore these results, four mediation analyses were conducted, using Model 4 in the PROCESS SPSS macro (Hayes, 2012). For these analyses, we decomposed our message independent variable

Table 2
Breakdown of means (standard deviations) for the main variables by treatment condition.

Message condition	Wildlife protection message	Cat benefit message	Control message
Motivation	3.01[a] (1.06)	3.00[a] (1.13)	2.75[b] (1.12)
Response efficacy	3.14[a] (1.04)	3.27[a] (1.09)	2.37[b] (1.19)
Intention	2.57[a] (1.14)	2.52[a] (1.16)	2.34[a] (1.16)
Behaviour adoption	1.98[a] (.75)	1.92[a] (.80)	1.70[b] (.81)

Means that do not share the same superscript are significantly different. Tukey's B post hoc test, $p < 0.05$. Motivation and response efficacy were assessed on a 5-point scale (1 = *not at all*, 5 = *extremely*), intention was assessed on a 5-point scale (1 = *extremely unlikely*, 5 = *extremely likely*) and adoption was assessed on a 3-point scale (0 = no action, 2 = action).

into two dummy coded predictors. In the first analysis, 'cat benefit' vs 'neutral' was the independent variable, motivation and response efficacy were the mediators, intention to contain was the dependent (outcome) variable and, consistent with the standard protocol for assessing dummy coded predictors, 'wildlife protection' vs 'neutral' was the covariate (Cohen et al., 2013). The second analysis was the same as the first, except the 'wildlife protection' vs 'neutral' was the independent variable and the 'cat benefit' vs 'neutral' was the covariate. The third and fourth analyses followed the same pattern of independent variables and covariates as the first two, with adoption of containment practices (4 weeks later) as the outcome variable.

Results for the mediation analyses for intention to implement a cat containment solution are presented in Fig. 2, and adoption of cat containment actions are presented in Fig. 3. No significant direct effects were detected, however both the 'cat benefit' and 'wildlife protection' messages had significant indirect effects on intention to act and cat containment adoption, mediated by motivation (Intention: 'cat benefit' $B_{indirect}$ = 0.16, SE = 0.08, 90%CI = 0.04 to 0.30; 'wildlife protection' $B_{indirect}$ = 0.17, SE = 0.08, 90%CI = 0.02 to 0.32; Adoption: 'cat welfare' $B_{indirect}$ = 0.06, SE = 0.04, 90%CI = 0.01 to 0.14; 'wildlife protection' $B_{indirect}$ = 0.04, SE = 0.03, 90%CI = 0.001 to 0.11), and response efficacy Intention: 'cat benefit' $B_{indirect}$ = 0.14, SE = 0.05, 90%CI = 0.07 to 0.23; 'wildlife protection' $B_{indirect}$ = 0.12, SE = 0.04, 90%CI = 0.05 to 0.22; Adoption: ('cat welfare' $B_{indirect}$ = 0.12, SE = 0.07, 90%CI = 0.02 to 0.25; 'wildlife protection' $B_{indirect}$ = 0.09, SE = 0.06, 90%CI = 0.02 to 0.20). Hence participants who viewed the 'wildlife protection' and 'cat benefit' videos both reported higher levels
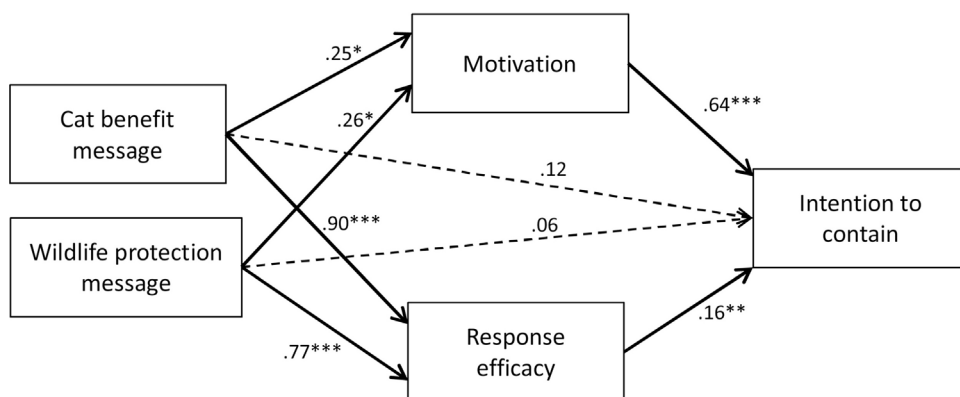
Fig. 2. Mediation model showing motivational influence and perceived efficacy mediating the effects of cat containment message on the intention to act. Values on pathways represent unstandardised regression weights (*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$). Model fit indices: R = 0.73, $R^2 = 0.53$, F = 145.1***. In accordance with dummy coding, the 'wildlife protection' message vs 'neutral' was used as a control variable for the 'cat benefit' analysis, and the 'cat benefit' message vs 'neutral' was used as a control variable for the 'wildlife protection' message.

of motivation and response efficacy to contain their cats compared to participants who viewed the 'neutral' control message. In turn, higher levels of motivation and response efficacy were both associated with stronger reported intentions to implement a cat containment solution and stronger reported adoption of cat containment behaviour.

3.3. Moderated mediation analysis

To further explore the influence of human-pet bond on these mediation variables, moderated mediation analyses were conducted, using Model 7 in the PROCESS SPSS macro (Hayes, 2012). For these analyses, we again decomposed our message independent variable into two dummy coded predictors, and for each moderator variable we ran the analysis twice − the first time with the 'cat benefit' vs 'neutral' as the independent variable and the 'wildlife protection' vs 'neutral' as the covariate, and the second with these two variables swapped.

The response efficacy of the 'cat benefit' containment message on owners' intention to contain their cats was found to be weakly, but significantly moderated by the human-pet bond (as measured by PAS) ($B_{interaction} = 0.01$, SE = 0.01, 90%CI = 0.01 to 0.02). The 90% bootstrap confidence intervals calculated for the conditional indirect effect of response efficacy for this variable was entirely above zero for all values, indicating the response efficacy effect was improved as the human-pet bond became stronger, and declined when the human-pet bond weakened. No significant moderating effects were detected for either the response efficacy or motivational influence of the 'cat benefit' message on owner's adoption of containment behaviours. There were no significant moderating effects detected at all for the 'wildlife protection' message.

4. Discussion

We compared the effects of two cat management messages ('wildlife protection' and 'cat-benefit' frames) on cat owners' intentions to contain their cat and their adoption of containment behaviours. We explored whether these message effects were mediated by the extent to which owners were motivated to contain their cat, and through their beliefs that cat containment actions would lead to the desired results (response efficacy). We also explored whether, in turn, these mediated message effects were influenced by the owner's bond with their pet.

4.1. Message effects

Our results supported our hypotheses that both the 'wildlife protection' and 'cat benefit' messages would influence intentions and adoption behaviour through the persuasive communication mechanisms: motivational influence and perceived response efficacy. Participants who viewed the 'wildlife protection' and 'cat benefit' videos both reported higher levels of motivation and response efficacy to contain their cats compared to participants who viewed the control message. In turn, higher levels of motivation and response efficacy were both associated with stronger reported intentions to implement a cat containment solution and containment behaviour adoption.

A common way of framing the messages of recent cat management interventions, particularly in Australia, has been around their negative impact on birds and other wildlife (Toukhsati et al., 2012; Hall et al., 2016; McLeod et al., in press), where evidence suggests the native biodiversity is threatened from perceived high rates of cat predation (e.g. Barratt, 1998; Dickman, 2009). However, studies on community attitudes to cat management policies in Australia suggest that even though cat owners value wildlife at similar levels to the rest of the community, they are, on the whole, less likely to agree that predation by pet cats is a problem (Grayson et al., 2002; Lilith et al., 2006; Toukhsati et al., 2012; Hall et al., 2016), implying that the 'wildlife protection' framed message may not be the most effective. Our results show that both type of messages, 'wildlife protection' framed and 'cat
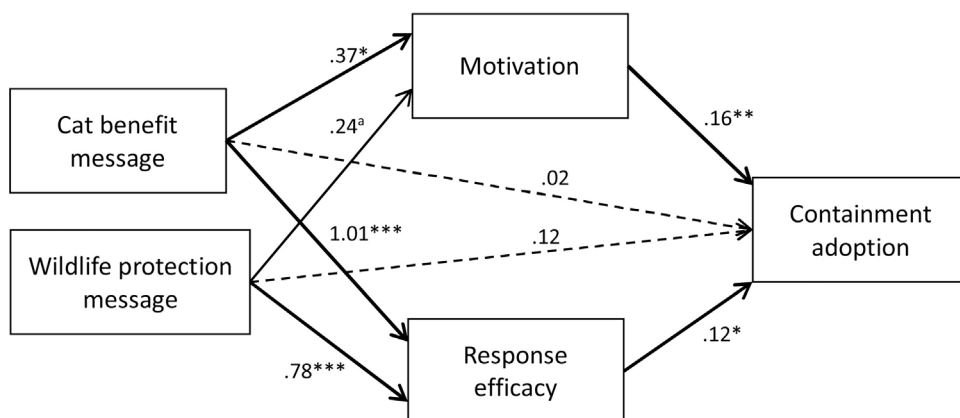

Fig. 3. Model showing motivational influence and perceived efficacy mediating the effects of cat containment message on self-reported cat containment action. Values on pathways represent unstandardised regression weights ([a]$p < 0.07$ *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$). Model fit indices: R = 0.41, $R^2 = 0.17$, F = 12.78***. In accordance with dummy coding, the 'wildlife protection' message vs 'neutral' was used as a control variable for the 'cat benefit' analysis, and the 'cat benefit' message vs 'neutral' was used as a control variable for the 'wildlife protection' message.

benefit' framed elicited changes in Australian cat owner's containment intentions and adoption of behaviour. However our moderated mediation analyses highlighted that the use of the 'cat benefit' framed message resonated slightly better with cat owners who have a strong bond with their pets.

Although the indirect effects of the messages through motivation and response efficacy were statistically significant for cat containment intentions and adoption of cat containment behaviours, the magnitude of the effects were modest. One possible explanation for the modest impact our intervention is audience heterogeneity. Behaviour change specialists have long acknowledged the utility of audience segmentation, whereby the audience is divided into homogenous groups based on specific psychological and behavioural attributes. Our finding that the strength of the 'cat benefit' message effects varied as function of strength of pet bond supports this possibility. Investigating how messages with different frames impact different audience segments (i.e., cat owners with different values about beliefs about their pets and biodiversity in general) represents an important avenue for future research.

4.2. Practical implications

The key take-home message from our research for practitioners is that using human behavioural approaches to develop interventions has the potential to improve adoption of desired cat management behaviours. Cat management is a complex issue and no single intervention or message will enhance adoption of desired management behaviours by all cat owners. Our results have highlighted the importance of considering the characteristics of the target audience, along with the drivers of and barriers to the desired behaviour when designing an intervention message. By incorporating persuasive communication techniques, principally message framing, we were able to encourage a range of cat owners to first, consider adopting a new behaviour, and secondly, to actually adopt this new behaviour. This tailoring of communications has been successfully used in other fields, such as human health and climate change, to effectively engage all segments within the intended audience (Slater, 1996; Darnton, 2008; Hine et al., 2014).

4.3. Study limitations

We collected a large, heterogeneous online sample, however we did not randomly sample all cat owners within Australia. Although the ORU research panel offers a diverse and high quality sample, it is unclear the extent to which this sample was representative of the wider population of Australian cat owners. Additional research is required to determine whether our findings will generalise to other respondents and settings.

An important strength of our study is that we assessed the potential impact of our cat containment messages on more than just behavioural intentions. We also included a behavioural measure, the adoption of containment practices, which was assessed after a four week period. Although we had a reduced sample size for our follow-up survey, there were no significant differences in respondent's demographics across treatments. The study could have been strengthened by multiple follow-ups at later time points to assess the impacts of the messages on further behavioural outcomes over time, and allow greater opportunity for viewers to have acted on their intentions during the post-treatment period, and possibly increasing the goodness of fit of the regression model for the adoption analysis.

The experimental methodology used in this study is suitable for making causal inferences about the specific impacts of each factor evaluated in an intervention, and random assignment provides a control for potential confounding factors. However, a potential drawback of many experimental studies is lack of ecological validity. Outside of the context of experimental research, cat owners would be exposed to range of messages from multiple sources (mainstream media, social media, councils etc.), often repeatedly, over extended periods of time. Further research is needed to understand the effects of repeated exposure to multiple messages, some of which may include contradictory information, on cat owners' attitudes, beliefs and behaviour.

In this study, we employed self-report measure of behaviour adoption, and incorporated techniques to ensure the validity of this measure. For example, we avoided leading questions, used multiple questionnaire items to measure the response, and ensured confidentiality to allow respondents to give more truthful responses (Kormos and Gifford, 2014). Nevertheless, self-reported behaviour sometimes fails to match actual behaviour, and, where practical, future researchers should attempt to include objective measures to validate self-reports (e.g., photographic evidence of constructed cat enclosures, collaring data to support verbal reports that have been contained, etc.).

5. Conclusions

This study aimed to improve our understanding of how intervention messages exert their impact and encourage people to act. We compared two differently framed cat containment messages. Our results revealed both the 'wildlife protection' and the 'cat benefit' messages increased cat owners' motivation to contain their cat and also their beliefs that they could effectively contain their cat (response efficacy). In turn, higher levels of containment motivation and response efficacy predicted increased cat containment intentions and increased adoption of cat containment. In addition, some of the effects of motivation and response efficacy of the 'cat benefit' message were strengthened by the characteristics of the cat owners themselves. Our results suggest audience segmentation may improve the effectiveness of interventions. These findings emphasise the value of adopting approaches incorporating human behaviour and persuasive communication theory to design cat, and indeed any invasive animal, management interventions. They should be relevant to practitioners involved in developing and delivering interventions aimed at improving adoption of best-practice animal management strategies.

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