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Original Article

The effects of corpse viewing and corpse condition on vigilance for deceased loved ones☆,☆☆

Claire White [a,*], Daniel M.T. Fessler [b], Pablo S. Gomez [c]

[a] Department of Religious Studies, California State University, Northridge, CA, USA
[b] Center for Behavior, Evolution, & Culture and Department of Anthropology, University of California, Los Angeles, CA, USA
[c] Department of Psychology, California State University, Northridge, CA, USA

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ABSTRACT

One cognitive facet of the adaptive response to the absence of a valued relationship partner is increased vigilance toward indications of the agent's return, manifested in part as a lowered threshold for the detection of such indications. However, increased vigilance is dysfunctional when death is the cause of the partner's absence. Reliable cues of death should therefore diminish vigilance and raise detection thresholds. In the contemporary West, grief and related experiences often follow the death of a beloved pet, affording the opportunity to study the effects of exposure to cues of the death of a relationship partner free of the Western medicalized and professionalized aspects of human dying and mortuary preparation. Consonant with our thesis, in an online survey of 142 recently bereaved pet owners, we find evidence that seeing a corpse that exhibits reliable cues of death, such as grievous injuries or extensive disruptions to the body envelope, reduces vigilance to seek out the agent in the environment; in contrast, visual exposure to an intact corpse is insufficient to diminish vigilance for that agent. We discuss the implications of our evolutionary approach for bereavement research and modern funerary practices.

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1. Introduction

Many recently bereaved individuals report the experience of interpreting sights and sounds as having been caused by their deceased loved ones, followed by the disquieting recollection that the person is dead (Archer & Winchester, 1994; Freed, Yanagihara, Hirsch, & Mann, 2009; Maciejewski, Zhang, Block, & Prigerson, 2007; Olson, Suddeth, Peterson, & Egelhoff, 1985; Shear & Shair, 2005; Weisman, 1991). For convenience, we refer to these experiences as false recognitions. False recognitions can be distinguished from hallucinations because they do not occur in the absence of external or relevant stimuli, and they are identified as a 'misperception' by the perceiver—the bereaved individual knows at a conscious level, after the initial experience, that the sight or sound has not been produced by the deceased agent (see Aleman & Larøi, 2008). Such experiences are not associated with psychopathology, and are in fact more common after normative bereavement (Grimby, 1993). From an evolutionary perspective, false recognitions appear puzzling, as, in addition to the disruptive effects of their emotional consequences, they suggest a misallocation of information-processing resources—why attend to and categorize cues regarding the presence of someone whom one knows is dead? Here, we frame this phenomenon as reflecting the signal-detection dynamics of a cognitive system whose ultimate function is to facilitate reunification with a living relationship partner following separation. Against this backdrop we investigate the effects that corpse exposure has upon such experiences, a variable that, we will argue, can be critical from both a theoretical and a clinical perspective.

Previously, our research group proposed that false recognitions reflect a low threshold (and in this context, correspondingly, high vigilance) for the detection of a specific agent, a pattern that, we postulated, is the product of a correctly functioning adaptive cognitive response to the absence of a significant other from the immediate environment (White & Fessler, 2013). Due to the limited availability of suitable partners (a challenge exacerbated in small groups such as those characteristic of ancestral human societies) and the extensive transaction costs involved, the costs of erroneously prematurely abandoning efforts at reunification and pursuing replacement relationships will usually exceed the costs of erroneously pursuing such efforts, especially in the early phases following separation. Further, as is true in the modern era, in the environment of evolutionary adaptedness temporary separation was likely more common than permanent separation by death.

Natural selection can be presumed to favor decision-making systems that calibrate signal detection so as to maximize expected value (see

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* Corresponding author.
E-mail address: claire.white@csun.edu (C. White).

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especially McKay & Efferson, 2010; Perilloux & Kurzban, 2014; relatedly, see Haselton & Buss, 2000; Haselton & Nettle, 2006; Johnson, 2000). In the case of an absent relationship partner, throughout our species' history, a signal-detection miss (i.e., failing to register evidence of the presence of the missing partner) will generally have been more costly than a false alarm (erroneously registering spurious stimuli as indicative of the partner's presence). If the expected value at issue is the return on investment in vigilance (where costs are a function of the attention and energy that a given level of vigilance entails, and benefits are a function of the importance of the relationship and the probability that the agents will be reunited as a result of a given level of vigilance), then we should expect natural selection to have crafted systems that adjust vigilance such that, when the missing agent is a highly valued relationship partner, vigilance is elevated. As a consequence, individuals who have lost such a partner can be expected to exhibit a baseline low detection threshold for signs that the missing individual is in the immediate vicinity and remains a viable interactant. Of course, death is a permanent separation, and in such instances, a correctly functioning system should eventually alter representations of the agent such that the deceased is no longer viewed as a potential relationship partner.

Broadly consonant with the above framework, prior research has shown that recently bereaved individuals exhibit attentional bias toward detecting information about the deceased over other agents (Archer & Winchester, 1994; Freed et al., 2009; Shear & Shair, 2005). Building on such results, our research group (White & Fessler, 2013) employed the above perspective to explore the informational underpinnings of false recognitions. We adopted the position that a critical cognitive component of the bereavement process is the recategorization of the deceased from the status of agent – and thus viable relationship partner – to the status of non-agent. Importantly, this recategorization can apparently be multifaceted and/or can occur at multiple levels of awareness, such that a bereaved individual can overtly know that a loved one has died, and yet still respond to stimuli as if this were not the case. Indeed, we suspect that incomplete recategorization and corresponding conflict between different levels of information processing lies behind such actions as attempts to cling to a casket as it is buried. Once this recategorization is complete, vigilance for signs of the agent's return should end, as the expected value of such vigilance is then zero. Prior to this point, however, expected value considerations dictate elevated vigilance and correspondingly lowered detection thresholds. Viewed in this light, false recognitions are an indication that the recategorization process is still ongoing.

Given the obstacles to studying grief experiences following the loss of a human partner, in our earlier investigation (White & Fessler, 2013), we examined respondents' experiences following the death of a beloved dog or cat. Prior research indicates that such bereavement is similar to that obtaining in human relationships, yet the death of a pet lacks cultural practices and other social mores that can influence the expression of grief and related phenomena (Archer, 1997; Clements, Benasutti, & Carmone, 2003; Serpell, 1996). Specifically, we found support for a number of predictions derived from their evolutionary framework, two of which have a bearing on the current study. First, consonant with the foundational issue of expected value, efforts to recover a lost relationship should be a function of the importance of that relationship. Correspondingly, we found that attachment to the deceased (a subjective proxy for relationship value) positively predicted the extent of false recognitions reported by the bereaved. Second, because the expected value of vigilance hinges on the probability of reunification, Bayesian updating of this expected value should occur as a function of experience during bereavement, with corresponding effects on vigilance. In light of this, and given the costs of both vigilance and living without a relationship partner, with the passage of time, the lost relationship should be abandoned and a replacement sought. Consistent with this, time elapsed since the onset of bereavement negatively correlated with the extent of false recognitions.

Distinguishing between living and dead agents, be they human or animal, is a critical and evolutionarily ancient adaptive challenge. As we have discussed, the baseline threshold for detecting signs indicating that an individual is alive is especially low for recently bereaved individuals. With regard to issues of signal detection, one of the most informative stimuli should be the immediate presence of a physical body. However, this is not as straightforward a cognitive mapping task as it might seem.

Adopting a signal-detection perspective, Barrett and Behne (2005) cogently argue that a basic asymmetry characterizes the task of differentiating living agents from dead entities, as, for example, erroneously concluding that an animal is dead when, in fact, it is merely not moving will generally be more costly than erroneously assuming that an animal is merely not moving when it is, in fact, dead. Correspondingly, Barrett and Behne propose that the influence of cues of death on the low-level recategorization of the agent from living to dead should be fundamentally contingent on their reliability. Cues such as grievous injuries and extensive disruptions to the body envelope have reliably indexed death throughout our species' evolutionary history. Thus, evolved mechanisms that distinguish between living agents and dead entities should be highly responsive to such indices, with corresponding implications for subsequent vigilance. In contrast, visual exposure to an intact corpse provides ambiguous cues regarding death, leading to a state of ambivalence as to the status of the individual (see also Boyer, 2001). For instance, in modern Western cultures, where the corpse is often manipulated so as to look as lifelike as possible, it is common for the bereaved to express ambivalence and even apparent disbelief upon seeing the body, captured by statements such as “I can't believe she's dead” or “he looks so peaceful, like he's sleeping.” Here we propose that, as a result of the signal-detection considerations outlined earlier, seeing an intact corpse will often be insufficient to diminish vigilance for that agent. In other words, when it comes to viewing the deceased, it is not whether one sees the corpse, but rather the state of that corpse, that matters.

To summarize the above, seeing a lifelike but immobile corpse following the death of a loved one is unlikely to reduce the (non-consciously) assessed probabilities that factor into the calculation of the expected value of vigilance. Correspondingly, at a minimum, exposure to such a corpse should not increase the low baseline threshold (and high vigilance) for detecting additional indications that a person remains a viable relationship partner. As a consequence, exposure to a lifelike corpse is unlikely to reduce false recognitions in response to spurious environmental stimuli. Rather, these experiences are sustained. In contrast, viewing a corpse that presents highly reliable cues of death, such as grievous injuries or extensive disruptions to the body envelope, should diminish vigilance and raise the detection threshold, resulting in a corresponding decrease in the frequency of false recognitions (see Fig. 1). We tested these predictions in a survey of bereaved pet owners.

First, seeking to replicate the basic results of White and Fessler (2013), we predict that (1) there will be a positive correlation between the level of attachment and false recognition scores, and that (2) time elapsed since the pet's death will negatively correlate with the extent of false recognitions. Next, examining the core concept at issue here, we predict that (3) exposure to an intact corpse will not significantly impact subsequent false recognition experiences, but (4) exposure to a non-intact corpse will correlate negatively with the frequency of false recognitions. Less directly, we also expect a relationship between the cause of death and the extent of false recognitions. For two separate reasons, owners of pets that have suffered accidental deaths, such as due to traffic accidents or attacks by other animals, may experience fewer false recognitions than owners of pets that have died of natural causes or have been euthanized. First, per our core hypothesis, accidents are more likely to lead to a non-intact corpse, hence the cues that the corpse presents may be responsible for more abandonment of representations of the pet as an agent when the pet dies accidentally. Second, independent of its effect on the corpse, an accident itself may constitute a

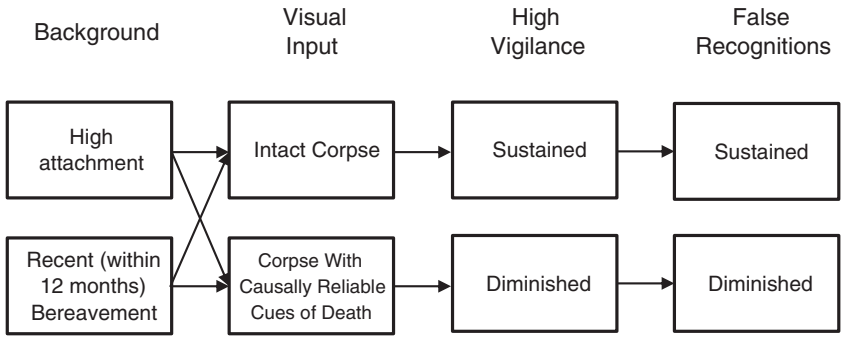

Fig. 1. Hypothesized model of background and information processing features of agent detection.

powerful cue. For example, although both are the products of modern technology, witnessing a pet being struck by an automobile may lead to a greater change in representation than witnessing a pet being euthanized by injection, as folk physics supports the inference of grievous harm in the former case but not the latter. We therefore tested the independent contributions of corpse condition and cause of death on false recognitions.

2. Methods

2.1. Recruitment

The study was approved by the UCLA Office for the Protection of Research Subjects. An online survey was promoted in veterinary practices in Belfast and Los Angeles through the distribution of flyers and the display of posters, and through Internet forums and groups designed for pet owners, including online grief support communities. The following inclusion criteria applied: residents of the U.S. or U.K.; owned a dog or cat for more than 1 year before its death within the last 12 months; and had resided in the same house as their pet and regarded their pet as a companion animal (as opposed to, for example, a working animal only). To ensure an adequate number of participants for key predictor variables, individuals who had seen their pet after its death and those whose pets had been involved in traffic accidents were particularly encouraged to participate. We invited residents of both the U.S. and the U.K. to participate because we were interested in the potential effects of regional variation within Western settings. However, preliminary analyses revealed no substantial differences in data, including questionnaire scores, between U.S. and U.K. residents, hence they were combined in subsequent reporting and analyses.

2.2. Materials

Participants completed a survey composed of items addressing demographic information about them and their pet, the circumstances surrounding their pet's death, and the nature of their contact with the corpse following the pet's death. Most questions were forced-choice. For example, to determine the nature of contact with the corpse, we included the item "After your pet had died, what was the next exposure you had with your pet?" (*I did not see my pet's body*; *I saw my pet's body intact* e.g., *still corpse*; or *I saw my pet's body but it was not intact*, e.g., *disrupted*, *injured or damaged such as a limb missing or body partly squashed*). We also included several open-ended questions to allow for richer data capture on some of the variables of interest and to ensure that participants had interpreted the forced-choice questions as intended. For example, to understand more about participants' interactions with, and corresponding representations of, their deceased pet, we included an optional 500-word open-ended question: "If you can, please provide us with some more information about how you knew that your pet had died. For example, if you saw your pet after death, did he or she look pale? Was his or her body not moving? Or did they look just the same?"

In addition, to determine the role that the cause of death played, participants who viewed their pet's corpse were asked "what was the cause of your pet's death?" (*euthanasia*, e.g., put to sleep at a veterinary hospital; *accidental*, defined as a death that was sudden and unanticipated by the owner, e.g., hit by a car, attacked by another animal; or *old age, illness or other natural causes*, e.g., cancer). Since this question could be interpreted in terms of either distal or immediate causes, yet we were interested in the circumstances in which actual death and corpse viewing occurred, we asked participants to focus on the immediate cause (e.g., "If your pet was involved in a road traffic accident, but after the accident received treatment to terminate his or her life by a veterinary practitioner, then the cause was 'euthanasia'") and included a space of up to 200 words for participants to include additional information. We subsequently examined these free responses to ensure that participants had selected the correct forced-choice option based on their description. If the description indicated a different immediate cause than the item checked, prior to analysis we altered the answer to match the description given in the free response.

To gauge emotional attachment to a pet, participants completed the 23-item Lexington Attachment to Pets Scale, which has high internal validity (LAPS; Johnson, Garrity, & Stallones, 1992), responding to items on a 4-point scale (ranging from *definitely applies to me* to *definitely does not apply to me*). We used White and Fessler's (2013) 6-item False Recognition Questionnaire, which has excellent internal consistency (Cronbach alpha coefficient .92). This questionnaire addresses the extent to which, in the past two weeks, participants have interpreted ambiguous stimuli (e.g., sights, sounds) as the deceased pet. Items probe experiences such as often believing that one saw or heard the pet, and often mistaking another pet for the deceased animal (see Supplementary Material, S1, available on the journal's website at www.ehbonline.org). A higher score on the scale denotes the frequent experience of misperceiving stimuli as being caused by the deceased pet in multiple modalities (e.g., sight, sound). Although the questionnaire does not measure the frequency of such experiences directly, agreement that experiences often happened was taken as a proxy for a high degree of multiple instances of false recognitions.

Upon completion of the survey, participants were thanked and provided with a list of resources for coping with bereavement following the death of a pet.

3. Results

3.1. Participant and pet-related descriptive statistics

Participants were 142 bereaved pet owners (122 female, 20 male; age range 18–69, mean age 33; 101 U.S. residents, 41 U.K. residents). Most participants (112) had had a pet die within the previous six months (mean period since loss of pet = 5.0 months, SD = 3.7, see Tables 1 and 2). Ninety-seven participants (68.3%) had experienced

Table 1
Participant and pet related descriptive statistics ($n = 142$).

Variable	*n*	%
Sex		
Female	122	85.9
Male	20	14.1
Age		
18–40	47	33.1
41–69	95	66.9
Country of residence		
USA	101	71.1
UK	42	28.9
Type of pet that died		
Dog	97	68.3
Cat	45	31.7
Months since pet's death		
0–6	112	78.9
7–12	30	21.1
Cause of pet's death		
Euthanasia	70	49.3
Accidental	50	35.2
Natural (e.g., old age)	22	15.5
Death exposure		
Did you see your pet's corpse?		
Yes	116	81.7
No	26	18.3
If you seen your pet's corpse, was it intact?		
Yes	72	62.1
No	44	37.9

the death of a dog and 45 participants (31.7%) had experienced the death of a cat (see Tables 1 and 2).

3.2. Causes of death, viewing the corpse, and state of the corpse

Almost half of the participants (70, 49.3%) had a pet that was euthanized. Where euthanasia was not the final cause of death, 50 participants (35.2%) had a pet die in an accident and 22 (15.5%) had a pet die of natural causes such as old age. Most participants (116, 81.7%) viewed their pet's corpse. As expected, the majority of participants had viewed an intact corpse (72, 62.1%), although a sizable minority (44, 37.9%) had viewed a corpse that was not intact (see Table 1).

Two questions concerning participants who had viewed the corpse were of interest. First, was there a relationship between the immediate cause of death and whether participants viewed the corpse? In particular, were participants whose pets died immediately following an accident more likely to view the corpse than pets who died from other means? Most participants who had viewed the corpse (63, 54.3%) had done so after their pet was euthanized, many (44, 37.9%) had viewed the corpse following an accidental death, and some (9, 7.8%) viewed the corpse following a natural death (see SM, S2). A chi-square goodness-of-fit test indicated that the proportion of those who had viewed the corpse after their pet was involved in an accident (44, 37.9%) was not significantly different from a value of 33.3% ($n = 38.6$) that would be obtained by chance, $\chi^2(2, n = 116) = 26.9$, $p < .001$.

The second question concerns the potential relationship between the cause of the pet's death and the state of the body after death, especially for corpses that were not intact when viewed. As expected, a chi-square goodness-of-fit test indicated that the proportion of corpses that were not intact and died an accidental death (34, 77.3%) was significantly different from a value of 33.3% ($n = 14.7$) that would be obtained by chance, $\chi^2(2, n = 44) = 29.8$, $p < .001$. Furthermore, the remaining ten participants who did not view an intact corpse had pets that died as a result of euthanasia (22.7%). As expected, most of the participants who had viewed a body that was not intact had a pet that had suffered a traumatic event (such as a traffic accident or attack by another animal) and died shortly thereafter, or was then taken to a veterinary practice and euthanized (see SM, S3).

Table 2
Descriptive statistics for continuous predictor variables ($n = 142$).

Variable	Range	Mean (sd)
Months since pet's death	0–12	5.0 (3.7)
Attachment score	10–69	51.0 (11.8)
False recognition score	2–18	7.5 (7.3)

3.3. Accounts of the pet's death by participants who viewed the corpse

Of the 116 participants who viewed their pet's corpse, 38 (32.8%) provided a response to our open-ended question concerning how the participant knew that the pet had died. In the ESM, we provide an example of a description for each of the combinations of death type (i.e., the final cause of death), and state of corpse (i.e., intact vs non intact) that were reported. These descriptions reveal patterns in representations of the pet's corpse (see SM, S4). Namely, when an intact corpse was viewed, there was a strong sense of disbelief that death has occurred because the deceased looked and felt like he or she was alive. This is especially the case where euthanasia had occurred. Participants often described the pet having been injected with a drug while being held by them, with the next exposure to their pet's body being when the pet had just died but still felt warm and looked physically the same. Statements to the effect that the corpse looked or felt like the deceased was still alive were, however, notably absent from testimonies when the corpse was not intact at the time of viewing, irrespective of the cause of death.

3.4. Questionnaires

3.4.1. Lexington Attachment to Pets Scale

The maximum possible score on the LAPS is 69. Among U.S. pet owners in general, the average score is 45. The scale is more adept at measuring strong pet attachment because the majority of the items are indicators of intense attachment (Johnson et al., 1992); hence a score of 45 indicates a strong attachment to the pet. Participants' scores on the LAPS questionnaire varied greatly (10–69), with a normal distribution of scores, but most participants were very strongly attached to their pet ($M = 51$, $SD = 11.8$). This likely reflected our having targeted participants via pet-loss forums and websites, as individuals who frequent such sites are likely to have had strong emotional ties to their pets. Given that we employ bereavement in the context of pet death as a model system for bereavement in the context of human death, this sampling bias is an asset, as it makes the sample more comparable to human loss in terms of attachment levels (see Table 2).

3.4.2. False Recognition Questionnaire

The maximum possible score on the False Recognition Questionnaire is 18. Scores on the False Recognition Questionnaire ranged between 2 and 18 ($M = 7.5$, $SD = 7.3$), with a normal distribution of scores. Many participants experienced false recognitions up to 12 months following their pet's death (see Table 2).

3.5. Main analyses

We are concerned with the impact of five factors upon the extent to which recently bereaved individuals mistakenly interpret ambiguous environmental stimuli as having been caused by the lost agent. The main predictors of interest are: 1) *level of attachment* to the deceased (LAPS score); 2) *time elapsed since pet's death*, which was coded from 0–12 months; 3) *accidental death*, which was defined as a death that was unexpected and sudden and was recoded = 1, and contrasted to a natural or veterinary-induced death (i.e., euthanasia), which was recoded = 0; 4) *viewing the corpse*, which was recoded = 1 and *did not view* the corpse, which was recoded = 0; and 5) *corpse not intact*, which described the corpse as disrupted when viewed, and was

recoded = 1, and contrasted to an *intact corpse* when viewed, which was recoded = 0. The extent of false recognitions for the deceased pet was the outcome variable, measured by scores on the FRQ.

3.5.1. Relationships between variables

We first conducted tests for associations and relationships between the outcome and predictor variables using Pearson's *r*. Correlation coefficients were computed for continuous and categorical variables.

i. *Relationships between predictor variables.* Unsurprisingly, there was a small positive correlation between having had a pet die an accidental death and viewing a corpse that was not intact, $r(142) = .16$, $p < .05$.
ii. *Relationships between predictor and outcome variables.* As displayed in Table 3, four variables correlated significantly with scores on the False Recognition Questionnaire. As per Prediction 1, there was a small positive correlation between the level of attachment (as determined by LAPS scores) and false recognition scores, $r(142) = .16$, $p < .05$. As per Prediction 2, there was a small negative correlation between the time elapsed since the death of the pet and false recognition scores, $r(142) = -.19$, $p < .05$. As per the intersection of Predictions 3 and 4, pooling across corpse condition categories, the relationship between seeing the corpse and false recognition scores was not significant, $p > .05$. Importantly, however, as per Prediction 4, there was a moderate negative correlation between seeing a non-intact corpse and false recognition scores $r(116) = -.48$, $p < .01$. Lastly, there was a smaller moderate negative correlation between having had a pet die an accidental death and false recognition scores $r(142) = -.28$, $p < .01$.

3.5.2. Multiple regression analyses

We next used direct logistic regression to assess the contribution of each of the five factors to the extent to which participants experienced false recognitions, and, in particular, to weigh the extent to which viewing a non-intact corpse predicted false recognition scores relative to the contributions of the other four variables (level of attachment to the pet, months since death of pet, type of death, and whether participants saw the pet's corpse).

Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity, and homoscedasticity. In particular, we were concerned with the intercorrelations between two predictor variables: having had a pet die an accidental death and having viewed a corpse that was not intact. Although Pearson's *r* correlation coefficients from previous analyses had already revealed that the correlations among these predictor variables were small, given the importance of the potential relationship in our theoretical account, we conducted collinearly diagnostics. Results indicated no problem with collinearity in the data (all VIF levels were low, <2.0).

The model contained five independent variables (level of attachment to the pet, months since pet's death, type of death, whether participants saw the pet's corpse, and the state of the corpse when viewed). Using the enter method, a significant model emerged ($F(5136) = 29.63$, $p < .01$), adjusted *R*-squared = .50. The total variance in false recognition scores explained by the model was 52.1%.

Seeing a non-intact corpse made the strongest unique contribution ($\beta = -1.22$, $p < .01$), significantly predicting lower false recognition scores. Attachment to the pet also made a unique, albeit smaller, contribution ($\beta = -0.05$, $p < .05$), with higher attachment scores predicting higher false recognitions scores. Time elapsed since pet's death was also a significant independent predictor of false recognitions scores ($\beta = -0.79$, $p \leq .5$). The remaining predictors were not significant. Importantly, neither merely having viewed the corpse ($\beta = -0.32$, $p \geq .05$) nor the cause of the pet's death ($\beta = -0.18$, $p \geq .05$) were significant independent predictors of false recognition scores.

4. Discussion

Our study of bereaved pet owners was designed to investigate the factors that diminish or heighten vigilance for recently deceased loved ones, where false recognitions – the temporary interpretation of spurious stimuli as having been caused by the deceased – are taken as revealing that the bereaved continues to maintain, at least in part, a representation of the deceased as a viable relationship partner, exhibiting a correspondingly low threshold for the detection of indications of the absent partner's presence. First, confirming the reliability of the methods employed, we replicated the basic results of our earlier investigation (White & Fessler, 2013), finding that participants who were more attached to their pets, and those whose pets had died more recently, were more likely to experience false recognitions. Particularly in the early phases of the absence of a valued relationship partner, erroneously concluding that living partners are dead will generally be far more damaging to fitness than erroneously concluding that dead partners are alive. Because immobility is not a definitive cue of death, whereas grievous injury or disruption of the body envelope is, we hypothesized that seeing the intact corpse of a loved one is not sufficient to alter the low baseline threshold for, and high vigilance toward, detecting cues of the agent in the environment; in contrast, by providing reliable indications that the agent is dead, exposure to a non-intact corpse will raise the detection threshold for, and lower vigilance toward, such cues. Correspondingly, we predicted, and found, that having been exposed to an intact corpse does not correlate with a reduction in false recognitions in the months that follow, whereas exposure to a non-intact corpse does predict such a reduction. We interpret this pattern as indicating that exposure to reliable causal cues of death provides adequate information about the ontological status of the lost agent to diminish unconscious vigilance for the lost agent.

Given the recruitment procedures and self-report methods used, our study is subject to a number of limitations. First, a questionnaire study does not allow us to capture the direction of causality and relationships

Table 3
Correlation matrix of predictor and outcome study variables ($N = 142$).

Variable	Months since pet's death	Accidental death	Viewed corpse	Corpse viewed not intact	LAPS	FRQ
Months since pet's death	–					
Accidental death	−.14	–				
Viewed corpse	.28	.10	–			
Corpse viewed not intact	.30	.16*	.82	–		
LAPS	−.69	.02	−.05	−.12	–	
FRQ	−.19*	−.28**	−.09	−.48**	.16*	–
Mean	5.0	1.45	1.82	1.32	51	7.5
SD	3.7	.05	.04	.76	11.8	7.3

* $p > .05$.
** $p > .01$.

between our variables. For example, although seeing a disrupted corpse was a stronger negative predictor of false recognitions than viewing an accidental death, we cannot rule out the possibility that seeing the process of unambiguous death (e.g., a car accident) dissipates vigilance, or, at the least, compounds the diminishing effect when combined with the viewing of a non-intact corpse. This is especially important to tease apart in future research because our survey did not differentiate between participants who were present at the time of accidental death and those who simply learned about it from another party. Second, a number of important factors that we have not measured may influence representational reclassification and false recognitions, including the age and general health of the pet at the time of death (as cues of senescence or illness may potentiate reclassification), and whether the owner has obtained a new pet since the loss (on the one hand, potentially enhancing the presence of stimuli that elicit false recognitions, but, on the other hand, potentially reducing vigilance due to the replacement of the relationship partner). Additionally, to understand the proximate mechanisms at issue, it would be useful to collect more detailed information concerning the bereaved's interactions with the corpse, including the time elapsed since death when the corpse was viewed, how many times the corpse was viewed, and whether the corpse was touched or handled. We did not include such questions in the present study because of their potential for causing emotional distress; however, future investigations, particularly those employing a less impersonal method than our online survey, could conceivably probe these issues in an ethical manner. Third, while it is reasonable to use beloved pets as a model for the loss of valued human partners, the many differences between pets and actual human partners are such that our findings should be considered preliminary. Lastly, our measure of false recognitions relies on self-report, and is therefore subject to a number of possible reporting biases, a limitation that could be addressed through the use of behavioral measures.

Despite these limitations, our results have the potential to impact several areas of research. First, our findings underscore the conclusion that false recognitions are a common experience and reflect the normal functioning of evolved mechanisms governing human responses to the loss of a relationship partner. These experiences have either been overlooked in the conventional grief literature or are stigmatized as abnormal despite evidence that they occur frequently during bereavement (see, for example Yamamoto, Okonogi, Iwasaki, & Yoshimura, 1969). Second, although we have examined information-processing features that are but one constituent of the experience of bereavement, our results nevertheless underscore the need for clinically-relevant research on the effects of viewing the corpse on the bereaved, an area that has lacked systematic enquiry in mainstream bereavement research (e.g., see Haas, 2003). The medicalization of the dying process in industrialized societies and the parallel professionalization of mortuary services have radically altered the experience of having a loved one die, to the point that these nations have become outliers on the spectrum of the world's cultures (White, Marin & Fessler, 2016). Today, bereaved individuals in industrialized societies rarely participate in the preparation of the corpse, and, indeed, have minimal exposure to cues of death of any sort; when visual contact does occur, it most often follows complex professional preparation of the corpse aimed at minimizing cues of death. Our work suggests that these evolutionarily novel practices may actually be retarding at least one part of the grief process by failing to deactivate agency detection. There is thus an urgent need for further research concerning how cues of death affect those who suffer the loss of a loved one.

Author contributions

C.W. and D.F. jointly created the theoretical framework, designed the study, and wrote the paper. C.W. collected the data, and C.W. and P.G. analyzed the data.

Supplementary Materials

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.evolhumbehav.2016.05.006.

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