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Behavioral and Emotional Consequences of Thought Listing versus Cognitive Restructuring during Discarding Decisions in Hoarding Disorder

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Abstract

An essential criterion for hoarding disorder (HD) is difficulty discarding or parting with possessions, yet few studies have examined reactions to actual discarding behaviors. The present study examined whether individuals with HD differed from non-hoarding community controls (CC) in discarding behavior and emotional reactions to discarding. A second purpose was to examine the course of experienced distress following discarding. A third purpose was to determine whether HD participants responded differently to a simple thought listing (TL) instruction or to a cognitive restructuring (CR) protocol. Participants were asked to decide whether to keep or discard (a) a personal possession and (b) a newly acquired object (magazine). HD participants anticipated more and longer distress and reported stronger attachment motives than community controls, but they did not differ significantly from community controls in actual discarding behavior. TL was somewhat more effective than CR in improving discarding behavior and reducing negative emotions and attachments to discarded objects among HD participants. Reductions in distress were observed for both HD-TL and HD-CR groups. Thought listing may have reduced avoidance of decision-making about discarding or perhaps CR, but not TL, provoked therapeutic reactance. Discarding was not related to reductions in distress or hoarding-related beliefs.

Keywords

hoarding; hoarding disorder; discarding; habituation

Hoarding disorder (HD) is characterized by severe difficulty parting with objects, resulting in clutter that impairs use of the home (American Psychiatric Association, 2013). Efforts to

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understand the mechanisms behind this reluctance to discard have focused on both cognitive and affective factors, as well as their interaction. Cognitively, individuals with HD appear to have difficulty with decision-making (Steketee & Frost, 2003), and research points to key problems of executive function that may impair the decision-making process (Grisham, Norberg, Williams, Certoma, & Kadib, 2010; Wincze, Steketee, & Frost, 2007). Affective aspects of HD include both anxiety and sadness when making decisions about possessions (Tolin, Stevens, Villavicencio, et al., 2012), likely fueled by maladaptive beliefs about responsibility for objects, being wasteful or losing important information, and excessive personal significance attributed to objects (Frost, Hartl, Christian, & Williams, 1995; Frost, Steketee, Tolin, Sinopoli, & Ruby, 2015; Steketee, Frost, & Kyrios, 2003).

These concerns raise questions about the adequacy of emotion regulation (ER) among individuals with HD. ER is a multidimensional construct that reflects an individual's capacity to downregulate negative affect (NA) and/or upregulate positive emotions (Gross, 1998). Tactics for ER may be behavioral (e.g., response modulation) or cognitive (e.g., reappraisal) (Gross & Thompson, 2007). Preliminary research suggests that student volunteers with hoarding symptoms exhibit ER-related problems such as greater intensity of NA and decreased emotion tolerance (Timpano, Shaw, Cougle, & Fitch, 2014). On self-report measures, individuals with HD report difficulty engaging in goal-directed behavior when distressed and difficulty accessing to strategies for regulating emotions (Fernandez de la Cruz et al., 2013), and report anticipating a higher level of NA when discarding (Shaw, Timpano, Steketee, Tolin, & Frost, 2015).

Cognitive-behavioral therapy (CBT) aims to improve ER capacity using both behavioral (response modulation) and cognitive (reappraisal) tactics (e.g., Steketee & Frost, 2007). This form of CBT has proven effective for HD, as evidenced by large pre-to-post effect sizes within a treated group as well as between treated vs. waitlist groups (Muroff, Steketee, Bratiotis, & Ross, 2012; Steketee, Frost, Tolin, Rasmussen, & Brown, 2010). Yet, most patients do not achieve clinically significant change or remission (Tolin, Frost, Steketee, & Muroff, 2015). That is, 57-75% of patients continue to exhibit clinical levels of severity. It is therefore reasonable to examine the utility of the specific tactics employed in CBT.

At a behavioral level, CBT for HD makes some use of exposure, although with less emphasis than CBT for other disorders such as obsessive-compulsive disorder (OCD). Clinical studies have suggested a relatively poor response to exposure-based CBT for hoarding vs. OCD patients (e.g., Abramowitz, Franklin, Schwartz, & Furr, 2003), but no study to date has examined the time course of emotional and behavioral responses to exposure in HD. Current models of extinction of emotional responses broadly, and exposure therapy specifically, focus on inhibitory learning in which one learning experience interferes with, or inhibits, another (Bouton, 1993). Primary affective characteristics in HD include not only fear, as has been studied in most research on exposure, but also a range of NA states including sadness, grief and guilt (Steketee & Frost, 2003; Tolin, Stevens, Villavicencio, et al., 2012). The extent to which these emotions are reduced during exposure is not clear. Craske et al. (2008) have further suggested that exposure may work by promoting toleration, rather than reduction, of negative emotional states. In such a case, reduction of negative

affect might not be observed in the short-term; rather, behavior would become disconnected from emotion and would be altered despite the continued presence of NA.

At a cognitive level, CBT aims to elicit cognitive reappraisal which is a key element of ER models (Gross & John, 2003). Cognitive reappraisal can be accomplished in multiple ways (Ochsner, Silvers, & Buhle, 2012). One well-known tactic is *reinterpretation*, which involves mentally changing the meaning of a stimulus (e.g., changing one's appraisal of an object from valuable to less valuable). Reinterpretation forms the core of traditional cognitive therapy (e.g., Beck, 1995), and as such has been emphasized in CBT for HD (e.g., Steketee & Frost, 2007). For example, patients are encouraged to ask themselves questions such as "do I have a plan to use this?" and "is this of good quality?" Changes in these beliefs are hypothesized to precede changes in discarding behavior.

There may be reason, however, to question the value of reinterpretation in CBT for HD. Although changes in cognition do play a mediational role in therapeutic outcome improvement for emotional disorders (DeRubeis et al., 1990; Hofmann et al., 2007; Smits, Rosenfield, McDonald, & Telch, 2006), dismantling research has often failed to demonstrate that the addition of reinterpretation-based cognitive interventions to behavioral interventions improves clinical outcomes (Adams, Brady, Lohr, & Jacobs, 2015). In the specific case of HD, basic research suggests impairments in many of the neural regions that have been reliably linked to reinterpretation in healthy controls and other patient groups, including anterior cingulate cortex, medial prefrontal cortex, and lateral orbitofrontal cortex (Saxena et al., 2004; Tolin, Kiehl, Worhunsky, Book, & Maltby, 2009; Tolin, Stevens, Nave, Villavicencio, & Morrison, 2012; Tolin, Stevens, Villavicencio, et al., 2012). It may be, therefore, that individuals with HD have diminished ability to recruit the frontal regions needed for effective reinterpretation.

Furthermore, we (Frost, Tolin, & Maltby, 2010) have noted that in some cases, cognitive challenging can elicit a defensive reaction among HD patients, consistent with the concept of *therapeutic reactance* (Beutler, Sandowicz, Fisher, & Albanese, 1996; Brehm, 1966), in which patients resist therapeutic interventions that they perceive as infringing on their sense of autonomy and self-control.

An alternative ER strategy, *distancing*, involves mentally changing one's personal connection to, or psychological distance from, a stimulus (e.g., mentally "detaching" from possessions or from one's internal thoughts and emotions). Although distancing is not strongly emphasized in traditional cognitive therapy, it is closely related to the concept of *cognitive defusion* (Luoma & Hayes, 2003) that is characteristic of acceptance- and mindfulness-based treatments (e.g., Hayes, Strosahl, & Wilson, 1999; Linehan, 1993). Simply identifying and attending to one's thoughts without debating or analyzing them is one commonly used method of distancing. Experimental research suggests that, in general, distancing may be a more effective tactic than reinterpretation for reducing negative affect (Ochsner et al., 2012). Whether that is the case for HD, and the extent to which reinterpretation and distancing lead to behavioral as well as affective change in HD, is unknown.

The present study examined behavioral, emotional, and cognitive responses to discarding decisions among participants with HD compared to non-hoarding community controls (CCs), by asking them to make decisions about a personal possession as well as a newly acquired item (a magazine) given to them by the experimenter. Extending prior research on emotional prediction and intensity in HD (Shaw et al., 2015; Timpano et al., 2014), we predicted that:

Hypothesis 1

When anticipating discarding of both personal possessions and a newly acquired item (magazine), participants with HD would (1a) report greater NA, (1b) endorse higher levels of maladaptive beliefs, and (1c) predict a longer duration of distress, compared to CC participants.

We further sought to examine the specific utility of behavioral (response modulation) and cognitive (reappraisal) tactics in modifying affective and behavioral responses to a decision-making task. Following an inhibitory learning model of exposure (Bouton, 1993), we predicted that:

Hypothesis 2

(2a) NA ratings would decrease for all groups over a relatively short period of time following discarding of a personal possession or a non-personal item given to them during the experiment. We also examined the possibility, following from the distress tolerance model (Craske et al., 2008), that (2b) behavioral responses (discarding) could occur even in the absence of changes in NA or maladaptive beliefs.

We tested the specific cognitive ER strategy of reappraisal (Ochsner et al., 2012), in which experimenters challenged participants' maladaptive beliefs during decision-making in order to guide their evaluation of the importance/value of the object and the advantages and costs of keeping it. Specifically, we investigated the extent to which emotions, cognitions, and behaviors are influenced by reinterpretation-based cognitive restructuring (CR) versus a comparison condition, thought listing (TL). Although TL was not designed specifically as a distancing strategy, listing one's thoughts might be considered a distancing strategy, as participants were simply asked to recite thoughts that came to mind, without instruction to evaluate or alter them in any way. We predicted that:

Hypothesis 3

HD participants receiving CR would (3a) save fewer items, (3b) show greater reduction in NA, and (3c) show greater reduction in maladaptive beliefs than would those receiving TL. However, consistent with research on distancing (Ochsner et al., 2012) and in keeping with certain biological (e.g., Tolin, Stevens, Villavicencio, et al., 2012) and behavioral (Frost et al., 2010) observations of HD, we also examined the possibility that (3d) CR might be ineffective or even less effective than TL.

To test these hypotheses, we used a decision-making task, similar to that used in CBT for HD, in which participants made discarding decisions about their actual possessions. Most

studies of the behavioral and cognitive aspects of HD have utilized neutral contexts that did not test decisions about discarding actual items, or modeled discarding using imaginary scenarios (Frost et al., 1998; Preston, Muroff, & Wengrovitz, 2009) without testing actual discarding behavior. Only Tolin and colleagues (Tolin et al., 2009; Tolin, Stevens, Villavicencio, et al., 2012) used an experimental discarding task involving personal possessions; they found that HD participants showed different patterns of neural activity while discarding compared to healthy controls. The need to employ active discarding tasks with personally relevant items to examine factors associated with discarding seems critical in understanding cognitive processes that maintain saving behavior (Frost et al., 1995).

Methods

Participants

The present study included 103 adult participants with HD and 66 community controls (CC), for a total sample of 169. An additional 12 participants were excluded due to recording errors. HD participants were recruited through news media, clinics and mental health settings, and via word of mouth. Trained interviewers used the Anxiety Disorders Interview Schedule (ADIS-IV) to determine diagnoses (see below). Consistent with current DSM-5 criteria for hoarding (American Psychiatric Association, 2013), inclusion in the HD group required interviewer ratings of moderate (rating of 4) or greater clutter, difficulty discarding, and distress or impairment from hoarding according to the Hoarding Rating Scale-Interview (HRS-I; Tolin, Frost, & Steketee, 2010). In addition, the clutter and difficulty discarding could not be attributed to another condition (e.g., OCD contamination, checking). HD was not required to be the primary diagnosis. CC participants were recruited through media advertisements and word of mouth; they were excluded if they met criteria for any mental disorder other than specific phobia. Criteria for exclusion from both groups were suicidal ideation or other risk factors requiring immediate attention, current psychotic symptoms, substance abuse or dependence within the past 3 months, and significant cognitive impairment such as mental retardation or dementia that could compromise informed consent or assessments.

Demographic information for participants is presented in Table 1; 74% were women and 90% identified as white, 6.1% as African American, and 1.7% as Asian American. The mean age of the sample was 52.4 years (SD=11.3, range=20-81). Comorbidities within the HD group included 55 participants with major depressive disorder, 24 with social phobia, 23 with generalized anxiety disorder and 11 with OCD. Within the HD group, 46 were randomly assigned via a coin toss to the thought listing condition (TL), and 57 were assigned to cognitive restructuring (CR). All 66 community controls were assigned to the TL condition.

Measures

The Anxiety Disorders Inventory Schedule for DSM-IV Lifetime version (ADIS-IV-L; Brown, Di Nardo, & Barlow, 1994) was used to determine diagnosis of OCD, anxiety, mood, somatoform, and substance use disorders and to screen for other conditions such as psychotic disorders. Clinical interviews were conducted by master's level clinical

psychologists or postdoctoral fellows trained to criteria using the ADIS-IV-L and supervised by licensed psychologists. The ADIS has shown good to excellent reliability for all the principal DSM-IV anxiety and mood diagnoses with the exception of dysthymia (Brown, Di Nardo, Lehman, & Campbell, 2001).

The *Hoarding Rating Scale-Interview* (HRS-I; Tolin et al., 2010) is a 5-item semi-structured interview that assesses symptoms of hoarding including difficulty discarding, clutter, acquisition, distress, and impairment. Responses are scored from 0 to 8, with a higher ratings indicating greater symptom severity. This measure has demonstrated excellent reliability (test-retest, inter-rater, home versus office, internal consistency) and validity (concurrent, discriminant) validity. The HRS was used in conjunction with the ADIS-IV-L to determine diagnosis of HD. The internal consistency (Cronbach's α) of the HRS-I in the present study was excellent (α=.97).

The *Saving Inventory-Revised* (SI-R; Frost, Steketee, & Grisham, 2004) is a self-report inventory containing 23 items scored from 0 to 4; higher scores indicate greater severity. SI-R subscales assess difficulty discarding, clutter, and excessive acquisition. The SI-R has shown good reliability and validity (Frost et al., 2004). Internal consistency for the three subscales was high in the current sample (α =.93-.98).

The *Possessions List-Discarding* (PL-D) is a list of 81 items or categories of items (e.g., clothing) based on a previously compiled list of objects that are most likely to be collected or hoarded (Frost & Gross, 1993). Participants were asked to rate the extent to which they saved or had difficulty discarding each item. These scores were used to determine which personal items to use in the present discarding task study. Examples of items selected for the discarding task included shirts, cereal boxes, school papers, catalogues, and baskets.

Three *discarding behaviors* were recorded: the number of personal items saved, decision to discard the first personal item considered (yes/no), and decision to discard the newly acquired item, a magazine (yes/no).

Distress Ratings were self-reported general feelings of distress ranging from 1 (not at all distressed) to 10 (most distress imaginable). Participants reported these ratings aloud to the experimenter before and after the TL/CR manipulation, immediately after the decision to discard, and at three 5-minute intervals after discarding (see procedure section).

After the first distress rating, participants were also asked to *predict* how long they expected their level of distress to last on a 10-point scale (1 =a few minutes or less; 3 = up to a day; 6 = several days to a week; 8 = a few weeks to a month; 10 = several months or more).

The *Saving Cognitions Inventory-Modified* (SCI-M) is an 11-item shortened version of the original 23-item SCI (Steketee et al., 2003) that used the same format and contained 5 subscales: emotional attachment, responsibility, and memory, aesthetic/intrinsic value, and utility/instrumental value. Participants completed the SCI-M before and immediately after the TL/CR manipulation. Alpha coefficients ranged from .78 to .94 for the five subscales in the present study.

Daily Ratings of the number of times they thought about the personal item and the newly acquired magazine were collected each day for the 7-days following the experiment. In addition, participants were asked to rate the extent to which they regretted discarding the personal item and the newly acquired magazine (from 1= no regret to 9 = intense regret) for each of the 7 days.

Procedure

The study was approved by the Institutional Review Boards at Smith College, Boston University, and Hartford Hospital. Participants signed an informed consent form following their participation in a diagnostic study on HD by the investigators (Frost, Steketee, & Tolin, 2011), and prior to the start of the current study at either Boston University or The Institute of Living at Hartford Hospital. Participants were reimbursed $20/hour for their participation. Data analyses were conducted with SPSS version 20.

Study procedures are depicted in Figure 1. Participants were interviewed using the ADIS-IV-L and HRS-I to verify eligibility for the study, and completed the SI-R and PL-D. PL-D ratings served to identify five items that could be used in the discarding experiment. The items selected were of low monetary value that people with HD – but not most people – typically save. To match discarding task items across the HD and CC groups, the PL-D items for the CC group were reduced so only those items also selected by HD participants remained. Five items were then selected from this collapsed list to use in the experiment. Diagnostic interviews and symptom questionnaires were administered in the clinic, and the discarding experiment was conducted in participants' homes by bachelors-level and masters-level research assistants. RAs were not trained therapists, and not all were paired with the participant they evaluated in the pretesting done at the clinic. Upon arrival at participants' homes, an item from the list was selected by the participant for the personal possession discarding task.

Prospective participants were asked to take part in a study during which they would be asked to consider discarding an item that they might otherwise keep. They were informed that they would be randomly assigned to either a condition in which they would speak aloud their thoughts during a 4-minute period before make the decision about saving or discarding, or to a condition in which the experimenter would ask them a series of questions about the advantages and disadvantages of discarding the item.

The experiment involved two discarding tasks in which participants decided whether to discard or save a personal possession and a newly acquired magazine given to them by the experimenter. The personal possession trial was administered first, followed by the newly acquired magazine trial. To begin the trial, participants were asked to think about discarding the item, rate their anticipated level of distress if they were to discard it, and estimate the duration of that distress. They also completed the SCI-M at this time.

HD participants were then randomly assigned (by a coin flip) to either the TL or CR condition. Those in the TL condition were asked to spend the next 4 minutes describing aloud their thoughts about discarding the target object with no effort on the part of the experimenter to modify these thoughts. Those in the CR condition were asked a series of

questions intended to focus their attention on the advantages of discarding and disadvantages of saving (e.g., "Do you really need it?" "Is this really important?"). CR participants were instructed to answer the questions aloud and to elaborate on their answers in order to fill the 4-minute period. All participant responses were recorded on tape. All CC participants were assigned to the TL condition.

At the end of the TL or CR portion of the trial, participants completed Distress Ratings and the SCI-M, and were asked to decide whether to discard or save the personal item. Items placed in the "discard" box were immediately removed from the room by the experimenter. Participants were asked for a third Distress Rating immediately after making their decision (post-decision rating). Participants who chose to discard were then asked to give Distress Ratings at 5-minute intervals over the next 15 minutes during which they listened to their taped comments from the discarding experiment (either thought listing or cognitive restructuring). If the participant kept the item, they continued the experiment with a second item from the beginning until they discarded an item or had considered all 5 items without discarding, after which this portion of the experiment was terminated. When the participant discarded an item, the ratings for each 5-minute interval were collected, and no further items were considered.

The second discarding task tested responses to a single standardized item, a magazine provided by the experimenter. Participants selected a magazine of interest from among several magazines provided by the experimenter and were asked to look through it for a minute before beginning the trial. Procedures were identical to those described above in the personal discarding task.

Before leaving, participants were given a set of questionnaires to complete on each of the following 7 days and return to the investigators. For each day, participants were asked to indicate how many times they thought about the discarded objects and the extent to which they regretted discarding them.

Data Analyses

Sample sizes for analyses vary depending on the number of participants completing each measure. For the distress ratings, missing values for individual time points were replaced with the rating from the previous period. Baseline data were examined via general linear modeling (GLM) or Pearson's chi square to examine differences among the three groups on demographic variables and between the two HD groups on hoarding severity. To make the discarding task comparable for all participants, and since most participants (72-87% of all groups) elected to discard a personal item on their first trial, analyses reported for emotion ratings include only data from the first personal discarding trial and from the magazine discarding trial. GLM was used to compare the impact on discarding behavior of thought listing for both HD and CC groups and cognitive restructuring for the HD group. Analyses of covariance for repeated measures were used to examine distress levels and saving beliefs/attachments (SCI-M) across time points using the initial rating as covariate with subsequent time points being immediately after the treatment (CR or TL), immediately after the discarding, and at 5, 10 and 15 minute time periods. Post hoc analyses using paired sample t-tests tested differences between specific time points. To correct for the number of

comparisons involved in these analyses, a corrected alpha of $p < .0083$ was used for detecting significance.

One HD participant dropped out after consenting, but before starting the discarding trial. There were no other missing data for the personal item decision or distress ratings. Four participants dropped out after the personal item trial and before the magazine trial, two in the HD-TL condition and two in the CC-TL condition. No other data were missing from the magazine trial. SCI-M ratings were not recorded for one participant (HD-TL), and post SCI-M ratings were not recorded for a second one (CC-TL). Two participants were missing SCI-M memory ratings, one in each of the HD conditions. One participant did not have a post SCI-M emotional attachment rating (HD-TL) and another did not have an SCI-M utility post rating (HD-TL).

Results

Sample description

Table 1 displays comparisons among groups on baseline variables. No significant differences were detected for age or gender; the community sample reported slightly higher education and income levels, but these were not significantly different from the HD groups ($ps > .05$). As expected, both HD samples had significantly higher scores on hoarding severity (SI-R, HRS-I) than did the CC group (all $ps < .001$), but did not differ from each other (all $ps > . 05$). Hoarding severity scores for the HD groups were comparable to other studies involving treatment-seeking patients with severe hoarding problems (e.g., Muroff et al., 2012).

Hypothesis 1

We predicted that when anticipating discarding both personal possessions and a newly acquired item (magazine), participants with HD would (1a) report greater NA, (1b) endorse higher levels of maladaptive beliefs, and (1c) predict a longer duration of distress, compared to CC participants.

Negative affect when anticipating discarding (1a)—When participants were considering discarding both personal possessions and the control item (magazine), significant differences were found between HD and CC participants (see Table 2). HD participants reported significantly more distress than did CCs, supporting hypothesis 1a, that HD participants would report greater NA when anticipating discarding than would CC participants.

Maladaptive beliefs when anticipating discarding (1b)—Examination of attachment-related beliefs using one-way analyses of variance (see Table 2) revealed significant differences between the HD and CC groups on each of the 5 beliefs (emotional attachment, responsibility, memory, utility, aesthetic appeal) for both personal possessions and the newly acquired item (magazine). In each case, multiple comparisons indicated that the HD groups endorsed more of each type of belief or attachment than did the CC group ($ps < .05$). Thus, hypothesis 1b, that participants with HD would endorse higher levels of maladaptive beliefs when anticipating discarding, was supported.

Predicted duration of negative affect (1c)—When participants were considering discarding both personal possessions and the newly acquired item (magazine), significant group differences emerged (see Table 2). Both groups of HD participants predicted a longer duration of distress than did CCs. Thus, hypothesis 1c, that participants with HD would predict greater NA duration when anticipating discarding, was supported.

Hypothesis 2

We predicted that (2a) NA ratings would decrease for all groups over a relatively short period of time following discarding of a personal possession or a newly acquired item; however, we also examined the possibility that (2b) behavioral responses (discarding) could occur even in the absence of changes in NA or maladaptive beliefs.

Decrease in negative affect after discarding—Figure 2 shows changes in distress ratings for the first personal item across six time points, beginning with the initial distress rating. These correspond to the initial distress rating, used as a covariate (time 0), immediately after the CR/TL manipulation (time 1), immediately after discarding (time 2), and at three 5-minute intervals thereafter (times 3, 4 and 5). There was a significant main effect for time ($F_{4,520} = 2.83$, $p < .01$) reflecting an overall decrease in distress ratings. Thus, hypothesis 2a, that NA ratings would decrease for all groups, was supported. The group and interaction effects will be discussed below.

Discarding in the absence of reductions in negative affect—Reductions in NA prior to discarding were defined as the percent reduction in distress ratings from time 0 (baseline) to time 1 (immediately after the CR/TL manipulation). The specific effects of the CR/TL manipulations will be discussed below. Any reduction in distress was observed in 41% of the HD-CR group, 44% of the HD-TL group, and 66% of the CC group. Overall, the number of items saved was lower for participants who reported a reduction of distress ($M = 0.17$, $SD = 0.56$) than for those who did not ($M = 0.41$, $SD = 0.87$), $t_{159} = 2.04$, $p = .04$. Examination of each group separately indicated that fewer items were saved when distress ratings decreased for the CC group ($p = .04$), but not the HD-CR group ($p = .23$), the HD-TL group ($p = 1.00$), or the combined HD group ($p = .29$).

Similarly, we examined whether reductions in maladaptive beliefs influenced discarding behavior. Reductions in beliefs prior to discarding were defined as the percent reduction in SCI-M total score from time 0 (baseline) to time 1 (immediately after the CR/TL manipulation). Again, the specific effects of the CR/TL manipulations will be discussed below. Any reduction in beliefs was observed in 59% of the HD-CR group, 63% of the HD-TL group, and 65% of the CC group. Overall, the number of items saved was equivalent for participants who reported a reduction of hoarding-related beliefs ($M = 0.26$, $SD = 0.85$) and those who did not ($M = 0.38$, $SD = 0.71$), $t_{157} = 0.93$, $p = .35$. Examination of each group separately indicated the number of items saved were equivalent whether beliefs were reduced or not for the CC group ($p = .31$), the HD-CR group ($p = .87$), the HD-TL group ($p = .36$), and the combined HD group ($p = .62$). These findings are consistent with hypothesis 2b: for HD participants, discarding behavior occurred equally in the presence or absence of changes in NA or maladaptive beliefs.

Hypothesis 3

We predicted that HD participants receiving CR would (3a) save fewer items, (3b) show greater reduction in NA, and (3c) show greater reduction in maladaptive beliefs than would those receiving TL. We also examined the alternative possibility that (3d) CR might be ineffective or even less effective than TL.

Effect of cognitive restructuring on saving behavior—For personal possessions, GLM analyses indicated a significant group difference in number of items saved ($F_{2,161}$ = 3.15, $p < .05$), and comparisons among groups (Tukey's B) revealed that the HD-CR group saved more personal items than did the HD-TL group (Ms = 0.53 vs. 0.17, $p < .05$), while the CC group ($M = 0.22$) did not differ from either HD group. Most participants discarded the first item (average=79%; range=72-87% across groups), with no significant differences among groups ($\chi^2_2 = 3.67$, $p = .16$). Thus, hypothesis 3a, that HD participants receiving CR would save fewer personal possessions than would those receiving TL, was not supported. Consistent with hypothesis 3d, CR resulted in *more* saving behavior than did TL. Most participants discarded the magazine given to them by the experimenter, and groups did not differ in the proportion who did so (M=76%; range=65-80%; $\chi^2_2 = 3.49$, $p = .18$).

Effect of cognitive restructuring on negative affect—GLM analysis of covariance (ANCOVA, controlling for initial distress rating) indicated a main effect for group ($F_{2,130} = 15.4$, $p < .001$), wherein the CC group reported less overall distress than did the HD groups ($p<.05$), while the HD-TL and HD-CR groups did not differ (ps>.05). We further found a significant time X group interaction ($F_{10,655} = 2.75$, $p < .05$) in distress rating changes from baseline. Pairwise *post hoc* investigation of the interaction effect indicated that the CC group reported a significant decrease in distress ratings from the initial distress rating to the post-discarding period (times 0 to 2; $t_{53} = 10.61$, $p < .001$), but this was not seen in the HD-CR group ($t_{40} = 0.78$, $p = .44$) or the HD-TL group ($t_{38} = 1.83$, $p = .076$). In contrast, both HD groups showed significant decreases in distress after discarding (time 2) to the end of the experiment (time 5); HD-CR $t_{40} = 3.62$, $p < .001$; HD-TL $t_{38} = 2.82$, $p = .008$, but the decrease in distress for the CC-TL group was not significant using the corrected alpha level, $t_{53} = 2.63$, $p = .011$. Decreases in distress over the course of the entire trial were 36% for HD-TL, 28% for HD-CR, and 54% for CC-TL.

Figure 3 displays mean percentage change in distress for the magazine trial from the initial distress rating (0). Not surprisingly, distress scores were notably lower than for the personal item trial. GLM ANCOVA (controlling for initial distress) failed to reveal a main effect of time ($F_{4,472} = 0.70$, $p = .60$) or group ($F_{2,118} = 2.16$, $p = .12$]. The time X group interaction was significant, however ($F_{8,472} = 3.10$, $p < .01$). Comparisons over time within groups indicated that the CC group reported reduced NA only from the initial distress rating to immediately after discarding (time 0 to time 2), $t_{47} = 2.88$, $p = .006$, at which time the distress ratings were at the floor of the rating scale. The HD-TL group showed a significant decrease in distress from time 0 to 2, $t_{27} = 4.28$, $p < .001$, but not from time 2 to the end (time 5), $t_{27} = 2.22$, $p = .035$ (based on corrected alpha). In contrast, the HD-CR decreases were not significant from time 0 to time 2, $t_{44} = 2.06$, $p = .045$, but were significant from time 2 to the end (time 5), $t_{44} = 3.52$, $p = .001$. Overall, distress ratings fell by 40% for HD-

TL, 40% for HD-CR, and 13% for the CC -TL group. At the final time point, a significant main effect of groups, $F_{2,119} = 7.19$, $p < .01$, probed by multiple comparisons, revealed that both HD groups reported significantly more distress than CCs ($ps < .05$), but did not differ from each other ($p > .05$). Interestingly, distress ratings at time 5 for both HD groups had fallen below 2 on the 10-point scale. Thus, hypothesis 3b, that HD participants receiving CR would show greater reduction in NA than would those receiving TL, was not supported for personal possessions or the control item. Consistent with hypothesis 3d, CR and TL led to equivalent reductions in NA over time.

Effect of cognitive restructuring on maladaptive beliefs—Analyses of change in beliefs about possessions (SCI-M) following the CR and TL manipulation for the personal item discarding trial are shown in Table 3. Comparisons for all five subscales showed a main effect of group (all $ps < .001$); in all cases, both HD groups reported stronger hoarding-related beliefs than did the CC group ($ps < .05$), but did not differ from each other ($ps > .05$). Three of the five analyses (emotional attachment, utility/instrumental value, aesthetic/intrinsic value) indicated a significant main effect of time, wherein beliefs decreased in intensity over the course of the trial. Two belief scales (emotional attachment and responsibility) showed a significant interaction of time X group. Multiple comparisons (Tukey B) revealed that, HD-TL participants showed a decrease in emotional attachment ($p < .05$) whereas no significant decrease was observed for HD-CR or CC groups ($ps > .05$).

For the magazine trial, GLM analyses revealed few significant differences. For each of the SCI-M subscales there was a significant main effect for group (Fs from 10.62 to 20.82, $ps < .01$). In each case, the CC group had lower levels of hoarding-related beliefs than either HD group. The HD groups did not differ from each other. There were significant time effects for responsibility ($F_{1,156} = 4.43$, $p < .05$) and for utility ($F_{1,157} = 10.31$, $p < .01$), reflecting a reduction of the level of these beliefs. Only emotional attachment showed an interaction of time X group ($F_{2,156} = 10.62$, $p < .001$), in which the HD-TL group showed a nonsignificant increase in attachment ($t_{40} = 1.87$, $p = .07$) while the other two groups showed slight and nonsignificant decreases. Thus, hypothesis 3c, that HD participants receiving CR would show greater reduction in maladaptive beliefs about personal possessions and a newly acquired item than would those receiving TL, was not supported. Consistent with hypothesis 3d, TL reduced certain maladaptive beliefs for personal possessions, whereas CR did not.

Post-trial analyses

After the experiment, a subset of participants (n = 56) provided daily ratings of the number of times they thought about the discarded items and regret over discarding them over a period of 7 days. Significant main effects were found for group and time on both the number of times participants thought about the discarded personal item, $F_{2,49} = 7.81$, $p < .01$, $F_{6,294} = 30.9$, $p < .001$, and ratings of regret over discarding the personal item, $F_{2,48} = 6.19$, $p < .01$, $F_{6,288} = 12.15$, $p < .01$. Both HD groups reported more thoughts about the discarded object than did CC participants, but did not differ from each other. Mean frequencies of thinking about the object across the 7 days were low, ranging from 0.30 (CC-TL) to 1.13 (HD-CR) and 1.5 (HD-TL) times per day. Similarly, regret ratings were low; however, the HD-TL group had more regret over discarding ($M = 2.57$) than did the CC group ($M = 1.10$),

whereas the HD-CR group did not differ from the either group in level of regret ($M = 1.83$). Significant interactions of group X day occurred for both measures. All three groups showed significant decreases in frequency of thinking about the item from day 1 to day 4, $ts > 3.50$, $ps < .004$. None of the groups showed decreases from day 4 to day 7, $ts < 1.1$, $ps > .05$. For regret, the only significant decrease was for the HD-CR group from day 1 to day 4, $t_{18} = 3.84$, $p = .003$. As CC group scores for both variables were at or near the lowest score (near 0 for number of times thought about item and 1 [of 9] for level of regret), it is not surprising that these did not change. Both HD groups showed significant decreases in frequency of thinking and regret from days 1 to 4, but no significant changes from days 4 to 7. For both measures, groups differed at day 7, $Fs_{2,52} = 4.99$ and 3.92, $ps < .05$. Overall, HD-TL participants reported more thoughts about the personal item discarded and expressed more regret about discarding it than did CCs ($p < .05$). HD-CR participants did not differ from either CCs or HD-TL groups on either measure.

As findings for the daily ratings about the magazine were generally similar to those for the personal item and lower overall, details for this portion of the experiment are not reported.

Discussion

The present study examined experiences of people with HD while making decisions to discard possessions. As expected, relative to CCs, HD participants reported more distress in anticipation of and throughout a discarding task, as well as stronger attachment motives (i.e., hoarding beliefs) associated with possessions being considered for discarding. They also predicted a longer duration of distress after discarding. These findings are consistent with previous research indicating that HD is characterized by intense emotional and cognitive responses to discarding (Frost et al., 1995; Frost et al., 2015; Shaw et al., 2015; Steketee et al., 2003; Timpano et al., 2014; Tolin, Stevens, Villavicencio, et al., 2012). Of note, HD participants' predicted duration of distress (which ranged from a day to several days) was not consistent with the actual duration of distress (distress dissipated by 28-40% within a relatively short period of 30 to 40 minutes).

This study further tested two key elements of CBT for HD (e.g., Steketee & Frost, 2007): exposure and CR. Exposure (namely, discarding a personal possession) was expected to result in a gradual reduction of NA. As expected, mean levels self-reported distress decreased for all three groups during the course of both the personal possession and newly acquired item trials. However, it is noted that the majority of HD patients did *not* report a decrease in distress from baseline to post-intervention during the personal possession trial, and the degree of subsequent saving behavior was unrelated to whether or not the person reported such a decrease. Furthermore, although maladaptive beliefs did decrease following intervention, subsequent saving behavior was not found to be related to those decreases. Thus, it seems unlikely that decreased NA or maladaptive beliefs were a cause of discarding behavior. These results correspond more closely to Craske et al.'s (2008) notion of distress tolerance, rather than distress reduction, as a mechanism of exposure.

Contrary to predictions, CR did not result in a reduction of saving behavior, NA, or maladaptive beliefs, or post-experiment rumination compared to TL. Indeed, HD

participants receiving CR saved *more* items, and showed *less* reduction in certain maladaptive beliefs, than did those receiving TL. The pattern of the data suggested that the TL condition was more effective in reducing distress during the initial phase of the discarding trials, although findings were significant only for the newly acquired item trial. In the CR group, distress levels initially increased, and subsequently decreased after the intervention period. At the end of the experiment, however, there was no difference between HD-TL and HD-CR groups for either item.

The failure of CR to result in more NA reduction, discarding behavior, or belief change compared to TL is noteworthy, and has potential implications for understanding and treating HD. As noted previously, although the efficacy of CBT for HD has been established, most patients do not remit with treatment (Tolin et al., 2015). CR, as currently practiced in CBT and as used in the present study, emphasizes the ER tactic of reinterpretation (mentally changing the meaning of a stimulus, such as changing one's appraisal of an object from valuable to less valuable). Basic research, however, suggests that many of the neural regions associated with reinterpretation (Ochsner et al., 2004; Ochsner et al., 2012) may be impaired in HD, which could impede HD patients' capacity to benefit from reinterpretation. Consistent with this hypothesis, Ayers and colleagues (2011) have noted that CR was particularly ineffective for, and less well received by, older adults treated for HD. The lack of differential effectiveness of CR in the present study does not imply that cognitive factors are not operative in those with HD, but rather that the CR technique used here may not be a particularly effective way to address those factors.

Another potential explanation is the phenomenon of *therapeutic reactance.* As individuals perceive that their sense of freedom is restricted, they become more likely to resist directives in order to maintain a sense of freedom and control (Brehm, 1966). Reactance in HD may stem from years of having to defend one's clutter and acquisition behaviors to family members, friends, and social agencies that have expressed repeated disapproval (Frost et al., 2010). Even in the context of high levels of self-reported motivation to change, reactance may also reflect a cognitive dissonance-reducing reaction to a belief that such change is not possible (Miller & Rollnick, 2002; Worden, DiLoreto, & Tolin, 2014).

Although the TL condition was not explicitly designed as a distancing intervention, its apparent superiority may suggest that this tactic has promise for treatment development. Unlike reinterpretation, distancing emphasizes mentally changing one's personal connection to, or psychological distance from, an external or internal stimulus. As practiced in acceptance- and mindfulness-based treatments (e.g., Hayes et al., 1999; Linehan, 1993; Wells, 2009), distancing (or defusion) often asks patients to identify and attend to thoughts, without debating or analyzing them. It is possible that this tactic of changing individuals' *relationship* to thoughts (e.g., noticing them, rather than acting on them) is more effective in addressing unhelpful beliefs and NA, and in facilitating behavior change, than is CR, which focuses more on changing the *content* or *perceived validity* of thoughts. This might explain why only the HD-TL group showed significant declines in emotional attachment while HD-CR did not.

It is also possible that distancing-based interventions are less likely to elicit therapeutic reactance than is CR. We (Frost et al., 2010) have noted that individuals with HD appear most receptive to interventions that are non-confrontational and supportive. In the present study, the experimenters encouraged openness and a non-threatening environment in which participants felt accepted. This non-demanding process may have reduced distress and enabled them to evaluate more clearly the personal value of the object. The thoughts that participants in the TL condition reported occasionally overlapped with the questions posed in the CR condition, thus creating some diffusion of the intervention. To the extent that difficulty discarding reflects an avoidance of distressing decision-making, the TL strategy may improve upon the CR questioning method ("Do you really need it?" "Will you really use it within a reasonable timeframe?"), which may be interpreted as judgmental and provoke distress and defensive urges to save as evident in some treatment reports. TL might also have reduced avoidance of the decision-making process by enhancing participants' ability to engage with their thoughts in a dispassionate and nonjudgmental way. In addition, thought listing could have engaged other active processes such as affect labeling (Kircanski, Lieberman, & Craske, 2012), thereby facilitating the discarding task. Future research on TL as a therapeutic strategy would help elucidate the therapeutic value of this method.

Nearly 80% of all participants chose to discard the both items, and the rate was similar across groups. The unexpectedly high rate of discarding for the HD sample may have been due to the instructions to select items of low value, as well as the presence of the experimenter which generated demand expectations that altered behavior. Although people with HD, by definition, discard less frequently, there may be some contexts in which their discarding behavior is comparable to people without HD. The high rate of first item discarding may have had an influence on our measure of the number of items saved since not everyone made decisions on multiple items.

Daily reports from the week after the trial of number of times spent thinking about the object and regret over discarding indicated that few members of any group reported thinking about the object by midway through the first week. For both variables (frequency of thinking and regret), the CC sample again gave lower scores compared to the two HD groups, although ratings of regret showed a difference only between the CC and HD-TL sample, this may be due to the small sample size for these post-trial analyses. HD groups did not differ from each other on either post-trial variable. Thus, the CR and TL manipulations did not appear to alter concern about the discarded object after the trial ended, although there is a slight suggestion that TL may have been less helpful in reducing regret over discarding. This finding is somewhat inconsistent with the inhibitory learning model, which posits that the use of cognitive modification strategies (e.g., reevaluating probability estimations) prior to or during exposures may compromise their efficacy by reducing the mismatch between expectancy (e.g., "There is a 90% probability that I will be upset for the next week") and experience (e.g., the participant noticed that the distress only lasted for 5 minutes) (Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014). Within this theoretical framework, the "success" of exposures is contingent on the presence of conditions that violate expectancies rather than fear reduction at the end of the trial. However, it is worth noting that the CR used in this study was probably different from standard cognitive techniques employed in clinical settings, and that we did not explicitly evaluate degree of new learning among participants.

Thus, the extent to which cognitive modification or expectancy violation occurred among participants is unclear. Further research testing the specific potential mechanisms underlying exposure in the context of HD would help to clarify present findings.

As was apparent in the personal item trial, the control group reported less overall distress than the HD groups when considering discarding a newly acquired object, but the HD groups did not differ in their pattern of distress reduction during this trial. It is noteworthy that although the HD groups showed declines in attachment motives when a personal possession was the target, this was not the case when the target was a newly acquired possession. This suggests that emotional attachment and its modification may depend on how recently a possession was acquired. The personal item trials provoked stronger reactions (distress levels and attachment beliefs) and somewhat less habituation of distress than did the newly acquired item trial. Alternatively, this may reflect something about the nature of the newly acquired item. For example, the magazine's association with information and opportunity rather than recency could have influenced the results.

Several important limitations in this study are worth noting. The study involved primarily women participants so findings may not generalize to men with hoarding. As noted earlier, demand characteristics of the experiment might have biased participants to discard target items compared to their normal decision-making patterns, though this may be comparable to a therapy situation. The RAs were not trained therapists, nor were they always matched with participants they evaluated in the clinic. This could have led to weaker working alliances with participants. Inclusion of a CC-CR group may have clarified whether the differences between the TL and CR HD groups were also characteristic of people without HD. Several other features may have influenced the findings and deserve further research. For instance, more than half of the HD participants were depressed and nearly a quarter were diagnosed with social anxiety or generalized anxiety disorder; these comorbid conditions may affect responses during the discarding process. Also, information processing deficits known to be characteristic of people with HD could have influenced the findings. Findings from the daily ratings represented only a small proportion of the participants in the study. This may have biased the findings. Finally, cognitive restructuring was conducted by trained research assistants who had limited professional experience with therapeutic methods, and therefore the CR methods used here may not have been typical of cognitive therapy.

Acknowledgments

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Highlights

- People with hoarding disorder (HD) report more and longer distress and attachment motives than community controls.

- Thought listing was more effective than cognitive restructuring in reducing negative emotions and attachments.

- Thought listing improved discarding behavior compared to cognitive restructuring.
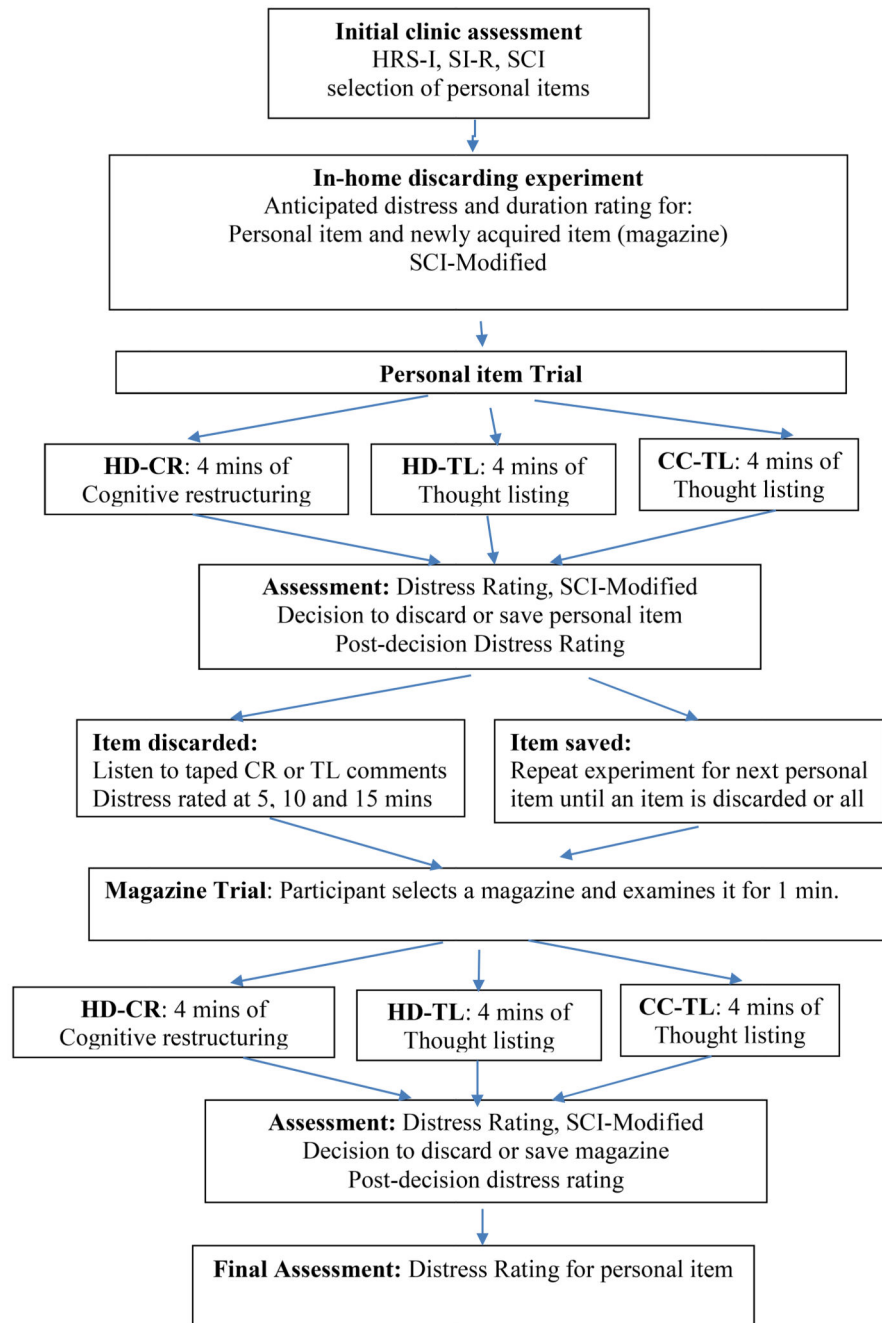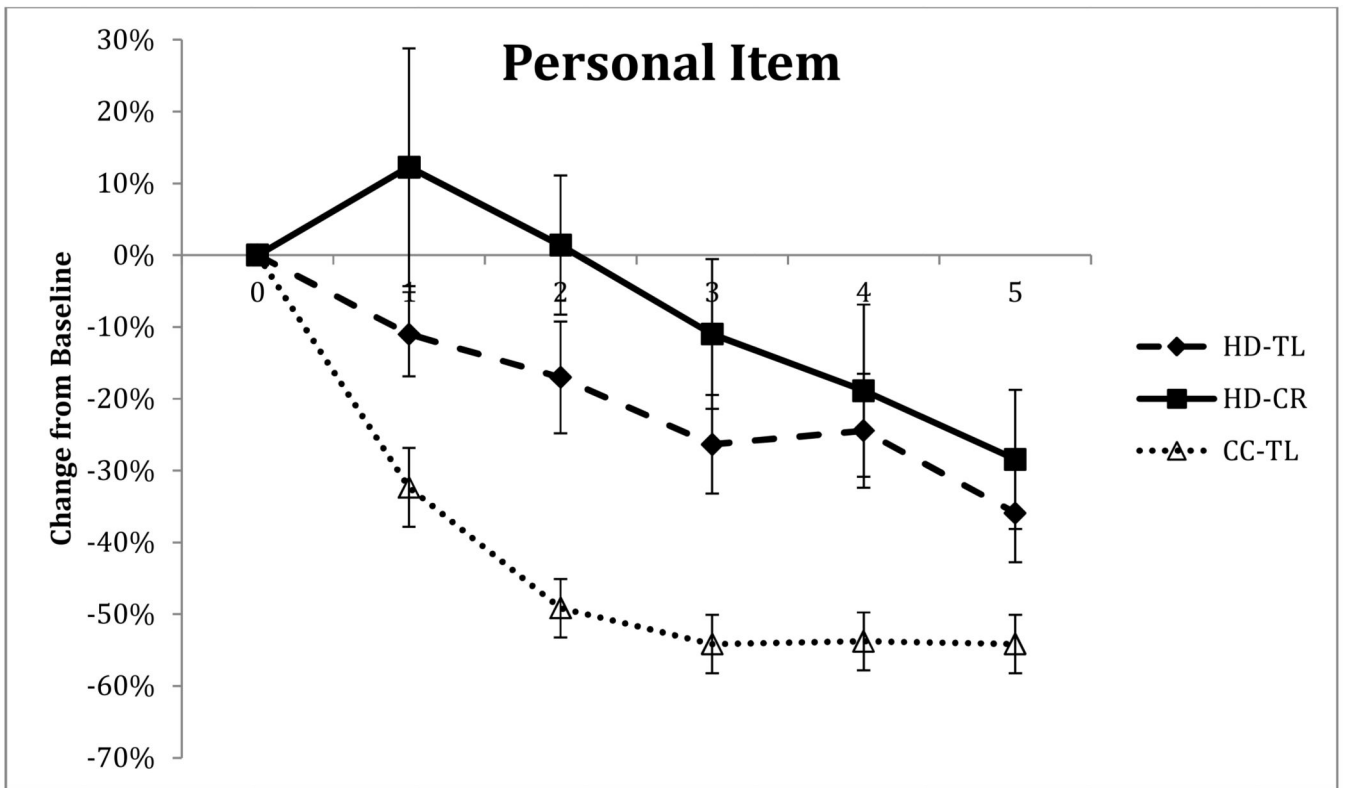
Figure 1.
Experimental design.

Figure 2.
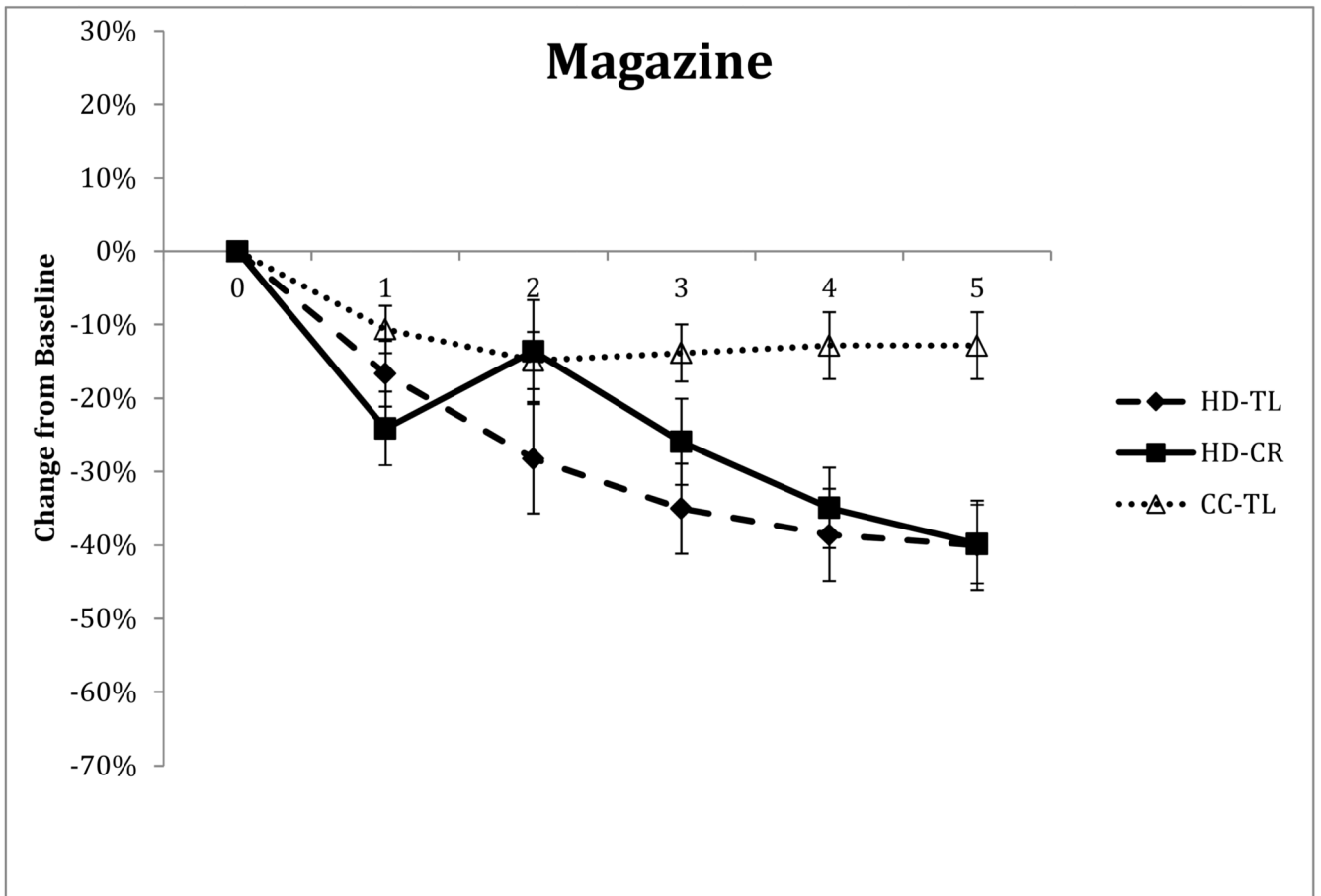Changes in distress ratings over time for the personal item.

Figure 3.
Changes in distress ratings over time for the newly acquired item (magazine) trial.

Table 1

Sample description

	HD-CR (N=57)	HD-TL (N=46)	CC-TL (N=66)	Chi sq. or F	df	p
% Women	66.7	73.9	77.3	1.78	2	.41
Age	52.72 (8.00)	51.35 (10.77)	53.85 (13.54)	0.68	2, 166	.51
Education [*]	5.14 (1.29)	5.11 (1.47)	5.65 (1.48)	2.49	2, 155	.09
Income [*]	4.41 (2.73)	4.95 (2.69)	5.68 (2.28)	2.95	2, 135	.06
Saving Inventory-Revised (SI-R) total	62.83[a] (11.40)	63.53[a] (12.52)	10.19[b] (9.15)	454.23	2, 157	.001
SI-R difficulty discarding	19.85[a] (4.38)	20.21[a] (4.51)	3.95[b] (3.61)	299.13	2, 161	.001
SI-R clutter	26.70[a] (5.22)	26.53[a] (5.71)	2.82[b] (4.15)	453.09	2, 160	.001
SI-R acquisition	15.74[a] (5.25)	16.79[a] (5.56)	3.22[b] (2.64)	161.50	2, 158	.001
Hoarding Rating Scale-Interview (HRS-I) total Initial Distress Ratings:	25.39[a] (4.14)	24.79[a] (3.89)	1.79[b] (3.53)	732.39	2, 162	.001

Significant differences between groups are indicated by different superscripts.

[*] Education ranged from 1=grammar school to 8=PhD, MD, or equivalent); 5=BA/BS or equivalent; 6=some graduate school; Income ranged from 1=$10,000 or less to 8=$70,000 +; 5=$40,001-50,000 and 6=$50,001-60,000; Duration ranged from 1=a few minutes or less to 10=several months or more.

Table 2

Initial distress and belief ratings by group

	HD	CC	*t*	*p*
Personal Possession				
Distress	5.17 (1.61)	3.39 (1.37)	7.37	< .001
Predicted Distress Duration	4.06 (2.34)	2.08 (1.78)	5.74	< .001
Emotional attachment	8.07 (4.90)	4.20 (2.36)	5.97	< .001
Responsibility	7.65 (3.93)	3.80 (2.62)	7.01	< .001
Utility-instrumental	8.80 (3.67)	5.68 (3.05)	5.73	< .001
Aesthetic-intrinsic	7.49 (4.05)	4.88 (3.25)	4.39	< .001
Memory	4.99 (3.80)	2.61 (1.33)	4.90	< .001
Control Item (Magazine)				
Distress	3.93 (2.46)	1.77 (1.56)	6.18	< .001
Predicted Distress Duration	2.40 (1.71)	1.45 (1.55)	3.38	.001
Emotional attachment	5.33 (3.76)	3.29 (1.04)	4.22	< .001
Responsibility	5.05 (3.31)	2.56 (1.42)	5.67	< .001
Utility-instrumental	7.90 (4.02)	4.11 (294)	6.50	< .001
Aesthetic-intrinsic	5.65 (3.76)	2.80 (1.84)	5.65	< .001
Memory	5.42 (3.89)	2.66 (1.64)	5.39	< .001

Table 3

Personal item discarding trial means and standard deviations ofpre- and post-manipulation scores on the Saving Cognitions Inventory-Modified (SCI-M) (HD-CR, n=38; HD-TL, n=38; CC-TL, n=50)

SCI-M subscale	Pre-trial	Post-manipulation	GLM test	F value	p
Emotional attachment					
HD-CR	8.11 (5.23)	7.82 (5.61)	time	12.85	.001
HD-TL	$8.09 (4.53)^a$	$6.79 (4.67)^b$	condition	15.16	.001
CC-TL	4.15 (2.35)	4.06 (2.83)	interaction	5.28	.01
Responsibility					
HD-CR	7.70 (3.80)	7.40 (3.96)	time	2.23	.14
HD-TL	$7.59 (4.13)^a$	$6.84 (4.00)^b$	condition	20.28	.001
CC-TL	3.83 (2.63)	4.12 (3.02)	interaction	3.21	.04
Utility-instrumental					
HD-CR	9.49 (3.54)	8.86 (4.00)	time	7.50	.01
HD-TL	7.98 (3.71)	7.53 (4.12)	condition	17.79	.001
CC-TL	5.74 (3.04)	5.29 (3.44)	interaction	0.12	.89
Aesthetic-intrinsic					
HD-CR	8.18 (4.06)	7.25 (4.56)	time	19.41	.001
HD-TL	6.59 (3.89)	6.02 (4.22)	condition	10.55	.001
CC-TL	4.88 (3.28)	4.29 (3.43)	interaction	0.58	.56
Memory					
HD-CR	5.45 (4.30)	5.38 (4.08)	time	0.33	.57
HD-TL	4.44 (3.03)	4.88 (3.76)	condition	14.86	.001
CC-TL	2.62 (1.34)	2.46 (1.15)	interaction	1.98	.14

Significant differences across time are indicated by different superscripts.