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Abstract

Pet ownership is on the rise with pets often considered social companions. Across two experiments we use the self-reference effect in episodic memory to assess whether pets form part of an extended self in a similar fashion to close friends. Participants completed an online surprise memory task for adjectives encoded in relation to either themselves, a close friend, or their pet (experiment one) or with an additional celebrity encoding condition (experiment two). A self-reference effect was identified, such that self-encoded words were better recognized than both close friend, pet, and celebrity-encoded adjectives across both experiments. Crucially, close friend-encoded adjectives were better (experiment one), or similarly (experiment two), recognized when compared with pet-encoded adjectives. Pet-encoded words were recognized better than celebrity-encoded words. Pets may be extensions of the self, but not to a greater extent than close human friends.

Keywords: self-reference effect; animal-human interaction; item memory; source memory; sensitivity

Pet ownership is rising across the world (Health for Animals, 2022) and is thought to be beneficial for both physical and mental health (Friedmann & Son, 2009). Pets are often considered social companions, especially in times of social disconnection, such as older age (Scheibeck et al., 2011) or a pandemic (Kogan et al., 2021). Social companions are important for our sense of self and are often considered part of an extended or connected self (Aron et al., 1991). Briefly, the extended self refers to the self plus close others, possessions, and places of personal relevance (Belk, 1988). Although predominantly studied through the lens of social psychology, the relationship between the self and close others has also attracted interest in cognitive psychology. Cognitive biases are evident in episodic memory, with superior memory for items encoded in relation to the self, known as the self-reference effect (Symons & Johnson, 1997). Moreover, this has been extended to encoding contextual elements of memory, such as the source of the information or to whom the information was directed, known as source memory, although self-biases may be unique across cognitive processes (Nijhof et al., 2020). In support of an extended-self model, similar cognitive biases are also evident for close others, such as close friends and family members (e.g. Kokici et al., 2023). This line of research is important for understanding episodic memory but also offers an insight into how the self is represented in relation to others and the extent of overlap in cognitive representations of self and other.

It is often stated that pets are *Man's best friend* and as such may form part of an extended sense of self in a similar fashion to close friends or family members (Belk, 2013). However, little research has addressed cognitive biases in relation to pets. Understanding cognitive biases in relation to close others provides an insight into self-other representation and the extended self. This will help inform social interventions that may suggest pets as a proxy for close human connection (Stanley

et al., 2014). Across two experiments, we assess whether pets and close friends are comparable in relation to cognitive biases relevant to episodic memory (experiment one) and whether pets should be considered part of an extended self (experiment two).

Experiment 1

Method

Participants

Seventy healthy young adults (mean age = 19.73 years, $sd = 2.10$, 58F/12M) who owned a dog or cat were recruited from [Redacted for purpose of anonymity]. All participants were free from psychiatric or neurological illness. The sample was determined by a power analysis conducted in WebPower (Zhang & Yuan, 2018) with power at 80% and alpha at 0.05 to detect medium to large effects (Cohen's $f = 0.4$) we required at least 62 participants. The effect size was based on previous evidence using a similar task (Kokici et al, 2023). We collected further participants in case of any removals due to technical or non-compliance issues.

Episodic Memory Task

Participants nominated a close friend and pet and were asked to rate how close they were to each on a scale from 1 (not very close) to 9 (very close). Participants were then presented with singular adjectives, such as 'scruffy' and were asked how well the adjective explained either themselves, their close friend, or their pet, using a scale from 1 (not accurate) to 9 (very accurate). This is a common approach for eliciting a self-reference effect in episodic memory (Symons &

Johnson, 1997). Adjectives were selected based on valence and arousal ratings from Warriner (2013) and were deemed suitable to describe both humans and animals. The words were presented in a pseudorandomised fashion with three randomisations of the word lists used to ensure any memory bias was not due to familiarity or other potential confound. Upon completion of the encoding task, participants completed an implicit visual perspective task (see Martin et al., 2017 for details) that lasted approximately 10 minutes and acted as a distractor task (data not presented here). In the recognition memory task, participants were presented with the 60 previously seen words (20 for each encoding condition) and 60 new distractor words. Participants were asked, “In the first task, did you see the following word?” If they answered “yes”, they were asked a follow up question “Who was the word presented in relation to?”. Participants responded using 1-3 for self, close friend, and pet, respectively. Participants responded at their own pace during all elements of the task.

Procedure

The study was completed online using both the Qualtrics and Pavlovia platforms. Ethical clearance was granted by The University of Kent Psychology Ethics Committee.

Design and Statistical Analysis

We manipulated the agent the word was encoded in relation to (Self, Close Friend, Pet) and assessed both item memory (i.e. Do you remember this word?) and source memory (i.e. Who was this word presented in relation to?). Therefore, we computed two 1x3 repeated-measures ANOVAs (RM-ANOVA) to assess the effect of encoding condition on both memory tasks. For item memory and source memory we calculated d-prime (d') as a measure of memory sensitivity.

Results

Both dogs ($M=8.09$) and cats ($M=7.19$) were rated as very close and these did not statistically differ, $t(68)=1.80$, $p=.08$, $d=0.26$. Participants reported feeling closer to their close friends than their pets, $t(68)=2.65$, $p=.01$, $d=0.32$. However, there was no relationship between closeness to friend and the difference in memory between self and friend-encoded words, $r(68)=0.07$, $p=.58$. Likewise for closeness to pet and memory difference between self and pet-encoded words, there was no significant association, $r(68)=-.11$, $p=.38$.

Item Memory Sensitivity

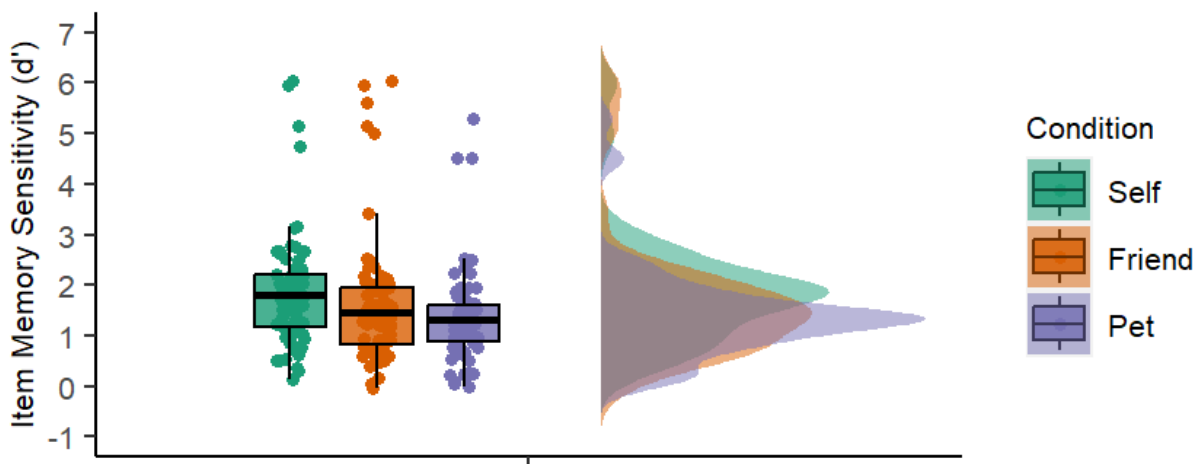
A main effect of AGENT was identified, $F(2,69)= 18.74$, $p<0.001$, $\eta^2_p = 0.21$. Simple effects analyses demonstrated greater sensitivity for self-encoded words in relation to both close friend, $t=2.86$, $p=.005$, Cohen's $d=0.21$ and pet, $t=6.12$, $p<.001$, $d=0.45$. Greater sensitivity was identified for friend compared with pet, $t=3.26$, $p=.003$, $d=0.24$ (see Table 1 and Figure 1).

Table 1. Item and source memory accuracy and sensitivity across self, friend, and pet encoding conditions.

	Self	Friend	Pet
	M (sd)	M (sd)	M (sd)
Item memory accuracy %	68.7 (17.7)	59.6 (18.9)	53.6 (15.11)
Item Memory d'	1.88 (1.14)	1.65 (1.27)	1.38 (0.93)
Source Memory accuracy %	77.0 (18.1)	75.4 (18.6)	70.0 (22.0)
Source Memory d'	2.46 (1.74)	2.17 (1.90)	2.10 (1.88)

Figure 1.

Item Memory Sensitivity



Note. The above figure depicts item memory sensitivity across the self, friend and pet encoding conditions. Each condition was significantly different from all others.

Source Memory Sensitivity

Differences in source memory sensitivity were not significant, $F(2,69)= 1.65$, $p=.20$, $\eta^2_p = 0.02$.

Experiment 2

In experiment one we showed that pets were not as cognitively close to the self as close friends. Here we assessed whether pets were considered an extension of the self by including a familiar, but not personally known, celebrity (Boris Johnson). We chose Boris Johnson as we have previously shown that a cognitive distance is observed in relation to a close friend in young adults from a comparable cohort (Kokici et al., 2023).

Method

Participants

Seventy-three healthy young adults who owned a dog or cat were recruited from [Redacted for purpose of anonymity]. All participants were free from psychiatric or neurological illness. The sample was set to match experiment one, with additional participants recruited in case of any issues with non-compliance or technical issues. One participant failed the attention check (see below), resulting in a final sample of 72 (mean age = 19.58 yrs, $sd=3.08$, 59F/12M/1Non Binary).

Episodic Memory Task

The task was identical as experiment one with 20 additional words encoded in relation to a celebrity (Boris Johnson) and 20 additional distractor words in the recognition phase. We asked an addition question, “How familiar is Boris Johnson to you?” on a scale from 1-9. We also included four attention checks, instructing participants to select a certain response on the slider, rather than respond to an adjective. We removed anyone who did not respond correctly to all four attention checks.

Procedure

The study was completed online using both the Qualtrics and Pavlovia platforms. Ethical clearance was granted by The University of Kent Psychology Ethics Committee.

Statistical Design

Analyses are identical to experiment one, except here we computed two 1x4 repeated-measures ANOVAs for item and source memory sensitivity due to the addition of the Celebrity condition.

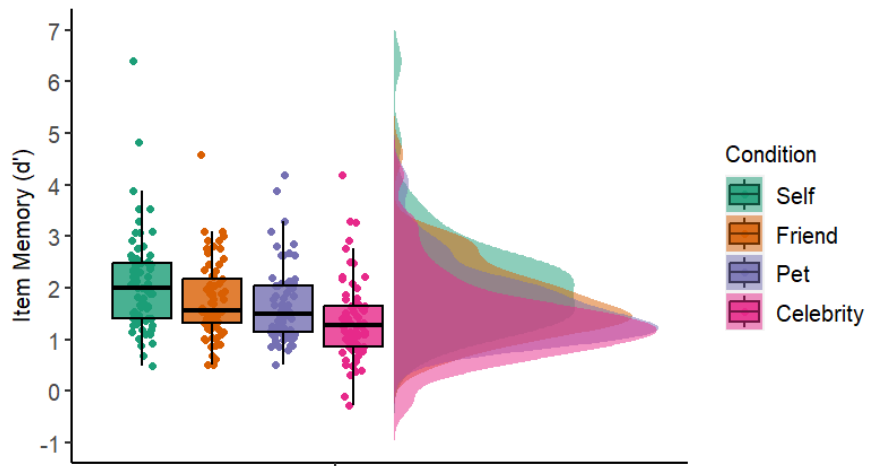
Results

Both dogs ($M=8.42$) and cats ($M=8.32$) were rated as very close and these did not statistically differ, $t(70)=0.42$, $p=.68$, $d=.10$. Participants reported feeling as close to their pets as to their close friends, $t(71)=0.27$, $p=.79$, $d=0.03$. There was no relationship between closeness to friend and the difference in memory between self and friend-encoded words, $r(70)=0.07$, $p=.56$. Likewise for

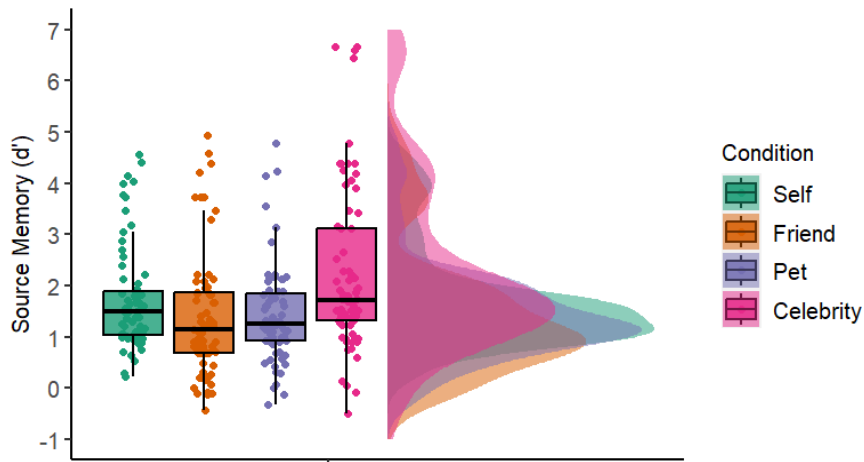
closeness to pet and memory difference between self and pet-encoded words, $r(70)=-.12$, $p=.33$. Boris Johnson was rated moderately familiar ($M=6.21$) and this did not correlate with SRE compared with Celebrity, $r(70)=.03$, $p=.80$.

Table 1. Item and source memory sensitivity across self, friend, pet, and celebrity encoding conditions.

	Self	Friend	Pet	Celebrity
	M (sd)	M (sd)	M (sd)	M (sd)
Item Memory Accuracy %	68.8 (17.8)	59.7 (18.1)	55.9 (16.6)	45.6 (18.7)
Item Memory d'	2.08 (0.94)	1.75 (0.73)	1.65 (0.72)	1.36 (0.77)
Source Memory accuracy %	71.0 (18.6)	74.1 (20.8)	69.1 (18.2)	74.9 (19.6)
Source Memory d'	1.72 (1.00)	1.42 (1.22)	1.43 (0.95)	2.24 (1.59)

Figure 2.*Item Memory Sensitivity*

Note. The above figure depicts item memory sensitivity across the self, friend and pet encoding conditions. Self, friend, and pet-encoded words were all recognized better than celebrity-encoded words. All conditions were significantly different except close friend and pet ($p=.09$).

Figure 3.*Source Memory Sensitivity*

Note. The above figure depicts source memory sensitivity across the self, friend, pet, and celebrity encoding conditions. Source memory for self, friend, and pet-encoded words was less sensitive than for celebrity-encoded words.

Item Memory Sensitivity

A main effect of AGENT was observed, $F(3,71)=49.24$, $p<.001$, $\eta^2_p = 0.41$. Post hoc tests showed greater item memory sensitivity for SELF-encoded words compared with FRIEND, $t(71)=5.44$, $p<.001$, $d=0.41$, PET, $t(71)=7.12$, $p<.001$, $d=0.54$, and CELEBRITY, $t(71)=0.91$, $p<.001$, $d=0.91$. No significant difference was identified between FRIEND and PET, $t(71)=1.68$, $p=.09$, $d=0.13$, whereas FRIEND-encoded words showed greater item memory sensitivity than

CELEBRITY-encoded words, $t(71)= 6.59$, $p<.001$, $d=0.50$. PET-encoded words had greater item memory sensitivity than CELEBRITY-encoded words, $t(71)= 4.91$, $p<.001$, $d=0.37$.

The difference between close friend and pet was not significant when limited to either dog owners, $t(37)=0.21$, $p=.83$, $d= 0.03$, or cat owners, $t(33)= 0.51$, $p=.61$, $d=0.12$. However, words encoded in relation to dogs, $t(37)=4.43$, $p<.001$, $d=0.62$ and cats, $t(33)=3.66$, $p=.001$, $d=0.54$ were recognised better than celebrity-encoded words.

It should be noted that in the combined sample (Experiment 1 and 2), FRIEND-encoded words ($M=1.70$) were remembered significantly better than PET-encoded words (1.50), $t(141)= 3.46$, $p<.001$, $d= 0.29$.

Source Memory Sensitivity

A main effect of AGENT was observed, $F(3,71)= 9.94$, $p<.001$, $\eta^2_p = 0.12$. Post hoc tests showed CELEBRITY-encoded words were sourced with greater sensitivity than SELF, $t(71)= 2.99$, $p=.01$, $d= 0.42$, FRIEND, $t(71)= 4.75$, $p<.001$, $d= 0.67$, and PET-encoded words, $t(71)= 4.71$, $p<.001$, $d= 0.66$. No significant difference was identified for source memory sensitivity for SELF, PET, FRIEND-encoded words (p 's between .24 - .97).

Discussion

We assessed whether pets hold a similar cognitive standing as close friends using an episodic memory task reliant on encoding information in relation to the self, a close friend, or a

pet. We identified a self-reference effect in accordance with previous research (Symons & Johnson, 1997) such that self-encoded words were recognised better than both friend and pet-encoded words. Crucially, we show that friend-encoded words display superior recognition (experiment 1), or comparable recognition (experiment 2), compared with pet-encoded words. Despite statistically comparable recognition in experiment two, the direction of effect was similar to experiment one, and when analysed together show that close friends and pets may have some overlap in ‘cognitive space’, but that friends likely share a greater overlap with the self. We also evidence pets as an extension of the self, as pet-encoded words were recognised better than celebrity-encoded words (experiment 2). It is also interesting to note that we did not identify a self-reference effect in source memory as has previously been shown (Lawrence & Chai, 2021). Instead, we show that self, friend, and pet-encoded words may occupy a similar representational space, resulting in source confusion. The increased number of self-relevant conditions and the use of sensitivity measures may explain the discrepancy with previous findings.

Pets are often considered proxies for human, social connection. However, these results suggest that we likely represent close friends as more similar to the self than we do our pets. Although pets may be considered social companions (Meehan et al., 2017), and may facilitate social connection with others (Wood et al., 2015), pets may not occupy the same cognitive ‘space’ as human social companions. Future research could include acquaintances or strangers to provide further information as to the cognitive space occupied by pets, length of friendship and pet ownership, and conduct research under more stringent laboratory based conditions rather than online. Research should assess cognitive biases towards pets in older adults and in those who experience periods of social disconnection.

Conflict of Interests

The authors declare no conflict of interests

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None to report

Data Availability

Data is available in the following repository [redacted for anonymous review]

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