



Object attachment and emotions in hoarding disorder

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ABSTRACT

Background and aims: Object attachment is a core feature of hoarding disorder (HD), but it also occurs in people without HD. It is therefore critical to clarify differences between normal and abnormal object attachment. Although previous studies show that HD is associated with high emotional reactivity, no study to date has examined the nature and intensity of discrete emotions in people with and without HD in relation to object attachment.

Method: Individuals with HD ($n = 93$) and matched controls ($n = 93$) were recruited via MTurk. They identified and described a possession of low monetary value that they were emotionally attached to and found difficult to discard. Participants rated their object attachment and the intensity of emotions when imagining being with the object (Scenario A) and irretrievably losing the same object (Scenario B).

Results: Unexpectedly, there were no significant between-group differences on object attachment; however, the HD group experienced more incongruent emotions about their possessions; they reported significantly higher disgust, anxiety and anger than controls when they imagined being with their chosen object (Scenario A) and were more relaxed compared to controls when the object was lost (Scenario B). There were no significant differences between groups on congruent emotions (i.e., positive emotions in Scenario A or negative emotions in Scenario B).

Conclusion: People with and without HD experience similar emotional attachment for sentimental items but people with HD experience more mixed emotions, consistent with an insecure object attachment.

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1. Introduction

Hoarding disorder (HD) is characterized by a strong need to save possessions and distress when discarding items, resulting in clutter and congested living spaces [1]. According to the cognitive-behavioural model, a central feature of HD is the emotional attachment that people with HD have for their possessions [2,3]. Objects take on a special significance, are imbued with human-like qualities, and bring feelings of comfort and safety. However, although an emotional attachment to objects is prominent in HD, it also occurs in people without HD [4]. Research in consumer psychology shows that most people have personal possessions that are treasured and experience strong emotional bonds with these objects. These possessions serve as extensions of self and identity or are cues to memories of important life events or significant others [5,6]. Furthermore, collectors can be differentiated from people with HD even though collectors are also emotionally attached to their collections [7]. Given that emotional attachment to objects (or object attachment) can exist without hoarding behaviours, differences

between normal and abnormal object attachment require further investigation. Understanding these differences could guide clinicians and researchers to focus on critical aspects of object attachment in HD. In their review of object attachment in HD, Kellett and Holden [8] suggested that one aspect that requires further investigation is the nature and intensity of both positive and negative emotions experienced by HD sufferers in relation to their possessions.

1.1. Emotions for objects in HD

Consistent with the cognitive-behavioural model of HD, several studies have demonstrated the positive association between HD and object attachment [8]. Compared to both clinical and non-clinical controls, individuals with HD have significantly higher levels of object attachment [3,9]. However, these studies use the emotional attachment subscale in the Saving Cognitions Inventory [10], which assesses the intensity of general feelings about possessions (e.g., "I could not tolerate it if I were to get rid of this") but does not provide information about discrete emotions that arise from object attachment.

The nature of object attachment in HD is probably most evident in the emotional reactions that occur when relating to possessions, and especially when facing the prospect of losing or having to discard them

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[11]. However, only a handful of studies have examined discrete emotions in HD. Taylor, Theiler, Nedeljkovic and Moulding's [12] recent qualitative study showed that hoarding behaviours served as sources of both positive and negative emotions for people with HD. Happiness was the most frequently reported positive emotion while anger, sadness, anxiety, depression and stress were the most common negative emotions. Interestingly, interpersonal relationships rather than possessions were identified as the main source of negative emotions. Feelings of loss and violation were prominent when family members discarded their possessions. Unfortunately, due to the qualitative nature of the study, it was not possible to quantify the levels of these emotions and evaluate whether HD participants had more intense emotions than people without HD.

Studies on emotion regulation in HD show that people with HD have higher emotional reactivity and thus might experience more intense emotions about possessions [13–15]. Timpano and colleagues [15] showed that HD symptoms of acquisition and difficulties discarding were positively associated with more intense fear, sadness and anger during mood inductions even after controlling for depression and anxiety. Likewise, Shaw and Colleagues [14] showed, in a large sample of self-identified individuals with HD, that after controlling for age, gender, depression and anxiety, hoarding symptoms were positively associated with general emotional reactivity. Furthermore, they found that HD symptoms (esp. acquisition and difficulties discarding) were associated with higher self-report ratings of anger, disgust, fear, sadness and not just right feelings during an imagined discarding task.

Although these studies showed that HD is associated with stronger negative emotions during imagined discarding, they did not examine the intensity of positive emotions associated with possessing the object. Given that possessions can serve as sources of comfort and security [16], it is possible that people with HD experience stronger positive emotions when they are with their possessions. Another aspect that requires further examination is the nature and intensity of emotions for objects that are difficult to discard in people without HD. As noted, if object attachment is a normal phenomenon, it is likely that people without HD also experience strong emotions for items that are difficult to discard. Whether there is a difference in the intensity of emotions experienced in relation to such items between individuals with and without HD has never been explored.

1.2. Aims and hypotheses

The aim of the current study is to examine the difference between individuals with and without HD in the nature and intensity of emotions triggered by an object with low monetary and use value, to which they had strong emotional attachments and found difficult to discard. Consistent with previous research showing that HD is associated with high emotional reactivity, we hypothesized that compared to a matched control group, individuals with HD would (1) report greater object attachment for the item, (2) experience stronger positive emotions when imagining being with the item, (3) stronger negative emotions when asked to imagine losing the item, and (4) experience the emotions for a longer time following its loss. Finally, we hypothesized that (5) individuals with HD will use more positive words and fewer negative words to describe their item than the matched control group.

2. Methods

2.1. Participants

Participants were part of a larger study [17] which comprised 532 individuals, of which 115 participants scored higher than the clinical cut-off score of ≥ 39 on the Saving Inventory – Revised (SI-R) [18,19]. Participants were recruited from Mechanical Turk (MTurk) and restricted to North American MTurk workers with at least 95% approval ratings. MTurk is a crowdsourcing marketplace that links workers to jobs

involving discrete computerized tasks (www.Mturk.com). MTurk samples have been shown to produce reliable and valid data [20] and are well suited for clinical psychology research given the higher prevalence of clinical symptoms [21]. The high prevalence of probable HD in the current sample is also consistent with recent research showing higher rates of hoarding behaviours in online samples [22] and MTurk studies [23].

Participants in the current study were drawn from the larger sample to form two groups matched on age, sex, and psychological distress as measured on the Depression Anxiety, and Stress Scales (DASS-21) [24]. A total of 186 participants were selected using fuzzy case control matching on SPSS v25 to form a hoarding disorder (HD) group and a matched control group. The group indicator was the cut-off score of 39 on the SI-R. Tolerance levels for age, sex, and psychological distress were set at 5, 0, and 5 respectively. Sampling was conducted without replacement and priority was given to exact matches. Case order was randomized when drawing matches. The HD group ($n = 93$) comprised 46 males and 47 females who scored higher than the SI-R clinical cut-off score. The control group ($n = 93$) comprised individuals who scored below the clinical cut-off score on the SI-R and also had 46 males and 47 females. There were no significant differences between groups on age and psychological distress (Table 2).

2.2. Materials

The following self-report measures were administered using an online survey platform (www.qualtrics.com).

2.2.1. Hoarding severity

Hoarding severity was assessed using the 23-item Saving Inventory – Revised (SI-R) [18]. The SI-R is a self-report questionnaire with three subscales measuring compulsive acquisition, difficulties in discarding, and clutter. Participants rate their experiences over the past week about their possessions in general on a 5-point scale from 0 (None/Not at all/Never) to 4 (Almost All or Complete/Extreme/Very Often). The total scale and subscales have excellent psychometric properties [25]. In the current sample, the internal consistency reliability of the total score and the compulsive acquisition, difficulties in discarding, and clutter subscales were very good ($\alpha = 0.95, 0.85, 0.90,$ and 0.93 respectively).

2.2.2. Psychological distress

To measure psychological distress, the 21-item Depression Anxiety Stress Scales (DASS-21) [24] were administered. The DASS-21 comprises three 7-item subscales: depression, anxiety and stress. Participants rate how they have been feeling for the past week on a 4-point scale from 0 (never) to 3 (always). The sum of all items multiplied by 2 was used as an indicator of overall psychological distress in the current study [24]. The DASS-21 has excellent psychometric properties [26]. The internal consistency reliability of the DASS-21 in the current sample was also excellent ($\alpha = 0.94$).

2.2.3. Discrete emotions

The Discrete Emotions Questionnaire (DEQ) [27] was used to measure participants' emotional responses to the objects that participants reported having difficulties discarding (see procedure). Participants were asked to rate the extent to which they experience 32 emotions on a 7-point scale from 1 (not at all) to 7 (an extreme amount) when (1) imagining themselves with the items and (2) imagining that they had accidentally and irretrievably discarded the items. These emotions form eight subscales of Anger, Disgust, Fear, Anxiety, Sadness, Desire, Relaxation, and Happiness, and have very good psychometric properties [27]. The internal consistency reliabilities of subscales in the current sample ranged from $\alpha = 0.76$ to 0.94 .

2.2.4. Vividness of mental imagery

As the study required participants to imagine being in different scenarios, their ability to vividly imagine mental images was a potential confound that needed to be measured. We therefore used the Vividness of Visual Imagery Questionnaire (VVIQ) [28] to measure the vividness of mental imagery. The VVIQ is a 16-item measure of the vividness of participants' mental imagery. Participants are asked to visualise four scenes and rate the clarity of the mental image on a 5-point Likert scale from 1 (no image at all) to 5 (perfectly clear and vivid as real seeing). The VVIQ has excellent psychometric properties with a test-retest reliability of 0.74 [28]. The internal consistency reliability in the current sample was very good ($\alpha = 0.91$).

2.2.5. Object attachment

The extent to which participants felt emotionally attached to the selected object was measured using a visual analogue scale (VAS) and the Relationship between Self and Items Scale (RSI) [29]. In the VAS, participants rated the extent to which they felt emotionally attached to the object from 0 (no emotional attachment) to 100 (extremely strong emotional attachment). In the RSI, participants were asked to choose, from a series of seven Venn-like diagrams, which one diagram best described their current relationship with the item. The diagrams depicted the interrelatedness between the self and the item using increasingly overlapping circles. The RSI showed good convergent and divergent validity and sensitivity to change following treatment [29].

2.3. Procedure

Following ethics approval, MTurk workers were recruited using Turkprime (www.turkprime.com) and invited to participate in "a survey examining our relationship to our possessions". Participants accessed the link to the Qualtrics survey and completed demographic information first. They were then instructed to think about a personal possession which they found difficult to discard or recycle. The item should be objectively of low value, and no longer used or useful. A list of examples was provided to constrain the choice of items (see Appendix A). Participants could indicate if they did not have such an item in their possession but none in the current sample did so. Participants were asked to write a short description of the item, their reasons why the item is difficult to discard, and any further thoughts about the item. They then rated their emotional attachment to the item on a 100-point visual analogue scale and completed the RSI.

Participants were then asked to respond twice to the DEQ. In the first scenario (Scenario A), participants were instructed to "Think of this item and imagine that you have it with you now". In the second scenario (Scenario B), participants were instructed to "Now think of this item and imagine that you accidentally threw away the item and you are unable to get it back." Participants were also asked to rate how long they expected to feel the emotions following Scenario B (emotion latency) and the highest amount they were willing to pay (WTP) to buy back the item if it was lost. WTP is used in this study as an indicator of the object's perceived monetary value. Participants then completed a series of self-report questionnaires including the SI-R, DASS-21 and the VVIQ. Participants were paid US\$4 upon completion of the study. Participants were also provided the option of uploading pictures of these items.

2.4. Data analysis

Two one-way analyses of variance (ANOVA) were conducted to examine differences between groups in object attachment as measured by the VAS and RSI. Due to the extreme positively skewed distributions on several measures (i.e., some of the DEQ subscales, WTP and emotion latency), and a failure to meet the homogeneity of variance assumption for parametric analyses, the non-parametric Mann-Whitney *U* test was used to examine differences between the HD and matched control groups. Given the large number of comparisons (eight discrete

emotions per scenario), a Bonferroni adjustment was made to the alpha level ($0.05/8 = 0.006$).

To examine the emotional content of text descriptions of items chosen, a Linguistic Inquiry and Word Count analysis was conducted using LIWC2015 (liwc.wpengine.com). LIWC15 is a computer-based text analysis program designed to read and count target words. The program counted the number of negative and positive emotion words (as defined in the LIWC2015 dictionary) in the text that participants wrote to describe the item, their reasons why the item is difficult to discard, and any other further thoughts about the item. The Mann-Whitney *U* test was used to compare differences in word counts for positive and negative words between the two groups.

3. Results

3.1. Preliminary analyses

There was a significant difference between groups on hoarding severity but no significant differences between groups on age, psychological distress, and vividness of mental imagery (Table 2). There were also no significant differences between groups on family income, $\chi^2(7) = 11.98, p = .10$.

To examine if there were differences between groups on the perceived monetary value of objects, we asked participants the largest amount of money they were willing to pay (WTP) to buy back the item in Scenario B. WTP ranged from \$0 to \$1,000,000 (Mdn = \$50.00, skewness = 13.60, kurtosis = 185.26). There was no significant difference between the control group ($n = 93$, mean rank = 98.72) and the HD group ($n = 93$, mean rank = 88.28), $U = 3839.00, p = .185, r = -0.10$.

To examine if there were differences between groups on the type of possession that was chosen, two independent raters read the descriptions, reasons and other comments about the chosen possession, and then categorized objects into one of four categories: a sentimental item, a functional item, an item with both sentimental and functional aspects, and an *other* category (where the item was difficult to discard because of some other reason).¹ Table 1 shows the categories of items across the two groups. Most items in both groups were of sentimental value. The control group tended to select more sentimental items and the HD group tended to select more functional items but differences between groups were not statistically significant, $\chi^2(2) = 4.78, p = .09$ (excluding the three participants who chose items that were neither sentimental nor functional). To examine if the type of item affected our results, we conducted statistical analyses with participants who selected sentimental or mixed items ($n = 147$). There were no substantial differences in findings between the partial and full sample, and as such the full sample was used.

3.2. Object attachment

Two one-way ANOVAs were conducted to evaluate differences between groups on the measures of object attachment: the VAS for object attachment and the RSI. There were no significant differences between groups (Table 2).

¹ The percentage of agreement between raters was 82.8% with an inter-rater reliability of $\kappa = 0.67, p < .0001$, indicating a moderate level of agreement. 81.3% of disagreements occurred when there were disagreements as to whether it was a sentimental, functional or mixed item (i.e., having both sentimental and functional aspects). To resolve these differences, these items were re-categorized in the mixed category. The remaining 18.8% of disagreements occurred when an item was categorized in the *other* category by one rater but was considered either sentimental, functional or mixed by the other rater. In these instances, the sentimental, functional or mixed categories were used.

Table 1
Number of participants (percentages in parentheses) across groups for categories of items chosen for the imaginal task.

	Control group, <i>n</i> = 93	HD group, <i>n</i> = 93
Sentimental	63 (67.7%)	49 (52.7%)
Functional	13 (14.0%)	23 (24.7%)
Mixed	16 (17.2%)	19 (20.4%)
Other	1 (1.1%)	2 (2.2%)

3.3. Discrete emotions

The DEQ results showed that for both control and HD groups, Scenario A (where participants imagined themselves being with the item) triggered high levels of positive emotions (desire, happy, relaxed), whilst Scenario B (where they imagined the item being lost) triggered high levels of negative emotions (anger, anxiety, fear, sad). There were no significant differences between groups on these emotions that were congruent with the scenarios (see Tables 3 and 4).

However, the HD group was more likely to experience incongruent emotions compared to the control group, with significantly higher levels of negative emotions: anger, anxiety, and disgust in Scenario A and significantly higher levels of relaxed feelings in Scenario B (Tables 3 and 4).

Participants also reported how long they expected to feel the emotions after scenario B (i.e., emotion latency). Two participants entered extreme values (999,999,999,999 and 100,000 days) and were excluded from the analyses. Emotion latency ranged from 0 min to 50 years (*Mdn* = 10 days, skewness = 10.53, kurtosis = 120.59). The control group reported longer emotion latency (*n* = 93, mean rank = 100.96) than the HD group (*n* = 91, mean rank = 83.86). $U = 3445.00$, $p = .029$, $r = -0.16$.

3.4. Linguistic and Word Count Analysis (LIWC)

Participants wrote descriptions about their selected item and reasons why they have difficulties discarding the item even though it is of low monetary value and would be considered useless by other people. They also had an opportunity to include further thoughts about the item. The majority of participants wrote rich descriptions of their chosen item and explained in detail the reasons why the item is difficult to discard. The average number of words was 100.57 (*SD* = 58.00) in the HD group and 111.72 (*SD* = 65.96) in the control group. There were no significant differences between groups on word count, $U = 4005$, $p = .39$, $r = 0.06$.

Table 2
Differences between control and HD groups on psychological distress, hoarding, vividness of mental imagery, and object attachment.

	Control group (<i>n</i> = 93) Mean (SD)	HD group (<i>n</i> = 93) Mean (SD)	<i>F</i> (1, 184)	<i>p</i>	Effect Size, η^2
Age	34.30 (8.49)	34.20 (9.14)	0.006	0.94	0.001
DASS-21 Total	41.05 (27.27)	43.40 (26.56)	0.353	0.55	0.002
SI-R (Total)	20.71 (10.21)	49.41 (8.92)	416.8	<0.0001	0.69
SI-R ACQ	6.57 (3.55)	13.96 (3.85)	185.4	<0.0001	0.50
SI-R DD	8.36 (4.63)	16.99 (3.99)	185.9	<0.0001	0.50
SI-R CL	5.79 (4.58)	18.46 (5.56)	288.2	<0.0001	0.61
VVIQ	56.13 (12.63)	55.56 (10.66)	0.111	0.74	0.001
VAS	76.36 (25.01)	72.67 (27.41)	0.919	0.339	0.005
RSI	4.45 (1.53)	4.35 (1.97)	0.140	0.708	0.001

Note. DASS-21Total = Depression Anxiety and Stress Scales Total score, SI-R (Total) = Saving Inventory Revised Total Score, SI-R ACQ = Acquisition subscale, SI-R DD = Difficulties discarding subscale, SI-R CL = Clutter subscale, VVIQ = vividness of visual imagery questionnaire, VAS = visual analogue scale for object attachment, RSI = Relationship between Self and Items Scale.

To examine whether there were differences between groups on how they felt about their chosen object, the number of emotion words were counted using LIWC2015 for participants' descriptions, thoughts about, and reasons for saving their chosen items. Results showed no significant differences between the control group (*n* = 93, mean rank = 95.83) and the HD group (*n* = 93, mean rank = 91.17) for positive emotion words, $U = 4108$, $p = .56$, $r = -0.04$. There were also no significant differences between the control group (*n* = 93, mean rank = 93.11) and the HD group (*n* = 93, mean rank = 93.89) for negative emotion words, $U = 4361$, $p = .92$, $r = 0.01$.

4. Discussion

The current study compared individuals with and without HD on discrete emotions associated with both possessing and losing an item that was difficult to discard. Results were inconsistent with hypotheses. There were no significant differences between the HD and control groups on both measures of object attachment. Furthermore, when imagining being with the item, the HD group did not experience significantly stronger positive emotions compared to the control group, and when imagining loss of the item, the HD group did not experience stronger negative emotions compared to the control group. Analyses of word counts also failed to show significant differences between groups on the number of positive and negative emotion words used to describe the item. Also unexpected was the finding that participants in the control group reported feeling the emotions for a longer time after losing the item compared to the HD group.

Interestingly, the HD group experienced significantly more incongruent emotions in both scenarios. That is, when imagining being with the item, the HD group had significantly stronger negative emotions of anger, anxiety, and disgust. On the other hand, when imagining the loss of the item, the HD group felt more relaxed compared to the control group.

4.1. Congruent emotions

The findings regarding the similarity between groups for congruent emotions are inconsistent with previous studies that have shown greater emotional reactivity among individuals with HD [14]. It is possible that stronger emotions in the HD group were not detected because the imaginal tasks were not sufficiently distressing for participants. Only one object was selected and perhaps differences in emotional intensity might have been more pronounced if the imaginal task involved the loss of a larger number of objects. Furthermore, the task instructions asked participants to imagine accidentally throwing away the item. Differences in emotional intensity might have been observed if the instructions required imagining discarding the item intentionally or imagining someone else discarding the item, which might have triggered additional distress associated with decision making difficulties and interpersonal difficulties. Differences might also have been observed if participants were required to choose other types of items. For example, it is possible that the acquisition and loss of a new and novel item would trigger stronger emotions in people with HD [30]. Alternatively, research with different task instructions and different items might elucidate other emotional aspects of object attachment that are more distressing to people with HD than controls. The study design could also be enhanced by using psychophysiological methods which would provide an objective real-time assessment of distress associated with object attachment in HD [31].

Another explanation for the lack of differences between groups is that the task instruction (choosing an item of low value that is difficult to discard) might have resulted in choosing of different types of items. Our preliminary analyses however showed no significant differences between groups on categories of items. Furthermore, when we excluded participants who chose items that were difficult to discard for reasons other than sentimental value, results were similar between

Table 3
Differences between groups in DEQ when imagining being with the item (Scenario A).

	Control group (n = 93)		HD group (n = 93)		Mann-Whitney U	p	Effect size, r
	Mean (SD)	Mean Rank	Mean (SD)	Mean Rank			
Anger	4.46 (1.34)	81.78	6.20 (4.08)	105.22	5414.5	<0.0001*	0.28
Anxiety	5.80 (3.25)	80.77	7.69 (4.60)	106.23	5508.0	<0.0001*	0.26
Disgust	4.32 (0.90)	83.13	5.85 (3.80)	103.87	5288.5	0.001*	0.25
Fear	4.71 (1.69)	85.27	6.11 (4.26)	101.73	5090.0	0.008	0.19
Sad	8.00 (5.78)	85.72	9.10 (5.35)	101.28	5048.5	0.044	0.15
Desire	10.75 (6.43)	86.01	12.13 (5.96)	100.99	5021.0	0.057	0.14
Happy	15.34 (7.07)	91.98	15.77 (6.81)	95.02	4466.0	0.70	0.03
Relaxed	14.05 (7.16)	92.00	14.36 (6.80)	95.00	4464.0	0.70	0.03

Note. DEQ = Discrete Emotions Questionnaire. The minimum score on each subscale is 4 and the maximum is 28.

* $p < .006$.

this partial sample and the full sample indicating that our findings were not due to the type of items that participants selected. It was nonetheless interesting that the HD group had almost twice the number of functional objects than the control group, which is consistent with their concerns about wasting things [31].

4.2. Incongruent emotions

The finding of higher levels of incongruent emotions in the HD group is novel and requires replication. These findings are consistent with research showing that HD symptoms are associated with an insecure attachment to objects [17,32] and indicate that people with HD have an emotional ambivalence for their possessions. Rather than just purely positive emotions, they feel insecure about their attachments to objects and as such, possessions are tinged with a range of negative emotions. Due to clutter and disorganisation, anxiety can arise because of concerns about losing the item. In addition, people with HD are often faced with the prospect that others might discard their possessions. They are reminded by others that their object attachments are unreasonable and irrational. These experiences might explain why they feel more anger and disgust when thinking about the chosen item, which is consistent with qualitative research showing that negative interpersonal interactions, rather than the discarding of things, triggered the most distress in people with HD [12].

Conversely, relief from the burden of having to save an item that is part of an excessively large collection of possessions might explain why individuals with HD report feeling more relaxed when imagining the loss of the item than the control group and why we found significantly shorter emotional latencies in the HD group.

4.3. Implications

Although there were differences in incongruent emotions, overall our findings suggest that people *without* HD do form strong emotional attachments to low value objects. Importantly, these results indicate that individuals with and without HD might be more similar than

different when it comes to the emotions associated with object attachment. Firstly, all participants regardless of hoarding severity could identify an item that they found difficult to discard. Secondly, all participants reported strong emotional attachments and positive emotions for these items regardless of hoarding severity. Finally, when lost, the items invariably triggered strong negative emotions which lasted longer in the control group. These findings are consistent with the idea that objects can serve as extensions of self and are reflections of our ability to create symbolic associations and relationships with our possessions regardless of extrinsic value [4].

4.4. Clinical implications

Individuals with HD or their family members might see HD treatment as requiring the complete negation of object attachment, and that successful treatment should somehow require an emotional detachment from belongings or minimalist homes. These findings suggest that having no object attachment is an unrealistic and unnecessary goal. Instead, we speculate that retaining emotional links with a small number of possessions might even be helpful. Perhaps improving their ability to identify and focus their object attachment on a small number of items could aid in discarding other items.

Interpersonal difficulties in HD sufferers are in part due to difficulties among family and friends to understand hoarding symptoms. Using the instructions and scenarios in the current study as part of family psychoeducation (e.g., asking family members to think of an object which was no longer used or useful that they have difficulties discarding) might help them better understand the challenges faced by HD sufferers. Further research into the use of this exercise in a non-clinical sample and its effects on empathy for HD is warranted. Recent research has shown that HD and object attachment are associated with loneliness [33,34]. Perhaps, a better understanding of object attachment from family and friends might lead to improvements in their relationships with the HD sufferer and a decrease in loneliness.

Finally, the finding that our participants with HD reported more incongruent emotions might be a useful evidence to cite to clients. This

Table 4
Differences between groups in DEQ when imagining loss of item (Scenario B).

	Control Group (n = 93)		HD group (n = 93)		Mann-Whitney U	p	Effect size, r
	Mean (SD)	Mean Rank	Mean (SD)	Mean Rank			
Anger	15.70 (8.00)	91.52	16.27 (7.06)	95.48	4509.0	0.62	0.04
Anxiety	13.84 (8.00)	91.10	14.18 (6.98)	95.90	4547.5	0.43	0.05
Disgust	8.57 (5.20)	87.54	9.54 (5.31)	99.46	4878.5	0.13	0.11
Fear	9.73 (7.01)	87.17	10.62 (5.95)	99.83	4913.0	0.11	0.12
Sad	16.77 (6.99)	93.96	16.71 (6.64)	93.04	4282	0.90	-0.01
Desire	13.36 (6.92)	87.25	14.88 (6.56)	99.75	4906.0	0.11	0.12
Happy	4.85 (2.24)	85.18	6.13 (4.28)	101.82	5098.5	0.008	0.20
Relaxed	5.07 (2.75)	82.13	6.85 (4.48)	104.87	5381.5	0.001*	0.25

Note. DEQ = Discrete Emotions Questionnaire. The minimum score on each subscale is 4 and the maximum is 28.

* $p < .006$.

might encourage further exploration of their ambivalent relationship with possessions as part of a motivational interviewing process to improve engagement with treatment [35].

4.5. Limitations

This is the first study to compare people with and without HD on discrete emotions and has shown interesting and counterintuitive findings that require further research. However, there are a few limitations that should be considered when interpreting the findings. Firstly, the study recruited MTurk workers who completed self-report questionnaires online. Although this method of recruiting participants has been shown to produce reliable and valid findings, clinical interviews with participants were not conducted to confirm their diagnosis of HD. In addition, the use of self-report measures to assess discrete emotions is limited by the participant's ability to accurately identify and assess their own emotional states. Another limitation is the quasi-experimental design of the study. Although we matched participants in age, gender, and psychological distress, other unknown confounding factors might have affected our findings. Finally, our conclusions are limited by the nature of the task in that only one object was selected. Although the task allowed for the testing of our hypotheses, further research is needed to examine if incongruent emotions are likewise experienced to a higher degree in HD for other types of objects (e.g., newly acquired items) or a wider range of possessions. It should also be added that we instructed participants to choose used objects that were of low monetary value. This ensured that objects chosen by participants were more likely to be deemed valuable for sentimental reasons. However, this meant that the same pattern of findings might not generalize to objects of high monetary value. Future research should examine the emotions triggered by objects of different monetary value in people with HD relative to controls. Furthermore, although allowing participants to choose their own objects increased the ecological validity of the study and ensured that objects were personally valued, it introduced variability in the type of object chosen. Future research could use a standardized set of objects.

5. Conclusion

Given that object attachment occurs in people with and without hoarding, we sought to identify whether there were differences between normal and abnormal object attachment in the experience of discrete emotions. Our findings showed that while both people with and without HD experience emotional attachments to objects, people with HD have more ambivalent feelings about their possessions. Further research into these incongruent or ambivalent emotions is recommended.

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Authors' contribution

Both authors made substantial contributions to the conception, design, data collection, analysis and interpretation of data. The manuscript was drafted by Keong Yap with critical revisions by Jessica Grisham. Both authors give final approval of the version to be submitted and any revised version.

Ethics

This study was approved by the University of New South Wales Human Research Ethics Advisory Panel C (File no. 2933) on 19th October 2017.

Declaration of competing interest

The authors are not aware of any actual or perceived conflict of interest, or potential conflict of interests.

Appendix A. Instructions for item selection, scenario A and B

A.1. Item selection

We are interested in knowing more about objects in people's homes that they find hard to discard or recycle, even though these items are objectively of low value and are no longer used or useful. Examples of such items include old clothes, books, mementos, souvenirs, greeting cards, letters, bills, statements, CDs, records, cassette tapes, knick knacks, stationery, magazines, old games and toys, old electrical or phone items, jewelry, clothing accessories, gifts, and old homewares such as kitchen utensils, containers, and mugs. Please think about the possessions in your home and select one item that is the most difficult to discard or recycle because you somehow feel attached to it, even though you know that the item is of low value and other people would have very little difficulty getting rid of it.

A.2. Scenario A

Think of this item and imagine that you have it with you now. Please rate the extent to which you experience the following emotions when you are with this possession on the following scale from 1 (not at all) to 7 (an extreme amount).

A.3. Scenario B

Now think of this item and imagine that you accidentally threw away the item and you are unable to get it back. Please rate the extent to which you experience the following emotions on the following scale from 1 (not at all) to 7 (an extreme amount).

How long do you expect to feel this way?

References

- [1] American Psychiatric Association. Diagnostic and statistical manual of mental disorders (5th Ed.). 5th edition ed. Arlington, VA: Author; 2013.
- [2] Frost RO, Hartl TL. A cognitive-behavioral model of compulsive hoarding. *Behav Res Ther.* 1996;34:341–50.
- [3] Kyrios M, Mogan C, Moulding R, Frost RO, Yap K, Fassnacht DB. The cognitive-behavioural model of hoarding disorder: evidence from clinical and non-clinical cohorts. *Clin Psychol Psychother.* 2018;225:311–21.
- [4] Belk RW. Attachment to possessions. *Human Behavior & Environment: Advances in Theory & Research.* 1992;12:37–62.
- [5] Belk RW. Possessions and the extended self. *J Consum Res.* 1988;15:139–68.
- [6] Kings CA, Moulding R, Knight T. You are what you own: reviewing the link between possessions, emotional attachment, and the self-concept in hoarding disorder. *J Obsessive Compuls Relat Disord.* 2017;14:51–8.
- [7] Nordsletten AE, Fernandez de la Cruz L, Billotti D, Mataix-Cols D. Finders keepers: the features differentiating hoarding disorder from normative collecting. *Compr Psychiatry.* 2013;54:229–37.
- [8] Kellett S, Holden K. Emotional attachment to objects in hoarding: A critical review of the evidence. In: Frost RO, Steketee G, Frost RO, Steketee G, editors. *The Oxford handbook of hoarding and acquiring.* New York, NY, US: Oxford University Press; 2014. p. 120–38.
- [9] Grisham JR, Steketee G, Frost RO. Interpersonal problems and emotional intelligence in compulsive hoarding. *Depress Anxiety.* 2008;25:E63–71.
- [10] Steketee G, Frost RO, Kyrios M. Cognitive aspects of compulsive hoarding. *Cognitive Therapy and Research.* 2003;27:463–79.
- [11] Grant JE, Chamberlain SR, Odlaug BL. *Clinical guide to obsessive compulsive and related disorders.* New York, NY: Oxford University Press; 2014.
- [12] Taylor JK, Theiler S, Nedeljkovic M, Moulding R. A qualitative analysis of emotion and emotion regulation in hoarding disorder. *J Clin Psychol.* 2019;75:520–45.
- [13] Crone C, Norberg MM. Scared and surrounded by clutter: the influence of emotional reactivity. *J Affect Disord.* 2018;235:285–92.
- [14] Shaw AM, Timpano KR, Steketee G, Tolin DF, Frost RO. Hoarding and emotional reactivity: the link between negative emotional reactions and hoarding symptomatology. *J Psychiatr Res.* 2015;63:84–90.
- [15] Timpano KR, Shaw AM, Coughle JR, Fitch KE. A multifaceted assessment of emotional tolerance and intensity in hoarding. *Behav Ther.* 2014;45:690–9.

- [16] Hartl TL, Duffany SR, Allen GJ, Steketee G, Frost RO. Relationships among compulsive hoarding, trauma, and attention-deficit/hyperactivity disorder. *Behav Res Ther.* 2005;43:269–76.
- [17] Yap K, Grisham J. Unpacking the construct of emotional attachment to objects and its association to hoarding symptoms. *J Behav Addict.* 2019;8:249–58.
- [18] Frost RO, Steketee G, Grisham J. Measurement of compulsive hoarding: saving inventory-revised. *Behav Res Ther.* 2004;42:1163–82.
- [19] Kellman-McFarlane K, Stewart B, Woody SR, Ayers CR, Dozier ME, Frost RO, et al. Saving inventory - revised: psychometric performance across the lifespan. *J Affect Disord.* 2019;252:358–64.
- [20] Chandler J, Shapiro D. Conducting clinical research using crowdsourced convenience samples. *Annu Rev Clin Psychol.* 2016;12:53–81.
- [21] Arditte KA, Çek D, Shaw AM, Timpano KR. The importance of assessing clinical phenomena in mechanical Turk research. *Psychol Assess.* 2016;28:684–91.
- [22] Turna J, Patterson B, Simpson W, Pullia K, Khalesi Z, Kaplan KG, et al. Prevalence of hoarding behaviours and excessive acquisition in users of online classified advertisements. *Psychiatry Res.* 2018;270:194–7.
- [23] Raines AM, Boffa JW, Allan NP, Short NA, Schmidt NB. Hoarding and eating pathology: the mediating role of emotion regulation. *Compr Psychiatry.* 2015;57:29–35.
- [24] Lovibond SH, Lovibond PF. *Manual for the depression anxiety stress scales.* 2nd. ed.. Psychology Foundation: Sydney, Australia; 1995.
- [25] Coles ME, Frost RO, Heimberg RG, Steketee G. Hoarding behaviors in a large college sample. *Behav Res Ther.* 2003;41:179–94.
- [26] Henry JD, Crawford JR. The short-form version of the depression anxiety stress scales (DASS-21): construct validity and normative data in a large non-clinical sample. *British Journal of Clinical Psychology.* 2005;44:227–39.
- [27] Harmon-Jones C, Bastian B, Harmon-Jones E. The discrete emotions questionnaire: a new tool for measuring state self-reported emotions. *PLoS One.* 2016;11:e0159915.
- [28] Marks DF. Visual imagery in the recall of pictures. *Br J Psychol.* 1973;64:17–24.
- [29] Dozier ME, Taylor CT, Castriotta N, Mayes TL, Ayers CR. A preliminary investigation of the measurement of object interconnectedness in hoarding disorder. *Cognitive Therapy and Research.* 2017;0:1–7.
- [30] Grisham JR, Frost RO, Steketee G, Kim H, Tarkoff A, Hood S. Formation of attachment to possessions in compulsive hoarding. *J. Anxiety Disord.* 2009; 23:357–61. [31] Norberg MM, Beath AP, Kerin FJ, Martyn C, Baldwin P, Grisham JR. Trait versus task-induced emotional reactivity and distress intolerance in hoarding disorder: Transdiagnostic implications. *Behav. Ther.* 2020;51:123–34.
- [31] Frost RO, Gabrielson I, Deady S, Dernbach KB, Guevara G, Peebles-Dorin M, et al. Scrupulosity and hoarding. *Compr Psychiatry.* 2018;86:19–24.
- [32] Nedelisky A, Steele M. Attachment to people and to objects in obsessive-compulsive disorder: an exploratory comparison of hoarders and non-hoarders. *Attach Hum Dev.* 2009;11:365–83.
- [33] Burgess AM, Graves LM, Frost RO. My possessions need me: anthropomorphism and hoarding. *Scand J Psychol.* 2018;59:340–8.
- [34] Yap K, Eppingstall J, Brennan C, Le B, Grisham J. Emotional attachment to objects mediates the relationship between loneliness and hoarding symptoms. *J Obsessive Compuls Relat Disord.* 2020;24.
- [35] Chasson GS, Carpenter A, Ewing J, Gibby B, Lee N. Empowering families to help a loved one with hoarding disorder: pilot study of family-as-motivators training. *Behav Res Ther.* 2014;63:9–16.