JOURNAL OF
SHELTER MEDICINE &
COMMUNITY ANIMAL HEALTH

ORIGINAL RESEARCH ARTICLE

Online Training Using an Educational Video Improves Human Ability To Identify and Rate Kitten Fear Behavior

Courtney Graham[1,2,3]*, Shaela Hurley[2], David L. Pearl[2], Georgia J. Mason[3,4] and Lee Niel[2,3]

[1]Department of Clinical Studies, Ontario Veterinary College, University of Guelph, Guelph, ON, Canada; [2]Department of Population Medicine, Ontario Veterinary College, University of Guelph, Guelph, ON, Canada; [3]The Campbell Centre for the Study of Animal Welfare, University of Guelph, Guelph, ON, Canada; [4]Department of Integrative Biology, University of Guelph, Guelph, ON, Canada

Abstract

***Introduction*:** Fear is a negative emotional state that can influence early behavioral development and lead to impairments in animal welfare. For young kittens, excessive fear early in life can instill lasting fearfulness leading to behavioral issues such as aggression, negative impacts on the human–animal bond, potential mistreatment, relinquishment to shelters, and/or euthanasia. Therefore, it is crucial that caretakers can accurately identify when their kittens might be experiencing fear in order to respond appropriately.

***Methods*:** We used an online survey to determine: (1) whether members of the general public (n = 761) can accurately identify and rate different severities of fear behavior in young kittens in short video clips (i.e. no fear requiring no intervention, mild fear requiring awareness of possible intervention, and moderate fear requiring immediate intervention); and (2) whether an educational video offering specialized training on identifying kitten behavior can improve human ability to correctly rate kitten behavior in comparison to a general kitten care video.

***Results*:** Using mixed logistic regression models, we found no difference at baseline in correct ratings between the two video groups across all fear categories. However, participants who received the specialized behavior training had significantly greater odds of being correct after video training for all three categories compared to participants who received the general kitten care video. Additionally, previous experience with cats and participant personality impacted ratings.

***Conclusions*:** Overall, the current study demonstrates that concise and specialized training in identifying kitten behavior is a useful tool for improving human ability to identify and rate fear levels in kittens. This training approach can help strengthen caretaker understanding of kitten behavior to ensure interactions with potentially fear-provoking stimuli are properly mitigated to reduce related welfare impacts. Thus, these types of educational resources are encouraged within shelters, veterinary clinics, research settings, and foster and adoptive homes to improve the welfare of kittens.

Keywords: *cat*; *behavior identification*; *observer rating*; *welfare*; *education*

Received: 21 April 2024
Revised: 18 June 2024
Accepted: 22 June 2024
Published: 27 August 2024

Correspondence
*Courtney Graham
50 Stone Road E. Guelph, ON
N1G 2W1, Canada
Tel.: 1-519-824-4120
Email: courtney.graham@uoguelph.ca

Reviewers
Michael Loizos Mavrovouniotis
Valerie Benka

Supplementary material
Supplementary material for this article can be accessed here.

Fear is a negative emotional state that can directly impair animal welfare and influence behavioral development, leading to higher levels of fearfulness and welfare impairments later in life (e.g. reviewed by[1]). Heightened fearfulness can also cause behavioral issues in cats, such as aggression.[2] It can also lead to negative impacts on the human–animal bond and potential mistreatment by caretakers, relinquishment to shelters, and/or euthanasia.[3–5] A key factor to preventing fear early in life is appropriate exposure to a range of different stimuli during the sensitive period for socialization, which is estimated to occur between 2 and 9 weeks of age in kittens.[6–9] During this time, kittens are more resilient to new experiences and can form positive associations with the world around them when exposures are appropriate.[10] However, if kittens experience excessive negative emotional states, like fear, during these exposures, it can result in lasting fear.[11] Therefore, it is important that caretakers can accurately identify when their kittens might be experiencing fear to be able to respond appropriately. Observer

Journal of Shelter Medicine and Community Animal Health 2024. © 2024 Courtney Graham et al.This is an Open Access article distributed under the terms of the Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/), allowing third parties to copy and redistribute the material in any medium or format and to remix, transform, and build upon the material for any purpose, even commercially, provided the original work is properly cited and states its license.
Citation: Journal of Shelter Medicine and Community Animal Health 2024, **3**: 91 - http://dx.doi.org/10.56771/jsmcah.v3.91

reporting has been shown to be a valid and valuable tool for animal welfare research[12] and is likely also a valid method for assessing kitten behavior.[13]

Previous research has investigated human–cat interactions with and without a short 5-min training intervention, which included information on appropriately interacting with cats and the importance of recognizing cat body language.[14] Compared to the control scenario without intervention, the interaction styles from the human participants who received the training intervention were found to be more closely aligned with best practice principles, demonstrating improved understanding of the connection between displays of behavior and emotional state.[14] Thus, improving human understanding of cat behavior – and the link to emotional state – can have major implications for improving feline welfare.

Research into human ability to correctly infer the emotional states of dogs and cats from expressions and vocalizations has been summarized,[15] with the majority of empirical studies focusing on dogs and only a few studies focusing on cats. Veterinary professionals have been found to have difficulty distinguishing between painful and pain-free cats from facial images,[16] whereas the general public has been found to rate positive and negative valence in cats from YouTube videos slightly better than chance.[15] Studies have also examined whether training is effective for improving human ratings of emotions in dogs, investigating whether caretakers are able to accurately identify behavioral indicators of fear before and after a training intervention.[17] Training improved caretaker recognition of fear in videos of unfamiliar dogs but, interestingly, did not influence how caretakers rated fear levels in their own dogs.[17] To date, no known studies have examined human abilities for identifying emotional states in kittens, or whether training is effective for improving identification. To avoid misclassification in feline behavior research and assessment, studies focused on kittens are an important next step.

The current study determined whether members of the general public could accurately identify and rate different severities of fear behavior in young kittens. We also tested the efficacy of specialized educational training for identifying fear behavior and emotional state in kittens and hypothesized that this training would be effective, resulting in improved participant ratings of kitten fear levels. Other factors we explored included: (1) gender, as it has been shown that women perform better than men at emotional recognition[18] and decoding nonverbal cues in humans[19]; (2) previous caretaking experience with cats, as experience with dogs and cats has been shown to improve accuracy of interpreting dog and cat behavior e.g. [20,21]; and (3) human personality traits, as personality has been found to influence caretaker-rated temperament in dogs, with varying effect depending on the human personality and dog temperament traits examined e.g.[22,23] as well as rating of dog and human facial expressions.[24]

Methods

Survey

The online survey (flowchart in Fig. 1; Table S1 in Supplemental Material) used in this study was hosted through Qualtrics® survey software (Qualtrics Software Company, Provo, Utah, USA). Survey participation required internet access and was open to anyone over the age of 18 years with no geographic restrictions. Response collection was open from 25 January to 5 March 2021. Participants were not required to be a current or previous caretaker for a kitten or cat to partake in the study. Participants were recruited through convenience sampling with a snowballing approach on social media platforms (Facebook, X/Twitter, and TikTok) on both personal pages and lab pages, as well as through an advertisement on our lab website. Additionally, humane societies and charities, professional cat bloggers, and other related shelter and animal behavior contacts were emailed with an advertisement and survey description asking them to share on their own social media pages. The survey protocol was reviewed and approved by the University of Guelph's Research Ethics Board for compliance with federal guidelines for research involving human participants (REB #20-11-007).

The online survey was available in English and consisted of three sections: (1) questions about participant demographics (e.g. age and previous experience with kittens or cats), their household (e.g. number of children, adults, and other pets in the home), and their general personality characteristics using the Ten-Item Personality Inventory (TIPI[25]), a validated shortened measure of the Big Five personality model; (2a and b) two series of 12 short video clips of kittens that participants were asked to rate for levels of fear; and (3) an educational video (in between each series of kitten video clips) that involved either specialized training on identifying emotionally relevant kitten behavior, or general information on kitten care (with no mention of kitten behavior or emotional states). At the end of the survey, participants were given the option to view the educational video they did not receive if they wanted to access the additional information.

For Section 2 of the survey, participants were asked to watch a series of kitten videos and rate the fear level of each kitten from three possible categories: neutral/positive (i.e. no fear), mild fear, or moderate fear. The videos in each series were taken from a previous study where kitten responses to novel stimuli were assessed.[35] Kitten testing and video collection procedures were approved by the University of Guelph's Animal Care Committee for compliance with federal guidelines governing the use

Citation: Journal of Shelter Medicine and Community Animal Health 2024, **3**: 91 - http://dx.doi.org/10.56771/jsmcah.v3.91

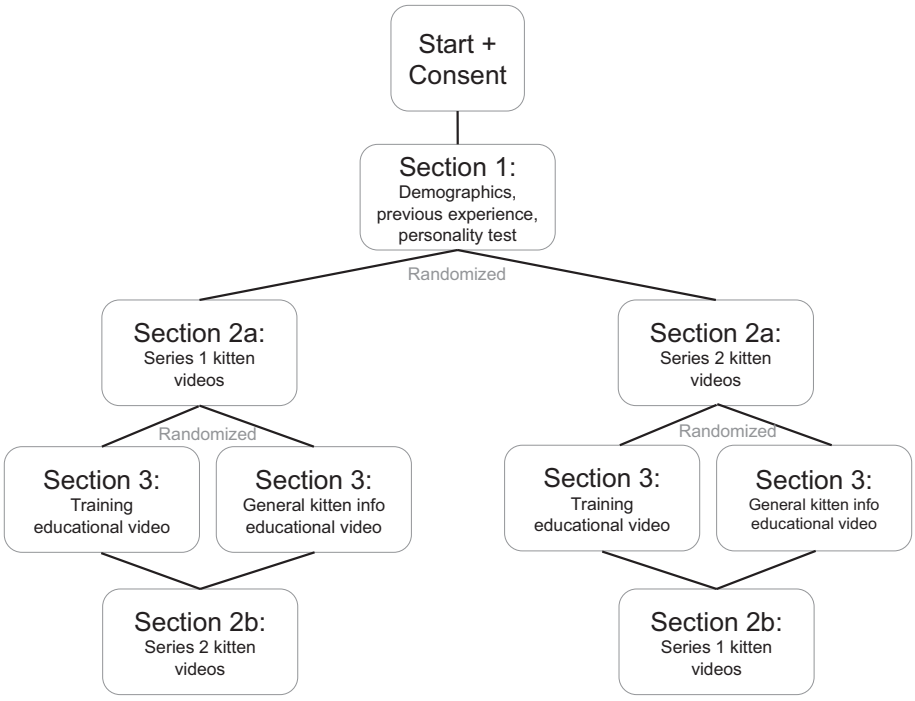


Fig. 1. Flowchart of online survey which examined participant ability to identify different levels of fear in companion kittens based on short video clips (n = 761 participants).

of animals in research (AUP #3943). Initial video selection for the current study was based on raw data from the previous study of the duration of time the kittens spent performing fear behaviors. Avoidance was used as the main criterion for defining fear behaviors, as is seen across the animal kingdom.[26,27] Therefore, fear behaviors were those that occurred when kittens were avoiding a novel stimulus, whereas neutral/positive behaviors were those that occurred when kittens were not showing avoidance and when no stimulus was present. In the previous study, kittens (n = 46) completed up to seven trials, which resulted in multiple unique videos to select from for the present study. In the current study, some kittens were selected for more than one short video; however, each video was pulled from unique trials from the previous study, and the same kittens were not used in the same fear category. In total, there were eight videos for each category (three fear categories for a total of 24 unique videos), randomly selected to be split between the two series. The final videos were selected for the most direct view of the kitten and were edited to ensure the view framed around the kitten was similar across videos (see Table S2 in Supplemental Material for example videos). For a video to be classified as neutral/positive, the kitten had to have not shown avoidance during the original trial and could also show eating, grooming, and/or holding their tail upright. For the two fear states, the kitten had to have shown avoidance during the original trial and could also show freezing, ears drawn back, and flinching. To differentiate between mild and moderate fear, we used the distinction of minimizing body size for mild fear (i.e. crouching and tucking the tail between the legs or around the body) and maximizing body size for moderate fear (i.e. piloerection, raised and arched back), in line with validated measures describing a fearful cat progressing to a defensive or aggressive state.[28] Three experts in feline behavior (blinded to fear category) rated all videos for the level of fear to ensure 100% consensus of the category being displayed. Each video was approximately 7 seconds in length and could be watched as many times as participants wanted.

Following completion of the ratings for the first set of 12 short kitten videos (Section 2a), participants watched one of two educational videos (Section 3). The educational videos were both approximately 5 min in length and were comprised of a narrated PowerPoint slideshow (created in Microsoft® PowerPoint for Mac v16.45 and edited in iMovie for Mac v10.2.2 to add subtitles for accessibility). The educational video on specialized training in kitten behavior (Table S3a in Supplemental Material) included descriptions and example videos and images of the different fear categories, focusing on full body behaviors, such as avoidance, freezing, and piloerection, and localized behaviors such as ear, tail, and abdomen positions.[29–32,35] The video on general kitten care (Table S3b in Supplemental Material) included descriptions of developmental stages for kittens, the importance of the socialization period, how to conduct desensitization and

counterconditioning, and aspects of the environment important for kitten welfare,[6–9] with no mention of how to identify kitten behavior or emotional states. Participants were asked to confirm that they watched the educational video in full and were then prompted to watch and rate the second series of 12 short kitten videos (Section 2b). The survey generator randomized all kitten videos within a series, which series was provided first, and which educational video was provided, and was set to randomize evenly for participants to ensure balanced responses between groups. Participants were required to consent to the survey conditions and to meeting the age criteria and had to have watched all kitten videos and the educational video in full to be included the final analyses.

Statistical analysis

Data were analyzed using mixed logistic regression models with Stata statistical software (v15.1 for Mac, StataCorp. 2015, College Station, Texas, USA) to assess the impact of the educational video on the accuracy of fear behavior ratings for each fear behavior category. The main outcome of interest was whether participants correctly rated the fear category of kittens in each video in the video series (based on 100% consensus expert ratings). To investigate the impact of the educational video, we assessed the interaction between whether or not the participants received training (versus general kitten information) and whether it was the first or second series of kitten videos (i.e. pre- versus post-educational video; Section 2a and 2b). Because there were multiple ratings for each participant, a random intercept of participant ID was included to account for any clustering at the participant level. Additional independent variables examined in the models included participant demographics (i.e. age, gender, community type, and country of residence), individual personality traits from the TIPI results, and previous experience with kittens or cats, such as holding positions with advanced knowledge (e.g. veterinary assistant and shelter volunteer), and previous and current status of kitten or cat guardianship.

Prior to full modeling, correlations between independent variables were assessed using Spearman rank or Phi correlation coefficients to identify potential issues with collinearity. If two variables were highly correlated (i.e. $>|0.70|$), the most biologically meaningful variable was selected for further analysis. The assumption of linearity between the continuous independent variables and the outcome variable on a log odds scale was graphically assessed using locally weighted regression curves (LOWESS) and by testing the inclusion of a quadratic term in the model. If the relationship was nonlinear and could not be appropriately modeled as a quadratic relationship, the continuous variable was categorized. Categorization was based on a median cutoff or a dichotomous variable based on ever experiencing an event or situation. The possible explanatory variables were first tested univariably against the binary outcome and were considered for inclusion in the multivariable model using a liberal significance level ($\alpha = 0.20$). All variables significant in the univariable analyses were included in a main effects model and were removed in a manual backward stepwise fashion. Variables were retained in a main effects multivariable model if they were statistically significant ($\alpha = 0.05$) or were considered an explanatory antecedent or distorter variable (i.e. confounding variable). Confounding variables were non-intervening variables that caused a change of greater than 20% in the coefficient of other statistically significant variables in the model when removed.[33] Two-way interactions were evaluated among all main effects and were retained in the model if they were statistically significant ($\alpha = 0.05$).

Model fit was assessed by graphically evaluating the homoscedasticity and normality of the best linear unbiased predictors (BLUPs). Pearson and deviance residuals were also assessed to determine if there were any outlying observations, which were then inspected for recording errors and impact on the model. Using the variance components from the multivariable mixed models, we estimated the variance partition components using the latent variable technique to determine the variance at the participant level (i.e. the random intercept).

Results

Summary statistics

In total, 1,124 responses were received, of which 363 were removed due to not providing proper consent, not meeting the age criteria, or noncompletion (i.e. entering no responses), leaving 761 fully completed responses for the final analyses. Reported in Table 1, most participants identified as women, resided in Canada in an urban community, did not have advanced knowledge or expertise in cat or animal behavior, and were not currently the primary caretaker for kittens, but were currently the primary caretaker for at least one cat. Furthermore, most participants had previously been the caretaker for at least one kitten and at least one cat. The average age of participants was 38.8 years (range: 18–79), and the average scores for all measured personality traits were slightly lower than the general population[25] (Table 1).

Across all three fear categories, the proportion of correct ratings at baseline were comparable between groups (i.e. before watching either educational video; Fig. 2). Post-training, the proportion of correct ratings from participants in both groups were also comparable for the neutral/positive category regardless of which educational video they received (Fig. 2). For both fear categories, a lower proportion of participants were correct in their

Table 1. Demographic characteristics of participants for an online survey examined participant ability to identify fear in companion kittens based on short video clips (n = 761 participants, unless otherwise indicated)

Characteristic	*N*	%
Gender		
Woman	642	84.5
Man	77	10.1
Nonbinary	27	3.6
Prefer not to answer	14	1.8
Gender identity not listed	1	0.1
Country of residence (n = 668)		
Canada	236	35.3
USA	224	33.5
UK	75	19.9
Other	133	13.9
Community type (n = 758)		
Rural (fewer than 1,000 people)	46	6.1
Small (1,000 to 29,999 people)	116	15.3
Mid-sized (30,000 to 99,999 people)	138	18.2
Urban (100,000 to 999,999 people)	301	39.7
Metropolis (more than 1 million people)	157	20.7
Advanced knowledge in cat or animal behavior[a]		
None	471	61.9
Veterinarian	39	5.1
Veterinary technician/assistant/student	60	7.9
Shelter worker/volunteer	108	14.2
Animal behavior/welfare researcher/student	107	14.1
Kitten or cat foster	189	24.8
Other (e.g. animal trainer, cat sitter, groomer)	38	5.0
Current primary caretaker for kittens		
0 kittens currently	709	93.2
1+ kittens currently	52	6.83
Current primary caretaker for cats		
0 cats currently	280	36.8
1+ cats currently	481	63.2
Primary caretaker for kittens over lifetime		
0 kittens previously	257	33.8
1+ kittens previously	504	66.2
Primary caretaker for cats over lifetime		
0 cats previously	132	17.4
1+ cats previously	629	82.7
Personality trait averages (n = 759)[b]	**Average [range; SD]**	
Extraversion	3.66 [1, 7; SD = 1.62]	
Agreeableness	5.13 [1.5, 7; SD = 1.13]	
Conscientiousness	5.35 [1,7; SD = 1.28]	
Emotional stability	4.34 [1, 7; SD = 1.28]	
Openness to experience	5.36 [2, 7; SD = 1.00]	

[a]Participants could select more than one.

[b]Population averages (Gosling et al.[25]): Extraversion: 4.44 (SD = 1.45), Agreeableness: 5.23 (SD = 1.11), Conscientiousness: 5.40 (SD = 1.32), Emotional stability: 4.83 (SD = 1.42), Openness to experience: 5.38 (SD = 1.07).

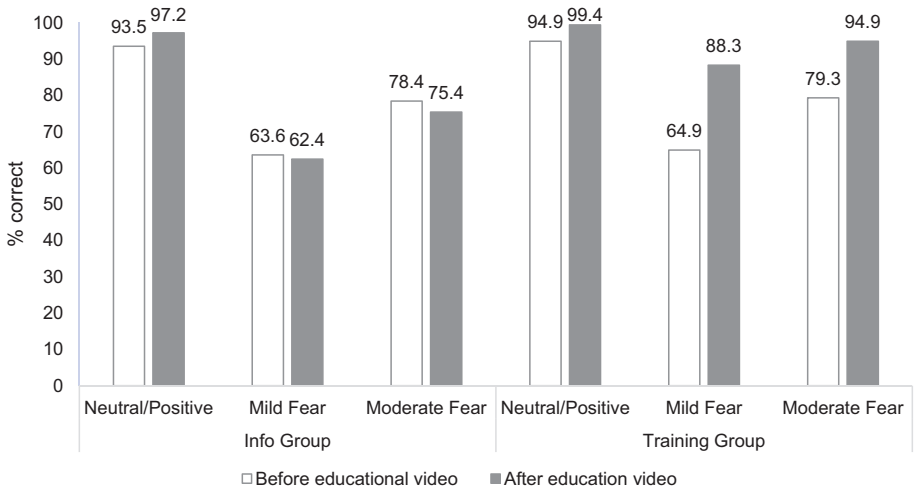


Fig. 2. Proportion of correct participant ratings of kitten fear states before and after watching a 5-min educational video on either general information on kitten care (Info group; n = 373 participants) or specialized training in identifying kitten behavior (Training group; n = 388 participants). Correct responses were based on 100% consensus of ratings by three feline behavior experts.

ratings if they received the info video compared to those who received the training video (Fig. 2).

Mixed logistic regression results: The impact of specialized training on the accuracy of participant ratings for kitten fear behavior categories was analyzed (Table 2). Pre-training, there was no difference in correct ratings between groups across all fear categories for the first series of kitten videos watched (i.e. at baseline; Table 3). In the second series of videos – after watching the educational video on either specialized training in identifying kitten behavior or general information on kitten care – participant ratings differed between groups across all fear categories (i.e. neutral/positive, mild fear, and moderate fear; see Table 2 for full model results and Table 3 for interaction contrasts). For all categories, participants who received the training for identifying kitten fear had significantly greater odds of being correct in the second series of kitten videos (Tables 2 and 3). For the neutral/positive category, participants who had ever been the primary caretaker of one or more cats over their lifetime had greater odds of correctly rating the videos compared to those who had never been the primary caretaker for any cats (Table 2). No additional covariates were significant for the mild fear category. For the moderate fear category, participants who received the general kitten care information video had reduced odds of rating correctly in the second series of kitten videos (Table 3). Additionally, for the moderate fear category, participants who had ever been the primary caretaker of one or more cats had reduced odds of correctly rating the videos compared to participants who had never been the primary caretaker for any cats. Finally, participants who had a high score for the personality trait openness to experience had reduced odds of rating correctly compared to participants who had a low personality score for openness (Table 2). For other comparisons between groups, please see Table 3.

Discussion

This study found that concise and specialized training in identifying kitten fear behavior is effective at improving human ability to rate different levels of fear in kittens. There was no difference between groups at baseline (i.e. pre-training), indicating equivalent abilities at the start of the survey. Participants in both groups improved their ratings for the neutral/positive category in the second series of kitten videos; however, the odds of being correct were greater for the group who received the specialized training in identifying kitten behavior (i.e. training group). The specialized training video was also particularly useful for improving the distinction between mildly and moderately fearful kittens. In fact, participants in the group who received the educational video on general kitten care (i.e. info group) made no improvements for the mild fear category and had significantly reduced odds of rating correctly for the moderate fear category. While comparisons between fear categories were not tested statistically, the odds ratio was numerically lowest for the mild fear category, suggesting that the associated behaviors may be more subtle and challenging to recognize. Distinction between these states is important as mild fear requires careful monitoring to prevent progression to moderate fear, whereas moderate fear may require immediate intervention to avoid further advancement to aggression or other welfare-relevant or public safety issues.[2] Detailed training for identifying the potentially more ambiguous state of mild fear is likely to be particularly beneficial for kitten caretakers.

Citation: Journal of Shelter Medicine and Community Animal Health 2024, **3**: 91 - http://dx.doi.org/10.56771/jsmcah.v3.91

Table 2. Results from mixed logistic regression models examining participant ratings of kitten fear states after watching a 5-min educational video on either general information on kitten care (Info group; referent; *n* = 373 participants) or specialized training in identifying kitten behavior (Training group; *n* = 388 participants)

Emotional state category	Variable	OR	95% CI	*P*
Neutral/Positive	Info group		REFERENT	
	Training group	1.33	0.93, 1.90	0.118
	First series of videos		REFERENT	
	Second series of videos	2.59	1.77, 3.80	**<0.0001**
	Info group*before educational video[b]		REFERENT	
	Training group*after educational video[b]	3.78	1.71, 8.39	**0.001**
	Never been a caretaker for cats previously		REFERENT	
	Caretaker for 1 or more cats previously	1.89	1.29, 2.77	**0.001**
Mild fear	Info group		REFERENT	
	Training group	1.06	0.90, 1.25	0.482
	First series of videos		REFERENT	
	Second series of videos	0.96	0.83, 1.12	0.641
	Info group*before educational video[b]		REFERENT	
	Training group*after educational video[b]	4.45	3.48, 5.67	**<0.0001**
Moderate fear	Info group		REFERENT	
	Training group	1.05	0.84, 1.31	0.658
	First series of videos		REFERENT	
	Second series of videos	0.82	0.69, 0.99	**0.038**
	Info group*before educational video[b]		REFERENT	
	Training group*after educational video[b]	6.68	4.83, 9.24	**<0.0001**
	Never been a caretaker for cats previously		REFERENT	
	Caretaker for 1 or more cats previously	0.65	0.50, 0.84	**0.001**
	Low openness to experience personality trait		REFERENT	
	High openness to experience personality trait	0.80	0.66, 0.97	**0.022**

Bold values indicate a p value of less than 0.05 (i.e., statistical significance).

Odds ratios are odds of rating fear state correctly compared to expert ratings, including random intercepts for participant[a].

[a]Variance components from each mixed model: *Neutral/Positive:* 0.962 (95% Confidence Interval [CI]: 0.560, 1.653); *Mild fear:* 0.195 (95% CI: 0.121, 0.315); *Moderate fear:* 0.722 (95% CI: 0.544, 0.959).

[b]Please see Table 3 for the interpretation effects of the interactions.

Table 3. Contrasts of combinations of interacting variables from mixed logistic models presented in Table 2 comparing participant ratings of kitten fear states before (baseline) and after watching a 5-min educational video on either general information on kitten care (Info group; referent; *n* = 373 participants) or specialized training in identifying kitten behavior (Training group; *n* = 388 participants)

Emotional state category	Contrast comparison	OR	95% CI	*P*
Neutral/Positive	Training group vs. Info group at baseline	1.33	0.93, 1.90	0.118
	Training group vs. Info group after educational video	5.03	2.37, 10.65	**<0.0001**
	Info group after educational video vs. Info group at baseline	2.59	1.77, 3.80	**<0.0001**
	Training group after educational video vs. Training group at baseline	9.81	4.87, 19.74	**<0.0001**
Mild fear	Training group vs. Info group at baseline	1.06	0.90, 1.25	0.482
	Training group vs. Info group after educational video	4.72	3.86, 5.79	**<0.0001**
	Info group after educational video vs. Info group at baseline	0.96	0.83, 1.12	0.641
	Training group after educational video vs. Training group at baseline	4.29	3.54, 5.19	**<0.0001**
Moderate fear	Training group vs. Info group at baseline	1.05	0.84, 1.31	0.658
	Training group vs. Info group after educational video	7.03	5.23, 9.44	**<0.0001**
	Info group after educational video vs. Info group at baseline	0.82	0.69, 0.99	**0.038**
	Training group after educational video vs. Training group at baseline	5.51	4.22, 7.20	**<0.0001**

Odds ratios are odds of rating fear state correctly compared to expert ratings.

The current study asked participants to rate overall fear severity in kittens and did not focus on identification of particular behaviors and their perceived meanings. Previous research on dog behavior suggests there is a disconnect between caretakers relating the display of specific behaviors and their dog's emotional state. In one study, nearly half of dog caretakers reported that their dog displays fear behaviors when exposed to noises, yet only a quarter reported their dog as 'fearful'.[34] In another study, dog caretakers provided with a training intervention on identifying fear in dogs had significantly improved ratings of fear states in dogs but not of 'no fear' states.[17] The current study did not disentangle human ability to rate specific behaviors in kittens, but rather assisted participants in making the connection between certain combinations of behaviors and the emotional state of fear. Future research could ask participants to rate individual behaviors and their relationships to overall emotional state to isolate whether specific behaviors are more difficult to distinguish.

In the current study, there was conflicting impact of previous experience with cats on fear state identification. For the neutral/positive category, participants who had been the caretaker for one or more cats over their lifetime had greater odds of rating correctly in the second series of kitten videos. In contrast, for the moderate fear category, participants who had ever been the caretaker for one or more cats had lower odds of rating correctly in the second series of kitten videos. There was no correlation between the variables for previous experience with either kittens or cats and any other independent variables, including holding positions with advanced knowledge or expertise with cats (e.g. veterinarian and shelter worker). Previous professional experience with cats has been found to have little effect on human ability to rate affective state from subtle facial expressions in cats.[15] Previous experience may impact human ability to rate emotional state from full body behavior and may be different depending on age and emotional state of the animal (e.g. young kittens compared to adult cats and neutral or positive states compared to fearful states). We also found that 22.6 and 18.0% of the variance was explained at the participant level for the neutral/positive and moderate fear categories, respectively, suggesting other characteristics of respondents play a role in explaining the variance in recognizing these affective states.

Having a high score for the personality trait of openness to experience was negatively associated with correctly rating the second series of kitten videos for the moderate fear category. While the TIPI used in the current study is human-reported, it is a validated and widely used tool and is a robust measure for assessing personality.[25] However, a more detailed personality assessment, such as the 44-item Big Five Inventory,[36] may provide deeper insight into the impacts of human personality. In general, people with a higher score for openness to experience are thought to have preference for variety and encourage ambiguity in their thinking, whereas people with a low openness score are thought to be more traditional and compartmentalised in their thinking.[37] In humans, higher openness to experience has been found to play an important role in affective processing and correctly recognizing emotions in others,[18] which is in contrast to what we found in the current study. A recent study investigating impacts of human personality on dog behavior while walking with shelter volunteers found that volunteers with higher openness were less likely to use verbal cues to attract the dog's attention, which is in line with the related research, suggesting that more open people may have a higher respect for the autonomy of dogs and have a stronger preference not to control and command their dogs.[38,39] In the current study, high participant openness may have resulted in participants permitting greater autonomy to the kitten's behavior and possibly being less concerned about their fear levels. In a study investigating the cat–human relationship, high openness of cat caretakers was associated with lower occurrence of reported cat behavior problems, suggesting this personality trait in humans may potentially be beneficial for cats; however, it is not known if these associations are due to misattribution of negative behaviors or selection of cats whose behavior is perceived to be most similar to the caretaker.[40] As the effect of personality in the current study was unexpected, it is also possible that it could have been a Type I error, and replication is needed to confirm the robustness of this finding.

Additionally, as with most survey research, a main limitation includes potential selection bias. Participants were recruited using convenience sampling and may not be representative of the general population. Participants may have been more interested in cat behavior or animal welfare in general, which may have skewed the study findings. We also did not deceive participants by informing them of both educational video options, which may have affected their performance in the second series of videos. Participants also primarily identified as women, which did not allow for proper assessment of the impact of gender. Future research should attempt to recruit more men and other gender identities. It is also not known if the improved efficacy in identifying the different fear states in kittens is retained longer than the consecutive test immediately following training. Future research should explore retained knowledge with a longer time period between training and testing.

Overall, the current study demonstrates that concise, specialized training in identifying kitten behavior is a useful tool for improving human ability to identify and rate fear levels in kittens. This training approach can help strengthen caretaker understanding of kitten behavior

to ensure interactions with potentially fear-provoking stimuli are properly managed to reduce related welfare impacts. Thus, these types of educational resources are encouraged within shelters, veterinary clinics, research settings, and adoptive homes to improve the welfare of cats.

Author credit statement

Conceptualization: CG and LN. Data curation: CG and LN. Formal analysis: CG, DP, and LN. Funding acquisition: LN. Investigation: CG, SH, and LN. Methodology: CG, DP, GM, and LN. Project administration: CG and LN. Resources: CG and LN. Software: CG, DP, and LN. Supervision: CG, DP, GM, and LN. Validation: CG, DP, GM, and LN. Visualization: CG, SH, DP, GM, and LN. Writing–original draft: CG. Writing–review and editing: CG, SH, DP, GM, and LN.

Acknowledgments

The authors would like to thank Kristina O'Hanley for their assistance with survey design and providing expert scoring for evaluating the kitten videos.

Conflict of interests and funding

The authors declare no potential conflicts of interest. This research was funded by the Natural Sciences and Engineering Research Council of Canada (NSERC). Stipend support to Courtney Graham was funded by the Ontario Veterinary College, the University of Guelph, and NSERC.

Author notes

A version of this manuscript was published in Courtney Graham's PhD thesis thesis.

References

1. Boissy A. Fear and Fearfulness in Animals. *Q Rev Biol*. 1995;70(2):165–191. doi: 10.1086/418981
2. Levine ED. Feline Fear and Anxiety. *Vet Clin North Am Small Anim Pract*. 2008;38(5):1065–1079. doi: 10.1016/j.cvsm.2008.04.010
3. Salman MD, New JG, Jr, Scarlett JM, Kass PH, Ruch-Gallie R, Hetts S. Human and Animal Factors Related to Relinquishment of Dogs and Cats in 12 Selected Animal Shelters in the United States. *J Appl Anim Welf Sci*. 1998;1(3):207–226. doi: 10.1207/s15327604jaws0103_2
4. Salman MD, Hutchison J, Ruch-Gallie R, et al. Behavioral Reasons for Relinquishment of Dogs and Cats to 12 Shelters. *J Appl Anim Welf Sci*. 2000;3(2):93–106. doi: 10.1207/S15327604JAWS0302_2
5. DiGiacomo N, Arluke A, Patronek G. Surrendering Pets to Shelters: The Relinquisher's Perspective. *Anthrozoos*. 1998;11(1):41–51. doi: 10.2752/089279398787000878
6. Bateson P. Behavioural Development in The Cat. In: Turner DC, Bateson P, eds. *The Domestic Cat: The Biology of Its Behaviour*. 3rd ed. Cambridge University Press; 2014:11–26.
7. Karsh EB. Factors Influencing The Socialization of Cats to People. In: Anderson RK, Hart BL, Hart LA, eds. *The Pet Connection: Its Influence on Our Health and Quality of Life*. University of Pennsylvania Press; 1984:207–215.
8. Karsh EB, Turner DC. The Human-Cat Relationship. In: Turner DC, Bateson PPG, eds. *The Domestic Cat: The Biology of Its Behaviour*. 1st ed. Cambridge University Press; 1988:159–177.
9. Lowe SE, Bradshaw JWS. Ontogeny of Individuality in The Domestic Cat in The Home Environment. *Anim Behav*. 2001;61(1):231–237. doi: 10.1006/anbe.2000.1545
10. Bateson P. Behavioural Development in The Cat. In: Turner D, Bateson P, eds. *The Domestic Cat: The Biology of Its Behaviour*. 2nd ed. Cambridge University Press; 2000:3–22.
11. American Veterinary Medical Association. *Literature Review on the Welfare Implications of Socialization of Puppies and Kittens*. American Veterinary Medical Association; 2015.
12. Meagher RK. Observer Ratings: Validity and Value as A Tool for Animal Welfare Research. *Appl Anim Behav Sci*. 2009;119(1–2):1–14. doi: 10.1016/j.applanim.2009.02.026
13. Feaver J, Mendl M, Bateson P. A Method for Rating the Individual Distinctiveness of Domestic Cats. *Anim Behav*. 1986;34(4):1016–1025. doi: 10.1016/S0003-3472(86)80160-9
14. Haywood C, Ripari L, Puzzo J, Foreman-Worsley R, Finka LR. Providing Humans with Practical, Best Practice Handling Guidelines During Human-Cat Interactions Increases Cats' Affiliative Behaviour and Reduces Aggression and Signs of Conflict. *Front Vet Sci*. 2021;8:714143. doi: 10.3389/fvets.2021.714143
15. Dawson LC, Cheal J, Niel L, Mason G. Humans Can Identify Cats' Affective States from Subtle Facial Expressions. *Anim Welf*. 2019;28(4):519–531. doi: 10.7120/09627286.28.4.519
16. Holden E, Calvo G, Collins M, et al. Evaluation of Facial Expression in Acute Pain in Cats. *J Small Anim Pract*. 2014;55(12):615–621. doi: 10.1111/jsap.12283
17. Flint HE, Coe JB, Pearl DL, Serpell JA, Niel L. Effect of Training for Dog Fear Identification on Dog Owner Ratings of Fear in Familiar and Unfamiliar Dogs. *Appl Anim Behav Sci*. 2018;208:66–74. doi: 10.1016/j.applanim.2018.08.002
18. Terracciano A, Merritt M, Zonderman AB, Evans MK. Personality Traits and Sex Differences in Emotion Recognition among African Americans and Caucasians. *Ann N Y Acad Sci*. 2003;1000:309–312. doi: 10.1196/annals.1280.032
19. Hall JA. Gender Effects in Decoding Nonverbal Cues. *Psychol Bull*. 1978;85(4):845–857. doi: 10.1037/0033-2909.85.4.845
20. Bahlig-Pieren Z, Turner DC. Anthropomorphic Interpretations and Ethological Descriptions of Dog and Cat Behavior by Lay People. *Anthrozoos*. 1999;12(4):205–210. doi: 10.2752/089279399787000075
21. Tami G, Gallagher A. Description of the Behaviour of Domestic Dog (*Canis familiaris)* by Experienced and Inexperienced People. *Appl Anim Behav Sci*. 2009;120(3–4):159–169. doi: 10.1016/j.applanim.2009.06.009
22. Kuroshima H, Hori Y, Inoue-Murayama M, Fujita K. Influence of Owners' Personality on Personality in Labrador Retriever Dogs. *Psychologia*. 2016;59(2–3):73–80. doi: 10.2117/psysoc.2016.73
23. Plueckhahn TC, Schneider LA, Delfabbro PH. Comparing Owner-Rated Dog Temperament Measures and A Measure of Owner Personality: An Exploratory Study. *Anthrozoos*. 2023;36(1):53–67. doi: 10.1080/08927936.2022.2062870
24. Kujala MV, Somppi S, Jokela M, Vainio O, Parkkonen L. Human Empathy, Personality and Experience Affect the

Emotion Ratings of Dog and Human Facial Expressions. *PLoS One*. 2017;12(1):1–18. doi: 10.1371/journal.pone.0170730

25. Gosling SD, Rentfrow PJ, Swann WB. A Very Brief Measure of the Big-Five Personality Domains. *J Res Pers*. 2003;37(6):504–528. doi: 10.1016/S0092-6566(03)00046-1
26. Adolphs R. The Biology of Fear. *Curr Biol*. 2013;23(2):R79–R93. doi: 10.1016/j.cub.2012.11.055
27. McNaughton N. Fear, Anxiety and Their Disorders: Past, Present and Future Neural Theories. *Psychol Neurosci*. 2011;4(2):173–181. doi: 10.3922/j.psns.2011.2.002
28. Leyhausen P. *Cat Behavior: The Predatory and Social Behavior of Domestic and Wild Cats*. 1st ed. Garland STPM Press; 1979.
29. Bradshaw JWS, Casey RA, Brown SL. *The Behaviour of the Domestic Cat*. 2nd ed. CABI; 2012.
30. Johansson GG, Rosset S, Sandström M, Soini H. Increased Fear Reactions in Cats after Carbachol Administered Intraventricularly. *Physiol Behav*. 1979;22:803–807. doi: 10.1016/0031-9384(79)90318-4
31. Kessler MR, Turner DC. Stress and Adaptation of Cats (*Felis silvestris catus*) Housed Singly, in Pairs and in Groups in Boarding Catteries. *Anim Welf*. 1997;6:243–254. doi: 10.1017/S0962728600019837
32. Roberts WW. Rapid Escape Learning Without Avoidance Learning Motivated by Hypothalamic Stimulation in Cats. *J Comp Physiol Psychol*. 1958;51(4):391–399. doi: 10.1037/h0042900
33. Dohoo I, Martin W, Stryhn H. *Veterinary Epidemiologic Research*. 2nd ed. VER Inc.; 2014.
34. Blackwell EJ, Bradshaw JWS, Casey RA. Fear Responses to Noises in Domestic Dogs: Prevalence, Risk Factors and Co-Occurrence with Other Fear Related Behaviour. *Appl Anim Behav Sci*. 2013;145(1–2):15–25. doi: 10.1016/j.applanim.2012.12.004
35. Graham C, Khalife S, Pearl DL, Mason GJ, Niel L. (Accepted in press). Tell-Tail fear Behaviours in Kittens: Identifying the Scaredy Cat. Animal Behavior and Cognition.
36. John OP, Srivastava S. The Big Five Trait Taxonomy: History, Measurement, and Theoretical Perspectives. *Handb Personal Theory Res*. 1999;2(510):102–138.
37. Costa PT, McCrae RR. The Five-Factor Model, Five-Factor Theory, and Interpersonal Psychology. In: Leonard M, Horowitz, Stephen Strack eds. *Handbook of Interpersonal Psychology: Theory, Research, Assessment, and Therapeutic Interventions*. John WIley & Sons, Inc; 2012:91–104. doi: 10.1002/9781118001868.ch6
38. Cimarelli G, Turcsán B, Range F, Virányi Z. The Other End of the Leash: An Experimental Test to Analyze How Owners Interact with Their Pet Dogs. *J Vis Exp*. 2017;2017(128):1–11. doi: 10.3791/56233
39. Shih HY, Paterson MBA, Georgiou F, Mitchell L, Pachana NA, Phillips CJC. Two Ends of The Leash: Relations between Personality of Shelter Volunteers and On-Leash Walking Behavior with Shelter Dogs. *Front Psychol*. 2021;12:1–14. doi: 10.3389/fpsyg.2021.619715
40. Finka LR, Ward J, Farnworth MJ, Mills DS. Owner Personality and the Wellbeing of Their Cats Share Parallels with the Parent-Child Relationship. *PLoS One*. 2019;14(2):1–26. doi: 10.1371/journal.pone.0211862

Table S1. Online survey 'Identification of kitten behaviour' hosted on Qualtrics survey platform which examined participant ability to identify different levels of fear in companion kittens based on short video clips (n = 761 participants).

Section 1: Participant demographics and Ten-item personality index (TIPI)

Previous kitten experience

1. Are you currently the primary caretaker of at least one kitten (12 weeks of age or younger) (i.e. you are financially responsible for the kitten)?
   (Choose from Yes/No) (If yes, next question prompted)
2. How many kittens (12 weeks of age or younger) are you currently the primary caretaker for?
   (Dropdown list to choose between 1 and 10+)
3. How many kittens (12 weeks of age or younger) have you ever been the primary caretaker for?
   (Dropdown list to choose between 0 and 10+)
4. How many cats (12 weeks of age or older) are you currently the primary caretaker for?
   (Dropdown list to choose between 0 and 10+)
5. How many cats (12 weeks of age or older) have you ever been the primary caretaker for?
   (Dropdown list to choose between 0 and 10+)
6. Do you have any advanced knowledge or expertise in cat training and/or cat behaviour?
   (Choose from Yes/No) (If yes, next question prompted)
7. Which of the following positions related to cats and/or animal behaviour have you held? Please select all that apply. *(Choose from: Cat Trainer; Veterinarian; Veterinary technician; Shelter worker; Groomer; Animal Behaviour Researcher; Kitten or cat foster; Other, please specify [text box])*
8. Have you ever consulted with an expert regarding cat behaviour problems?
   (Choose from Yes/No)

Demographics

1. What is your age?
   (Choose one selection from dropdown list: 18 to 100+ years)
2. Which gender do you identify with?
   (Choose one selection from: Man; Woman; Non-binary; My gender identity is not listed; Prefer not to answer
3. How many adults (18+ years of age) live in your household (including yourself)?
   (Choose one selection from dropdown list: 1 to 10+)
4. How many children and/or teenagers (under 18 years of age) live in your household?
   (Choose one selection from dropdown list: 1 to 10+)
5. Which country do you currently live in?
   (Choose one selection from All countries available)
6. Which type of community do you currently live in?
   (Choose one selection from: Rural community (fewer than 1,000 people); Small community (1,000 to 29,999 people), Mid-sized community (30,000 to 99,999); Urban community (100,000 to 999,999 people); Metropolis (more than 1 million people))

Ten-item personality inventory (TIPI)

Here are a number of personality traits that may or may not apply to you. Please select the rating next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

Please select your agreement with each pair of traits.

Personality traits	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
Extraverted, enthusiastic	☐	☐	☐	☐	☐	☐	☐
Critical, quarrelsome	☐	☐	☐	☐	☐	☐	☐
Dependable, self-disciplined	☐	☐	☐	☐	☐	☐	☐
Anxious, easily upset	☐	☐	☐	☐	☐	☐	☐
Open to new experiences, complex	☐	☐	☐	☐	☐	☐	☐
Reserved, quiet	☐	☐	☐	☐	☐	☐	☐
Sympathetic, warm	☐	☐	☐	☐	☐	☐	☐
Disorganized, careless	☐	☐	☐	☐	☐	☐	☐
Calm, emotionally stable	☐	☐	☐	☐	☐	☐	☐
Conventional, uncreative	☐	☐	☐	☐	☐	☐	☐

Section 2a: Kitten videos

Video instructions

It's time to look at some kitten videos!

You will be shown 12 short video clips of kittens and asked to rate their emotional states ranging from neutral/positive to fearful.

You will be able to select from the following 3 options:

- neutral/positive state
- mild fear state
- moderate fear state

Please watch the clips as many times as you like and select which option you believe the kitten is displaying. (There is no sound in the kitten videos.)

Next, you will be randomly selected to receive a short narrated educational video (approx. 5 min) of either specialized training on identifying kitten behaviour or general information on kitten care. Which one you receive will be randomized by the survey generator. At the end of the survey you will be given the option to view the educational video that you did not receive. (There is sound in these videos – you will need access to speakers but subtitles are also available.)

You will then be shown 12 different short video clips of kittens and asked again to rate their emotional states as above.

Kitten videos for rating – Series 1

Participants were randomly selected to view one of two series of 12 kitten videos. Links to an example video below (Table S2).

Please select what level of fear you think this kitten is displaying.

(Choose one from Neutral/Positive; Mild fear; Moderate fear)

Section 3: Educational videos

We are now going to show you a short 5-minute narrated educational video. There is sound in this video so please turn your volume up (subtitles available).

Participants were randomly selected to view one of two educational videos. Links to videos below (Table S3). [Time spent on video page was recorded]

Option 1: You have been selected to receive specialized training in kitten behaviour. Please watch the video below (subtitles available).

Option 2: You have been selected to receive information on general kitten care. Please watch the video below (subtitles available).

Video completion

Did you complete the video?

(Choose from Yes/No)

Citation: Journal of Shelter Medicine and Community Animal Health 2024, **3**: 91 - http://dx.doi.org/10.56771/jsmcah.v3.91

Section 2b: Kitten videos for rating – Series 2

Participants were then prompted to watch the other series of 12 kitten videos to the series they were first selected to watch (e.g. if they were provided with Series 2 first, they now received Series 1).

Please select what level of fear you think this kitten is displaying.

(Choose one from Neutral/Positive; Mild fear; Moderate fear)

Finish

During this survey, you either received specialized training in identifying emotional states of kittens or general kitten information and care. If you are interested in accessing the other video, you can do so below.

(Included links to both educational videos)

Table S2. Links to videos used in an online survey that examined participant ability to identify different levels of fear in companion kittens based on short video clips (n = 761 participants).

S2a. Example short video of a kitten displaying a neutral/positive (i.e. no fear) emotional state	S2a. https://youtu.be/8Pxf2FmOxd0
S2b. Example short video of a kitten displaying a mild fear emotional state	S2b. https://youtu.be/If2j8HTmnEo
S2c. Example short video of a kitten displaying a moderate fear emotional state	S2c. https://youtu.be/Bc1kWs9QMdU

Table S3. Links to educational videos providing specialized training in identifying kitten behaviour (Training group) or general information on kitten care (Info group) used to examine participant ability to identify fear in companion kittens.

S3a. Educational video providing specialized training in identifying kitten behaviour (Training group) used to examine participant ability to identify fear in companion kittens.	S3a. https://youtu.be/qq1O50SRMMU
S3b. Educational video providing general information on kitten care (Info group) used to examine participant ability to identify fear in companion kittens.	S3b. https://youtu.be/pHP6WGJVDGk