

**CLARIFYING THE RELATIONSHIP BETWEEN COMPULSIVE HOARDING AND  
CATEGORIZATION DEFICITS**

by

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## Abstract

In 1996, Frost and Hartl proposed that the excessive clutter and difficulty discarding objects characteristic of compulsive hoarding disorder may be partially explained by a cognitive deficit in the ability to efficiently categorize objects. Subsequent studies that empirically investigated Frost and Hartl's (1996) proposed categorization deficit have been highly inconsistent in terms of whether this deficit exists and, if so, whether it is dependent on symptom severity and the personal significance of objects. The current study sought to help clarify the inconsistent pattern of past research by replicating and extending a study by Luchian, McNally, and Hooley (2007) to contrast population and task differences between previous studies. The current study compared healthy controls ( $n = 35$ ), individuals with subclinical symptoms of compulsive hoarding ( $n = 30$ ), and individuals with clinical symptoms of compulsive hoarding disorder ( $n = 20$ ), on sorting tasks involving participants' personal possessions, typically hoarded objects, and the collection of trivial objects employed in the Luchian et al. sorting task. Results suggest that both the clinical and subclinical groups show tendencies towards underinclusive categorization. However, this effect was not strong. A larger difference was found between groups on distress and latency; the clinical group took longer to complete sorting tasks and exhibited greater distress while engaging in sorting tasks than both other groups. These results suggest that traditional sorting tasks may not be sufficient for examining categorization difficulties in compulsive hoarding, and that behavioral avoidance is a more plausible mechanism for the disorganization of hoarded homes than is underinclusive categorization.

## **Preface**

In collaboration with my advisor, Dr. Sheila Woody, I am responsible for the design, data collection, analysis, and authorship of the work presented in this thesis. Alison Welsted assisted by helping to develop recruitment materials, train research assistants, and administer clinical interviews during data collection. The study presented in this dissertation was approved the UBC Behavioral Research Ethics Board (BREB # H12-02310).

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## **Introduction**

Compulsive hoarding is a mental illness associated with a range of serious risks to the health and safety of those who are affected, their families and their surrounding communities. Compulsive hoarding is characterized by the excessive accumulation of possessions that amass in disorganized piles (i.e., clutter) around the home. Large amounts of clutter can pose immediate risks to an individual's physical welfare by acting as a fire hazard, blocking exits during emergencies, producing an unsanitary environment, and creating a risk of falling objects. Beyond physical hazards, hoarding is associated with higher rates of psychological disability, work impairment, social disability, and family conflict (Frost, Steketee, & Williams, 2000; Tolin, Frost, Steketee, Gray, & Fitch, 2008; Tolin, Frost, Steketee, & Fitch, 2008). In addition to these personal ramifications, the adverse impact of hoarding can have on surrounding communities was made evident in a survey by Frost, Steketee, and Williams (2000) of health departments in Massachusetts. The 88 health officers surveyed reported a combined total of 451 hoarding related complaints in the past five years, most frequently lodged by neighbors, police, or fire department officials. In several cases where direct intervention was necessary to resolve complaints, such as forced clean outs of hoarders' homes, it came at serious financial cost to the city. Moreover, unresolved hoarding complaints also resulted in evictions, condemned housing and moving former tenants to care facilities.

In terms of prevalence, based on the occurrence of hoarding as a prominent subtype of obsessive-compulsive disorder, hoarding has been estimated to have a lifetime prevalence of 0.04% (Steketee & Frost, 2003). However, when hoarding is considered outside of OCD, its prevalence has been estimated to be between 2-5% in Western countries (Iervolino et al., 2009; Mueller et al., 2009; Samuels et al., 2008). Overall, it is clear that the development of effective



interventions for treating compulsive hoarding would be physically, psychologically, and financially beneficial for individuals with compulsive hoarding and the greater public.

Compulsive hoarding has recently been codified as a mental disorder in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013). The addition of hoarding disorder to the DSM-5 is due to the growing recognition of compulsive hoarding as a distinct mental disorder separate from obsessive-compulsive disorder (OCD; Mataix-Cols et al., 2010; Steketee & Frost, 2003). The diagnostic criteria for hoarding disorder as stated in the DSM-5 are: “A) persistent difficulty discarding or parting with possessions, regardless of their actual value, B) this difficulty is due to a perceived need to save the items and distress associated with discarding them, C) the symptoms result in the accumulation of possessions that congest and clutter active living areas and substantially compromise their intended use; if living areas are uncluttered, it is only because of the interventions of third parties (e.g., family members, cleaners, authorities), D) the hoarding causes clinically significant distress or impairment in social, occupational, or other important areas of functioning, and E) is not attributable to another medical condition, or F) better accounted for by the symptoms of another DSM-5 disorder” (p. 247).

One promising area of research examines cognitive deficits in the ability to categorize objects and make decisions. The theory driving this line of research proposes that hoarding behavior may be partially explained by a categorization deficit in which individuals see objects as more unique and therefore less easily replaced and more difficult to group into categories when organizing one’s home (Frost & Hartl, 1996). Currently, research on categorization deficits in compulsive hoarding is so inconsistent that it is unclear whether this deficit exists. Puzzlingly, Luchian, McNally, and Hooley (2007) found a significant evidence of this categorization deficit

in a sample of individuals with nonclinical symptoms of hoarding while several other studies have been unable to demonstrate a similar categorization deficit in clinically severe compulsive hoarding samples. Despite the confusing state of the literature in this field, improving deficient categorization skills is a part of Steketee and Frost's (2007) treatment protocol for compulsive hoarding. One important step in developing more effective treatments for hoarding is understanding the mechanisms underlying clutter and difficulty discarding objects. Before underinclusive categorization can be considered one of these mechanisms, it is imperative to determine whether there is a reliable relationship between hoarding symptoms and difficulty categorizing and why past research has been unable to reliably observe categorization deficits amongst compulsive hoarders using similar tasks.

The current research aims to provide insight into the question of why past research on the relationship between categorization deficits and compulsive hoarding has been inconsistent and counterintuitive. To begin addressing this question, the current research will replicate Luchian et al. (2007) with several methodological improvements. Moreover, the current research will expand upon Luchian et al.'s methods to contrast several of the methodological and population differences between past studies that may have contributed to the inconsistency of past findings on hoarding and categorization.

### **Cognitive Deficits Associated with Compulsive Hoarding**

As a means of integrating the limited research available at the time, Frost and Hartl (1996) proposed a cognitive behavioral model of compulsive hoarding. This model conceptualized hoarding as stemming from information processing deficits, problems in forming emotional attachments, behavioral avoidance, and erroneous beliefs about the nature of possessions. The proposed information-processing abnormalities were general deficits in

decision-making, categorization/organization, and memory. This was a landmark paper as it stimulated lines of research that empirically tested the association of each of these deficits with compulsive hoarding. The following is a review of current research on decision-making and categorization deficits in compulsive hoarding. These cognitive processes are also highly related as organizing objects into categories requires making decisions about which objects should be grouped together.

**Decision-making.** According to Frost and Hartl (1996), indecisiveness is frequently observed in compulsive hoarders when deciding whether to retain or discard a possession. Indecisiveness was theorized to stem from perfectionistic tendencies that manifest in the fear of making a mistake when deciding to discard possessions, an exaggerated sense of responsibility for the possessions to be discarded, erroneous judgments about the probability of using objects in the future and a differential weighting of the cost of saving an object versus discarding an object. Frost and Gross (1993) speculated that the saving behavior that characterizes hoarding may be in itself an avoidance behavior intended to circumvent the distress of having to make decisions about discarding objects. Preliminary support for this theory of avoidant behavior can be seen in studies involving sorting tasks wherein participants with compulsive hoarding reported more anxiety prior to tasks and rated tasks as significantly more difficult and stressful (Grisham, Norberg, Williams, Certoma, & Kadib, 2010; Hayward, 2011; Luchian et al., 2007; Wincze, Steketee, & Frost, 2007).

Overall, with some important variations, subsequent research on decisiveness in compulsive hoarding has largely supported the theory that compulsive hoarders are more indecisive than individuals without mental illness. Studies measuring indecisiveness amongst individuals with compulsive hoarding have often used the Frost Indecisiveness Scale (FIS),

which is a self-report scale measuring fear and attitudes toward decision making. Studies using the FIS, either through total scores or through correlations with hoarding scales, have generally found clinical and nonclinical hoarders to have significantly higher ratings of indecisiveness than healthy controls (Fitch, 2011; Frost & Gross, 1993; Grisham et al., 2010; Steketee, Frost, & Kyrios, 2003; Tolin & Villavicencio, 2011; Wincze et al., 2007). Moreover, the association of abnormal decision-making processes with compulsive hoarding is also supported by a neurobiological study by Tolin, Kiehl, Worhunsky, Book, and Maltby (2009) wherein hoarders were asked to make decisions about shredding low value paper items (e.g., junk mail and newspapers). Relative to healthy controls, compulsive hoarders displayed excessive hemodynamic activity in their lateral orbitofrontal cortex, which suggested compulsive hoarders experienced discarding as more punishing and were more emotionally engaged during decision-making.

Whether a decision-making deficit is uniquely associated with hoarding is less clear when hoarders' scores on the FIS are compared to a psychiatric control group. Several studies that included a psychiatric control group found that although hoarders reported they were more indecisive than did healthy participants, they were not more indecisive than participants with OCD (Wincze et al., 2007) or other Axis I disorders (Grisham et al., 2010). Conversely, three other studies that also included a psychiatric control group and measured self-reported indecisiveness through the FIS found hoarders to be more indecisive than participants with OCD (Hayward & Coles, 2009; Steketee et al., 2003; Tolin & Villavicencio, 2011). Interestingly, one of these studies found that after controlling for mood state and OCD symptoms, the correlation between hoarding and indecisiveness was no longer significant (Steketee et al., 2003). The other two studies did not control for mood state or OCD symptoms. These findings suggest that

indecisiveness may not be a unique feature of hoarding, but rather secondary symptom of the high comorbidity of hoarding with mood disorders and moderate comorbidity with anxiety disorders and OCD (Frost, Steketee, & Tolin, 2011).

Moreover, studies employing a behavioral task called the Iowa Gambling Task (IGT) to measure decision-making abilities in compulsive hoarders have also yielded inconsistent findings. The IGT measures advantageous decision-making through participants' tendency to choose card decks associated with modest wins, minimal risk and higher overall profit over card decks associated with large wins, large risks and lower overall profit. In studies by Grisham et al. (2010) and Tolin and Villavicencio (2011), hoarders did not differ from healthy or Axis I control groups on their performance on the IGT. However, Blom et al. (2011) found that hoarders did better than healthy controls on the IGT over time. Moreover, Lawrence et al. (2006) found that hoarding and washing symptoms of individuals diagnosed with OCD were negatively associated with IGT performance. Amongst these participants, those with high hoarding symptoms performed worse on the IGT than did those with mild symptoms of compulsive hoarding.

Overall, these results suggest that compulsive hoarders consider themselves to be more indecisive, even if this indecisiveness is primarily due to a comorbid disorder. Behaviorally, studies using the IGT with individuals without comorbid OCD have not produced compelling results. Tolin and Villavicencio (2011) proposed that one explanation for this pattern of results is that differences between indecisiveness self-report scales such as the FIS and behavioral tasks such as the IGT may be the difference between an actual and perceived deficit in decision-making. Alternatively, it is possible that the IGT is not a suitable task for measuring the particular decision-making difficulties experienced in compulsive hoarding. In order to succeed on the IGT, one must adopt a strategy of choosing card decks that are only likely to produce

modest wins but are *low risk* in terms of loss. Given that compulsive hoarding is often associated with higher scores on the FIS, suggesting hoarders are more fearful when making decisions, it is plausible that compulsive hoarders are generally inclined to make more low risk decisions. Therefore, the decision-making deficit associated with hoarding may be characterized by over-cautiousness, and therefore would not conform to the perseverative and/or risky decision-making style detected by the IGT. Furthermore, an overcautious decision-making deficit would be consistent with a tendency to create more categories when sorting objects, as a more thorough consideration of differences between objects would decrease the likelihood of losing something valuable.

**Categorization/organization.** Another type of cognitive deficit that is proposed to underlie hoarding behaviors in Frost and Hartl's (1996) cognitive behavioral model of compulsive hoarding is an impairment in processes related to categorization and organization. This deficit is an extension of previous research on an abnormal 'underinclusive' style of categorization in which individuals define categories more narrowly, and therefore produce a larger number of categories with fewer members. The potential implications of this deficit for explaining compulsive hoarding behaviors is that hoarders may find their possessions difficult to organize, as they would perceive fewer commonalities among them, and more difficult to discard, as items seem more unique and consequently less replaceable. Presently, the existence and nature of a categorization deficit amongst compulsive hoarders remains undetermined because the small number of studies that have examined it are highly inconsistent.

**Origins of underinclusion.** Originally, Reed (1969a) suggested underinclusive thinking as a cognitive feature of obsessive-compulsive personality disorder (OCPD), related to an impairment in the ability to spontaneously organize and integrate experience. OCPD is

characterized by a preoccupation with orderliness, perfectionism, and control at the expense of flexibility and efficiency (DSM-5). Reed (1969a) described underinclusion as the “over-structuring of input and... the maladaptive over-defining of categories and boundaries” (p. 781). Reed (1969a) predicted that, as an indication of underinclusive thinking, individuals with OCPD would be overly restrictive when defining category boundaries and therefore only accept prototypical category attributes or members when given a classificatory or conceptual task. To test this hypothesis, individuals with OCPD, a psychiatric control group, and a healthy control group performed an ‘Essentials’ task. This task involved a series of trials wherein participants are presented with a concept (e.g., book) and are asked to underline words that were considered essential for defining that concept (e.g., cover, pictures, pages, print). Theoretically, an individual with underinclusive thinking may only underline “pages” as part of the essential definition of a book, because they would not consider something to be a book on the basis that it has a cover, print, or pictures. Conversely, an individual with overinclusive thinking may consider all things with pictures, pages, and print, and covers to be books.

As predicted, in relation to both comparison groups, individuals with OCPD were more stringent when defining conceptual categories and underlined significantly fewer words. This result was interpreted as evidence that individuals with OCPD apply overly strict limits to category membership and therefore admit fewer components or attributes to individual categories. If compulsive hoarders exhibit a similarly strict style of defining category boundaries when classifying objects, then a useful system of household organization would be understandably more difficult to maintain because household objects could not be organized into a manageable number of categories. Possibly, as suggested by Frost and Hartl (1996), each

household object may become its own unique category and therefore no system of organization would be intuitive.

To explore whether underinclusion is also apparent when individuals with OCPD engage in inductive thinking, Reed (1969b) conducted a follow-up study using a sorting task where participants are required to produce their own categories. Reed (1969b) used the Vigotsky test of concept formation that requires participants to sort 22 blocks with varying shapes, colours, heights, and widths into as many categories as desired and subsequently as few categories as possible. On both trials, individuals with OCPD created a significantly larger number of categories than did healthy controls. Moreover, participants with OCPD verbally expressed complex considerations, distress over the aptness of their choices, and indecisiveness when defining categories during the task. These complex considerations and distress were interpreted as evidence that individuals with OCPD use overly complex and stringent criteria when defining categories, causing decisions about category membership to be more difficult. Evidence of underinclusive categorization for individuals with OCD was later found by Persons and Foa (1984), as shown by the creation of more piles and greater latency than healthy controls in a sorting task.

*Underinclusive categorization in compulsive hoarding.* The extension of this theorized categorization deficit to compulsive hoarding was supported in a study by Luchian et al. (2007). This study investigated whether underinclusive categorization deficits play a role in the etiology of compulsive hoarding by examining categorization in individuals with nonclinical symptoms of hoarding ( $n = 21$ ) compared to healthy controls ( $n = 20$ ). The inclusion criterion for the non-clinical group was self-identification as a 'packrat'. The validity of group assignment was checked by confirming that the mean scores of the packrat group on the Savings Inventory-



Revised (SI-R; Frost, Steketee, & Grisham, 2004) and Savings Cognitions Inventory-Revised (SCI-R; Frost et al., 2003) were significantly higher than those of the healthy control group. For the categorization task, undergraduate participants were presented with 20 objects of no or minimal monetary value (e.g., sticky notes, part of a puzzle piece, small Hershey's chocolate bar) and given unlimited time to categorize them into as many or as few categories as necessary. Consistent with the Frost and Hartl (1996) theory, packrats made significantly more categories than healthy controls ( $d = 0.62$ ) and found the categorization task significantly more stressful and difficult. However, the packrat group did not exhibit significant changes in affect from pre to post task as measured by the Positive and Negative Affect Schedule (PANAS). Luchian et al. theorized that the packrat group did not provide higher ratings on the PANAS over time because some negative affect items on the PANAS (e.g., afraid, ashamed, guilty, hostile, and scared) were not sensitive to the type of stress nonclinical hoarders otherwise reported.

Similar studies examining categorization deficits amongst individuals with clinically severe symptoms of compulsive hoarding have yielded a range of contradictory findings. Wincze et al. (2007) found that individuals with compulsive hoarding only created a larger number of categories than healthy controls when sorting stimuli were personalized to reflect the types of objects each participant typically saves ( $d = 0.80$ ). Participants in Wincze et al.'s study did not create a larger number of categories than healthy controls when sorting typically hoarded objects ( $d = 0.57$ ). Even more divergent from the findings of Luchian et al., similar sorting tasks employed by Grisham et al. (2010) and Hayward (2011) did not result in evidence of a categorization deficit amongst compulsive hoarders in comparison to healthy controls ( $d \leq 0.40$  for comparisons in these studies).

Mackin, Delucchi, and Mathews (2010) found evidence of categorization difficulties in a sample of individuals with severe compulsive hoarding and late life depression using the Delis-Kaplan Executive Function System (D-KEFS) card sorting task. However, the D-KEFS card sorting task also measures concept formation, cognitive flexibility, and problem solving. Therefore, it is difficult to separate whether the hoarding group's performance on the D-KEFS card sort was due to deficient categorization abilities or poorer skills in other areas. Moreover, the lack of a healthy control group, and the older age of participants ( $M = 70.6$ ,  $SD = 7.0$  years old) than typical samples of hoarders, limits the generalizability of their results. Mackin et al.'s hoarding group also had a very small sample size ( $n = 7$ ). The surprising inability of studies in this field to produce consistent evidence of an abnormal style of categorization with compulsive hoarding samples prompts the question: were the findings of Luchian et al. an anomaly or is nonclinical hoarding associated with an underinclusive style of categorization not seen in more severe samples?

***Group definition in Luchian et al. (2007).*** One factor that may contribute to the contrast between Luchian et al.'s findings and subsequent studies may be the manner in which they defined their subclinical group. Luchian et al. conceptualized the symptoms of their 'packrat' group as lying on a continuum with compulsive hoarding, possibly in a prodromal stage. However, above average scores on the SCI-R and SI-R may not be sufficient to differentiate symptoms of hoarding from other disorders or circumstances that may cause hoarding like behavior. Neither of these instruments is intended for diagnostic purposes. It is possible to score above average on the SI-R and the SCI-R without qualifying for symptoms of compulsive hoarding as specified in the DSM-5. For example, someone may score above average on questions regarding difficulty discarding and clutter, but not because of intent to save.

Individuals may be suffering from clutter due to a third party living in their home or have trouble discarding due to the lethargy of depression. Exhibiting difficulty discarding or clutter for these underlying reasons would not qualify for even mild symptoms of hoarding, but may result in above average scores on SI-R.

The SCI-R measures cognitions and attitudes associated with hoarding that occurred when an individual tried to discard something during the past week. While endorsement of items on the SCI-R implies difficulty discarding during the last week, the DSM-5 requires individuals to experience *persistent* difficulty discarding. An individual who experiences difficulty discarding a small number of personally significant items, or recently inherited items from a deceased loved one, should not reasonably be seen as exhibiting symptoms of hoarding. Moreover, as acknowledged by Luchian et al. (2007), the nonclinical hoarding and control group were not adequately distinct because several members of the control group had higher scores on the SI-R than some members of the nonclinical hoarding group. Therefore, it is plausible that their findings were an anomaly caused by the diversity of the nonclinical hoarding group.

Given contradictory evidence in the same field, one manner of rendering Luchian et al.'s (2007) findings more convincing would be to replicate their results in a study that uses more comprehensive tools and inclusion criteria to characterize the subclinical hoarding group. Unfortunately, since very little is known about the course of compulsive hoarding, the task of constructing a group of individuals who are in the early stages of compulsive hoarding disorder or are at least experiencing symptoms on the same continuum as compulsive hoarding is a difficult task. However, it is possible to significantly improve upon Luchian et al.'s self-report method of defining groups. One method of doing this would be to use a clinical interview that verifies hoarding problems are not solely due to depression, inheritance, or a third party.

Moreover, this interview could use clinical severity ratings to establish that each participant in the subclinical group displays hoarding symptoms that are elevated in comparison to healthy controls, but are less severe than a clinical sample. A study that uses this procedure for defining groups would be better in a better position to interpret how the performance of a subclinical group relates to processes in compulsive hoarding.

*Personal Relevance of Sorting Stimuli.* Another possible reason why studies on underinclusive categorization and hoarding have produced inconsistent results may be differences in the stimuli used in sorting tasks. The stimuli participants have been asked to categorize range from an assortment of trivial objects (i.e., not personally relevant and of little or no monetary value) to participants' own possessions. Personalized stimuli may be more difficult for hoarders to categorize due to the emotions evoked by their possessions.

Within the cognitive sciences, numerous studies have shown that emotional states and stimuli influence processes related to categorization. For example, positive and negative moods have been found to influence the number of categories individuals produce when sorting stimuli as well as flexibility to adapt categorization strategies to task demands (Murray, Sujan, Hirt, & Sujan, 1990). Moreover, people have also found to categorize based on the emotions evoked by stimuli (e.g., happiness, fear, sadness) when in emotional states (Niedenthal & Dalle, 2001; Niedenthal, Halberstadt, & Innes-Ker, 1999). For a review of research on the perception and categorization of emotional stimuli, see Brosh, Pourtois, & Sander (2010).

For compulsive hoarders, the influence of emotional relevance on categorization decisions may be even stronger than for healthy individuals due to an intensified sentimental valuing of objects, termed 'hypersentimentality' (Frost et al., 1995; Frost & Hartl, 1996). Abnormal emotional attachment to objects in compulsive hoarding has been noted in multiple

case studies, anecdotes and positively associated with measures of hoarding behavior (Frost & Gross, 1993; Frost & Hartl, 1995; Frost et al., 2003; Greenberg, 1987; Warren & Ostrom, 1988). Therefore, individuals with compulsive hoarding may be more likely to display underinclusive categorization when sorting personal possessions because the emotional salience of their possessions could cause a shift in emotional state or increase the number of features they attend to when defining categories.

Sorting tasks using more personalized stimuli, however, have produced inconsistent results. In the study by Wincze et al. (2007), three groups of participants, compulsive hoarders ( $n = 21$ ), psychiatric controls with OCD but no hoarding symptoms ( $n = 21$ ), and non-psychiatric controls ( $n = 21$ ), were compared on three different categorization tasks. The first of these tasks was an object sorting task that required participants to sort 20 objects reflecting five types of items typically collected by hoarders according to their meaning or potential value. The subsequent 'modified' sorting task required participants to sort the same 20 objects into the smallest number of meaningful groups possible. The third sorting task required subjects to sort index cards personalized with the names of objects they previously indicated are representative of the types of items they have in their home.

In Wincze et al. (2007), the three groups did not differ significantly in the number of categories created in the object sorting task ( $d = 0.57$ ) or in the modified sorting task ( $d = 0.08$ ). Groups also did not differ on the time taken to complete either of these tasks. These results were unexpected given that Luchian et al. (2007) found that a collection of diverse objects and trinkets of minimal value was sufficient to elicit a significantly larger number of categories from nonclinical hoarders in comparison to healthy controls. Only the personalized sorting task produced significant between-group differences on time, and number of piles. On the

personalized sorting task, the hoarding group created more piles than the healthy controls ( $d = 0.80$ ) but did not create significantly more piles than the OCD group ( $d = 0.47$ ). Moreover, within the hoarding group, participants made significantly more piles when sorting personalized index cards than non-personal stimuli, whereas the OCD group and healthy control group showed no difference in number of piles created across tasks.

The hoarding group in Wincze et al. (2007) also gave higher ratings of distress than the healthy control group on the subjective units of distress scale (SUDS) prior to each sorting task. The SUDS ratings provided before tasks were approximately 20/100 for the hoarding group and OCD group, whereas the SUDS reported by the healthy control group were close to zero ( $M = 0.7 - 2.4$ ). Overall, these findings would suggest that categorization may generally be more distressing for individuals with compulsive hoarding than for healthy controls but underinclusive categorization tendencies are specific to personal possessions. One difference between the personal and non-personal sorting tasks is that personal stimuli are likely to have greater emotional value. Due to the greater emotional value hoarders tend to imbue objects with (i.e., hypersentimentality), the emotional value of the personalized items may have been amplified for compulsive hoarders, and therefore may have influenced categorization processes more than for healthy controls.

The conflicting findings of Luchian et al. (2007) and Wincze et al. (2007) render it unclear whether particular circumstances are necessary for underinclusive categorization to emerge amongst individuals with symptoms of compulsive hoarding. Moreover, although the comparison between the hoarding group and control group in Wincze et al. was not statistically significant, its effect size was similar in size to that yielded by the sorting task in Luchian et al. study. In an effort to clarify this inconsistency, Grisham et al. (2010) conducted a study similar

to Wincze et al. with some methodological improvements. The experimental groups in Grisham et al. were compulsive hoarders ( $n = 23$ ), healthy controls ( $n = 20$ ), and individuals with an Axis I disorder other than hoarding ( $n = 17$ ). The categorization tasks required participants to sort 20 possessions they brought to the lab that were “representative of the types of items they would have in their home[s]” (p. 869), 20 non-personal objects, 20 personal index cards (cards labeled with the objects participants brought from home), and 20 non-personal index cards (cards labeled with the names of the non-personal objects).

Conversely to Wincze et al., Grisham et al. found that compulsive hoarders did not create a significantly greater number of categories than the healthy control group on any of the categorization tasks. Effect sizes for comparisons between the compulsive hoarding group and the healthy control group for non-personal categorization tasks ranged from  $0.00 \leq d \leq 0.37$  and from  $0.04 \leq d \leq 0.15$  for personalized tasks. However, for both personalized tasks, both hoarders and healthy controls created a greater number of piles than the Axis I group. Moreover, the hoarding group reported more pre- and post-task distress on the SUDS in comparison to the healthy control group and the Axis I group on every task but the non-personal index card task. Pre- and post-task SUDS scores tended to be around 30/100 for the hoarding group, around 15/100 for the Axis I group, and around 9/100 for the healthy control group. Since the clinical group reported significantly higher distress than other groups before hearing the instructions for the sorting task, higher post-task distress is more likely to stem from anxiety caused by the experimental situation than reactivity to sorting tasks. Therefore, Grisham et al. did not provide support for underinclusive categorization in compulsive hoarding or the idea that sorting is a more distressing activity for individuals with compulsive hoarding.

Contradictory findings regarding sorting index cards personalized with hoarders' possessions between Wincze et al. (2007) and Grisham et al. (2010) are particularly unexpected given that both studies used personalized sorting stimuli and clinical populations. Moreover, the improvement in external validity made by adding a task involving hoarders' actual possessions would be expected to enhance the effect found in Wincze et al., rather than contradict it. One potential reason these studies differ may be the degree to which stimuli were standardized across groups. All of the personalized index cards Wincze et al. developed for participants were based on their answers to a common questionnaire. Moreover, index cards listed items at a general level (e.g., sports magazine), rather than specific examples of things participants owned (e.g., *Sports Illustrated*, Volume 3, Issue 2). The use of a similar questionnaire and the identification of items at a general level is likely to have limited the variation of sorting stimuli more than the procedure used in Grisham et al.'s personal task. Grisham et al. asked participants to bring in items that were representative of their homes and therefore allowed for a wider range of variation in stimuli both among participants and among groups. The diversity of stimuli used in the personal tasks may have masked between-group differences by altering the number of implicit categories present in differing sets of stimuli. Despite this variation, having participants categorize their own possessions is a substantial improvement on Wincze et al.'s task because real possessions offer additional dimensions upon which categories can be based (e.g., size, colour, frequency of use, cost) and are more likely to carry emotional associations. One method of combining the advantages of Wincze et al. and Grisham et al.'s personal tasks would be to design a sorting task that uses a standardized set of personal possessions that are especially likely to carry emotional value.



In a different approach to studying categorization amongst compulsive hoarders, Hayward (2011) investigated whether compulsive hoarders viewed more unique qualities in stimuli and whether compulsive hoarders sorted personal items differently from healthy controls following a relaxation induction and an anxiety induction. The first sorting task consisted of index cards depicting perceptually unique figures and perceptually distinct figures that were divided into two categories: household items (drawings of tea pots and mugs) and non-household items (abstract bugs). Compared to healthy controls, compulsive hoarders generated more criteria for sorting perceptually unique and distinct household figures but not non-household figures. This result provides some support for the notion that hoarders may have more difficulty categorizing personal items as it suggests that compulsive hoarders may perceive more features of items when items are familiar. However, it is also possible that greater perfectionism associated with hoarding (Frost & Gross, 1993) may have resulted in hoarders feeling compelled to list more criteria beyond the point healthy controls were satisfied.

For the second task in Hayward's (2011) study, participants rated a list of 75 common household items on a Likert scale from 0 = not at all difficult to discard to 5 = extremely difficult to discard. The 15 items that were rated as most difficult to discard were defined as personally relevant stimuli and the 15 items that were rated as least difficult to discard were defined as non-personally relevant stimuli. Contradictory to Wincze et al. (2007) and consistent with Grisham et al.'s (2010) findings, compulsive hoarders did not take more time, or produce a significantly larger number of categories, than healthy controls ( $d = 0.31$ ) when sorting personally relevant stimuli listed on index cards following the relaxation induction in Hayward's study. Moreover, consistent with both Wince et al. and Grisham et al., there were also no significant between-

group differences in the number of categories created when sorting non-personally relevant stimuli listed on index cards ( $d = 0.05$ ).

In summary, Wincze et al. (2007) found that individuals with compulsive hoarding exhibited underinclusive categorization when sorting index cards personalized with the names of objects each participant saves, but not when sorting physical objects typically found in hoarded homes. Given that only stimuli personalized to match each participant's possessions were sufficient to elicit a significant between-groups difference, the findings of Wincze et al. suggest that, for hoarders, categorization deficits are specific to personal possessions. Conversely, Grisham et al. (2010) found that compulsive hoarders did not exhibit a categorization deficit when sorting typically hoarded items, personal possessions, or index cards with the names of personal or typically hoarded items written on them. Similarly, Hayward (2011) did not find that compulsive hoarders exhibited a categorization deficit when asked to sort index cards personalized with the names of items participants indicated would be most or least difficult to discard. This strange mixture of findings where hoarding symptoms have been associated with underinclusive categorization for a random collection of trivial objects, inconsistently for personalized objects, and never for typically hoarded objects, prompts the following question. Are hoarding symptoms associated with underinclusive categorization deficit for all objects or is this relationship moderated by the personal relevance of stimuli?

## **The Current Research**

The current research aims to clarify the confusing pattern of results that has emerged from the literature on compulsive hoarding and categorization. To achieve this goal, the current research will address two research questions. Firstly, do individuals with subclinical hoarding symptoms and individuals who meet criteria for compulsive hoarding disorder both exhibit underinclusive categorization? Secondly, does the presence of underinclusive categorization for either of these groups vary depending on the personal relevance of the stimuli being sorted? To address these questions, I will replicate and expand the study by Luchian et al. (2007).

Although replications are always necessary in science to verify that findings are not due to methodological artifacts, a replication of Luchian et al.'s (2007) study is particularly necessary given its disparate place in the literature. This replication will help determine whether the findings of Luchian et al. were an anomaly, and if not, whether their findings extend to individuals who fully meet criteria for compulsive hoarding, and remain robust when different sorting stimuli are used. The current study will improve upon how Luchian et al. selected and defined experimental groups in three ways. Firstly, the current study will better distinguish between groups by requiring members of differing groups to meet different cut-off scores on an instrument measuring the core symptoms of hoarding. This method will also facilitate characterization of the subclinical group. Secondly, the current study will obtain a more representative sample of participants by recruiting from the community instead of exclusively relying on university students.

To address the first research question, concerning whether underinclusive categorization differs depending on severity of hoarding symptoms, I will expand my replication of Luchian et al. (2007) by including a compulsive hoarding group so that direct comparisons can be made

between subclinical hoarders, clinical level compulsive hoarders, and healthy controls. Currently, no other study has directly compared the performance of a subclinical and clinical hoarding group on the same categorization tasks. Comparing these populations in the same study will help to determine whether population differences may be responsible for the discrepancy between previous studies. If Luchian et al.'s findings are only replicated for the subclinical hoarding group, then future research should strive to explain why underinclusive categorization is a phenomenon that only affects individuals with subclinical hoarding symptoms and how this deficit may influence the development of more severe hoarding symptoms. However, if both the subclinical and clinical hoarding groups exhibit a categorization deficit, then this study would support the continuation of current research on categorization abilities as a means of furthering our understanding of hoarding behavior.

The second research question, regarding whether the personal nature of stimuli moderates the relationship between hoarding and underinclusive categorization, will be addressed by adding additional sorting tasks to the replication of Luchian et al. (2007). In addition to sorting a variety of trivial objects as was done in Luchian et al., participants will sort personal and typically hoarded items. The addition of these stimuli will help determine whether categorization deficits are restricted to personal possessions, typically hoarded items or trivial objects and whether this restriction differentially applies to individuals with subclinical and clinical hoarding symptoms. Moreover, the personal task will improve upon Wincze et al. and Grisham et al.'s personal tasks by requiring participants to bring a standardized set of personal possessions that are especially likely to carry emotional value. Standardizing the personal possessions used in the personal task will ensure that between-group differences in the number of categories created are not influenced by unintended group differences in the exact objects participants bring to the laboratory.

Overall, this study will contribute to the literature by helping to explain the inconsistency of current research in this field and further testing the validity of Frost and Hartl's (1996) proposition that individuals with compulsive hoarding possess categorization deficits. In addition to further testing the existence of a relationship between hoarding symptoms and a deficit in categorization abilities, this study will help uncover the shape of this relationship when hoarding symptoms vary in severity by contrasting a subclinical and clinical group.

## Method

### Participants

Study participants were 20 individuals with clinical symptoms of hoarding, 30 individuals with subclinical symptoms of hoarding, and 35 healthy controls. In order to recruit a diverse sample of participants, our recruitment strategy targeted people of various age groups and socio-economic statuses around Vancouver. Poster advertisements were placed in community centers around Vancouver and online advertisements were posted on our laboratory's website, and community websites (e.g., craigslist, kijiji) several times per week.

Inclusion criteria were that participants must be between the ages of 18-65 and fluent in English. This upper age limit was chosen to help exclude individuals who exhibit hoarding behaviors associated with dementia. Healthy controls were excluded if they reported being currently engaged in treatment (including taking any medications) for their mental health. Group assignment was determined by cut-off scores on four of the five items of the Hoarding Rating Scale Interview (HRS; Tolin, Frost, & Steketee, 2010). These four items of the HRS were chosen because they assess the core components of hoarding according to the diagnostic criteria for compulsive hoarding in the DSM-5. These items are: 1) difficulty discarding ordinary objects, 2) difficulty using one's home due to clutter, 3) emotional distress due to hoarding problems and 4) impairment in daily life due to hoarding problems. Participants in the compulsive hoarding group required scores in the high range (4-8) on all items concerning difficulty discarding and clutter, and either impairment or distress. Participants in the subclinical group required scores in the moderate range (2-3) on HRS items concerning difficulty discarding and clutter and any score on impairment and distress. Participants in the healthy control group required scores in the low range (0-1) on all relevant HRS items.

As a means of further validating group assignment, individuals in the hoarding group were also required to report a score of 4 or higher in at least one room of their home on the Clutter Image Rating Scale (CIR; Frost, Steketee, Tolin, & Renaud, 2008). Moreover, participants were required to collect more than one type of object to exclude less common forms of hoarding wherein individuals specialize in one type of item or collect animals. These less common forms of hoarding were excluded as a precaution against potential differences between these groups confounding results.

A total of 148 people participated in the phone screening after contacting the laboratory. Five people were no longer interested in participating after hearing more about the study, and 37 people cancelled or failed to show up for their appointments after being scheduled to participate and could not be rescheduled. Fifteen people were excluded because they were engaged in therapy or taking medication for emotional problems or mental health issues. Three participants who completed the study were excluded because they could not be classified into a group due to discrepancies between scores on clutter and difficulty discarding items of the HRS. Two of these individuals indicated that they had either no difficulty or mild difficulty using rooms in their home due to clutter but severe difficulty discarding objects. The third individual indicated he experienced mild to moderate difficulty using rooms in their home due to clutter, but no difficulty throwing things away when clutter did begin to bother them. Moreover, two participants from the subclinical group were excluded because they failed to complete the SI-R.

The entire sample had a mean age of 32.95 years ( $SD = 13.47$ ), and 60.20% were female. The clinical group was significantly older than both the healthy control group and the subclinical group,  $F(2, 82) = 9.57, p < .001$ . The subclinical and healthy control groups were matched for age. No significant differences between groups were found for any other demographic variable

(see Table 1).

Table 1

*Demographics as a Percentage of the Sample and Each Group*

	Entire Sample ( <i>N</i> = 85) <i>n</i> (%)	Group			<i>X</i> <sup>2</sup>	<i>p</i>
		Control ( <i>n</i> = 35) <i>n</i> (%)	Subclinical ( <i>n</i> = 30) <i>n</i> (%)	Clinical ( <i>n</i> = 20) <i>n</i> (%)		
Female	50 (60.2)	24 (70.6)	16 (53.3)	10 (52.6)	2.58	.28
Highest Degree					8.85	.18
High school	28 (33.3)	14 (41.2)	6 (20.0)	8 (42.1)		
College	15 (18.1)	4 (11.8)	5 (16.7)	6 (31.6)		
Bachelor's	26 (31.3)	10 (29.4)	13 (43.3)	3 (15.8)		
Beyond Bachelor's	14 (16.9)	6 (17.6)	6 (20.0)	2 (10.5)		
Income						
< \$10,000	29 (34.9)	15 (44.1)	9 (30.0)	5 (26.3)	7.71	.46
\$10,000 – 19,999	25 (30.1)	11 (32.4)	7 (23.3)	7 (36.8)		
\$20,000 – 49,999	21 (25.3)	6 (17.6)	10 (33.3)	5 (26.3)		
\$50,000 – 99,999	6 (7.2)	2 (5.9)	2 (6.7)	2 (10.5)		
≥ \$100,000	2 (2.4)	0 (0.0)	2 (6.7)	0 (0.00)		
Age ( <i>M</i> , <i>SD</i> )	32.9 (13.5)	28.5 (11.5)	31.37 (13.5)	43.2 (14.9)		

*Note.* Two participants did not provide demographic information for gender, income, and education.

**Materials**

*Hoarding Rating Scale-Interview* (HRS-I; Tolin, Frost, & Steketee, 2010). The HRS-I is



a semi-structured interview that assesses 5 dimensions of hoarding: difficulty using rooms due to clutter, excessive acquisition of objects, difficulty discarding possessions, distress due to hoarding behaviors, and functional impairment due to hoarding. The HRS-I is composed of 5 questions that are rated on a 8-point scale ranging from 0 (*none*) to 8 (*extreme*). The HRS-I has good internal consistency ( $\alpha = 0.96$ ), test-retest reliability ( $r = 0.96$ ), good convergent validity with the CIR ( $r = 0.72$ ) and the SI-R ( $r = 0.91$ ), and clearly distinguishes individuals with compulsive hoarding from community controls and OCD patients without hoarding (Tolin et al., 2010). In this study, all raters were clinical graduate students with training and experience in assessment of hoarding.

***Demographic Questionnaire:*** A brief open-ended questionnaire assessing demographic variables such as age, gender, education, and income was created for this study. Income brackets were calculated based on those provided for Statistics Canada for British Columbia (Statistics Canada, 2012).

***Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995):*** The DASS is a 42 item self-report scale that measures depression, anxiety, and stress using three 14-item subscales. Factor analyses of the DASS have repeatedly demonstrated a three-factor structure corresponding to these constructs (Crawford & Henry, 2003; Clara, Cox, & Enns, 2001; Lovibond & Lovibond, 1995). When completing the DASS, participants indicate how much items applied to them during the past week (e.g., I just couldn't seem to get going) on a 4-point Likert-type scale ranging from 0 (*did not apply to me*) to 3 (*applied to me very much, or most of the time*). The DASS has shown high internal consistencies of 0.91 for depression subscale and 0.84 for anxiety subscale (Nezu, Ronan, Meadows, & McClure, 2000). The DASS has also demonstrated good reliability over a two-week period in a clinical sample for both the depression

subscale ( $r = 0.71$ ) and the anxiety subscale ( $r = 0.79$ ; Brown, Chorpita, Korotitsch, & Barlow, 1997). Moreover, Lovibond and Lovibond (1995) provided evidence of convergent and discriminant validity through correlations differing in the expected direction with the Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI). The DASS depression subscale correlated highly with the BDI ( $r = 0.74$ ) and the DASS anxiety subscale correlated highly with the BAI ( $r = 0.81$ ). Lower correlations were found between the DASS depression subscale and the BAI ( $r = 0.54$ ), and between the DASS anxiety subscale and the BAI ( $r = 0.58$ ).

***Saving Inventory-Revised*** (SI-R; Frost, Steketee, & Grisham, 2004). The SI-R is a 23-item self-report questionnaire with three subscales; each scale measures the severity of one of the three core components of compulsive hoarding: difficulty discarding, clutter and excessive acquisition. Items are rated according to a 4-point Likert scale from 0 (*not at all*) to 4 (*almost all*). The SI-R subscales have test-retest reliabilities exceeding 0.78, internal consistencies exceeding 0.87, and have displayed convergent validity with both self-report scales and observer-rated scales of hoarding (Frost et al., 2004). Moreover, the SI-R also displayed discriminant validity with measures unrelated to hoarding such as those measuring OCD symptoms. The mean scores obtained from compulsive hoarders and non-hoarding individuals by Frost et al. (2004) clearly differentiated these two groups ( $M = 53, SD = 14$  vs  $M = 24, SD = 12$ ). The SI-R is therefore a valid, reliable and suitable measure for assessing symptom severity of compulsive hoarding in both clinical and non-clinical groups. The SI-R will be used as a secondary means of validating group assignment; mean scores of the subclinical and clinical hoarding group are expected to be significantly higher than the healthy control group.

***Clutter Image Rating Scale*** (CIR; Frost, Steketee, Tolin, & Renaud, 2008). The CIR is a visual rating tool for measuring the severity of clutter in a home and can be completed as a self-

report measure or an observer-rated measure. The CIR contains four separate cards for rating kitchens, living rooms, bathrooms and bedrooms, each containing 9 standardized colour photographs depicting increasingly severe levels of clutter. Ratings ranging from 1 (no *clutter*) to 9 (*severe clutter*) are made for each type of room by having a participant or observer select the picture that best corresponds to the amount of clutter in a patient's home. Clinically significant clutter is defined by a rating of 4 or more for any of the rooms (Steketee & Frost, 2007). The CIR demonstrated good convergent validity with the clutter subscale of the SI-R ( $r = 0.72$ ), discriminant validity through weaker correlations with other subscales of the SI-R not assessing clutter ( $r = 0.37 - 0.56$ ), and good internal consistency for the composite score ( $\alpha = 0.84$ ; Frost et al., 2008).

One of the inclusion criteria for the clinical group in the present study was a score of 4 or higher on any room in the home that is frequently used. This criterion for clinically significant clutter was used instead of a composite rating of all rooms because the composite score may underrepresent the extent of hoarding problems in some situations. For example, participants may restrict their clutter to particular rooms in the home at the behest of roommates or spouses. A score of 7 in one's bedroom, and 4 in one's bathroom, and 1 in common spaces such as the kitchen and living room, would result in a composite score of 3 which is below the threshold for clinically significant clutter. Moreover, a high score in two commonly used spaces may be enough to create distress and impairment. For example, a score of 7 in one's living room, 4 in one's kitchen, and 2 in one's bathroom and bedroom, would result in a composite score below 4 even though this person is coping with an impairing amount of clutter in major areas of their home.

***Subjective Units of Distress Scale*** (SUDS; Wolpe, 1990). The SUDS is a commonly

used single question anxiety barometer used to determine how anxious or distressed a subject feels from 0 (absolute calm) to 100 (most distress possible). It has demonstrated convergent validity with measures of autonomic arousal (Thyer, Papsdorf, Davis, & Vallecorsa, 1984). In the current study, subjects rated their SUDS level at the beginning and end of each categorization task.

### **Experimental Tasks**

The order in which categorization tasks were presented was randomly generated. This was done to prevent a systematic difference on outcome measures of these two tasks due to test sensitization and emotional distress carrying over from a previous task.

*Trivial items task.* As in the sorting task employed by Luchian et al. (2007), participants were asked to sort 20 objects of no or minimal monetary value into categories and were given unlimited time. Objects used in this sort task include: a pencil, an upbeat fortune from a fortune cookie, a cocktail umbrella, a small package of moist cleansing wipes, a button with a written slogan, two 37-cent stamps, a pen with the university's name on it, a gummy candy, a pair of interlocking metal puzzle pieces, a stack of Post-Its, an old *Newsweek* magazine, a brightly colored "stretch" frog, a small Hershey's chocolate bar, a travel-sized bar of soap, a box of black-and-white film, a rubber ball, an individually wrapped fortune cookie, a birthday candle, a smiley-face sticker, and a die.

*Typically hoarded items task:* Based on the object sorting task by Grisham et al. (2010), 20 objects were chosen that reflect the five types of items most commonly found in hoarders' homes: clothing, office supplies, reading material, used containers, and bathroom items. Objects in this task include a newspaper, magazine, book, journal article, baseball cap, tie, t-shirt, sock, empty coffee can, empty paper-towel roll, candy wrapper, worn paper bag, pencil, paper clip,

elastic band, transparent tape, soap bar, tooth paste, deodorant, and shaving cream. Participants were given unlimited time to sort their objects into any number of categories.

***Personal items task.*** Participants were asked to bring 20 of their personal possessions into the laboratory after being guaranteed that their objects would be returned to them. To increase the standardization of this task, participants were directed to select objects corresponding to a set list of objects most people would be expected to own (e.g., spoon, pen, book). To enhance the likelihood objects brought to the laboratory would be personally meaningful, if participants had multiple objects for a given item on the list, they were asked to bring their “favorite” one. The experimenter supplied missing items when participants neglected to bring all 20 objects to the lab so that all participants sorted the same number of items. Participants were given unlimited time to sort their objects into any number of categories.

## **Procedure**

**Phone screen.** Individuals who contacted the lab expressing interest in participating in research were scheduled for a preliminary phone screen with a research assistant. During this phone screen, participants were asked their age, assessed for English proficiency according to how easily they conversed with the interviewer, and queried about their willingness to bring 20 personal items into the laboratory. Moreover, participants were also asked if they experienced difficulty with clutter or discarding possessions. If they did not experience difficulty with clutter or discarding possessions, they were asked if they were currently taking any medications or engaged in treatment for their mental health.

**Laboratory session.** Participants were contacted via email two days before their session in the laboratory to confirm their availability, and reminded to bring in 20 personal items. After initial arrival in the laboratory, participants were given verbal and written information about the

study and encouraged to ask questions before giving written consent. Subsequently, participants were administered the HRS-I. Next, participants completed the demographic questionnaire, the SI-R, and the DASS on a computer in the laboratory. Before beginning the sorting tasks, participants were offered an optional 10-minute break to prevent fatigue from influencing performance, although few participants availed themselves of this opportunity.

The experimenter gave scripted instructions based on those used by Luchian et al. (2007), Grisham et al. (2010), and Wincze et al. (2007) before each task (see Appendix for script). The experimenter administered the SUDS before and after each sorting task. The SUDS rating taken after each task was a rating of peak distress experienced during the sorting task. After the completion of each sorting task, the experimenter took notes on the number of piles produced and the time taken to sort items. Participants were then debriefed, rewarded with \$15, thanked for their participation, and dismissed.

## Results

### Research Design and Overview of Analyses

The research design of the current study is a 3 x 3 mixed model factorial design. The between subjects independent variable is compulsive hoarding pathology. The three levels of this variable are clinically severe symptoms of compulsive hoarding, subclinical symptoms of compulsive hoarding, and healthy controls. The repeated measures factor is categorization stimuli, and the three levels are trivial items (i.e., objects used by Luchian et al., 2007), typically hoarded items, and personal possessions. The dependent variables expected to change as a function of group membership and categorization stimuli are: number of categories generated in sorting task, time taken to complete sorting task, and level of distress.

Demographic variables such as age, gender, education, and years of education are summarized for each group in means and standard deviations for descriptive purposes. Furthermore, one-way ANOVAs and chi-squared tests were performed to test for group differences on demographic variables. Next, as a group assignment check, I verified that there were significant differences between groups in the expected direction on the SI-R and CIR using one-way ANOVAs by group. I then conducted one-way ANOVAs by group on the number of personal items participants forgot to bring the laboratory to examine whether lack of personal ownership of stimuli could have influenced the results of the personal task. When significant *F* values were obtained, Tukey-Kramer post-hoc tests were conducted because they take into account unequal group sizes and are one of the more powerful post hoc tests. Games-Howell post hoc tests were used when the homogeneity of variance assumption was violated because they do not require this assumption to be met.

Separate 3 (group: subclinical hoarding, clinical hoarding, healthy control) x 3 (stimuli:

trivial items, typically hoarded items, personal items) mixed model ANOVAs were performed with categorization task outcome measures (the number of categories produced, task latency, and peak distress scores) as dependent variables. The interaction between group and task and the main effects of group were of interest in these analyses. Main effects of group indicate whether the clinical and subclinical groups display more underinclusive categorization, indecisiveness, and distress than healthy controls across tasks. Interactions are relevant to research questions about whether the type of stimuli being sorted moderates the relationship between compulsive hoarding and underinclusive categorization, indecisiveness, and distress.

Moreover, independent sample *t*-tests between the subclinical group and healthy control group were conducted on the number of categories created and latency to replicate Luchian et al.'s (2007) analyses for enhanced interpretation. Lastly, to examine hoarding symptoms from a dimensional perspective, correlations between the SI-R total score and outcome measures were computed.

### **Group Validation**

To check on the validity of group assignments, one-way ANOVAs were conducted on the total score and subscales of the SI-R. Groups differed in the expected direction on the SI-R and all subscales. Significant differences were found between groups for the SI-R total score,  $F(2, 82) = 77.33, p < 0.001, \eta^2 = 0.65$ . Analyses on the clutter subscale,  $F(2, 82) = 74.67, p < .001, \eta^2 = 0.65$ , difficulty discarding subscale,  $F(2, 82) = 40.73, p < .001, \eta^2 = 0.50$ , and acquisition subscale,  $F(2, 82) = 32.68, p < .001, \eta^2 = 0.44$ , also yielded large and significant group differences. Tukey-Kramer post-hoc tests indicated that these differences were in the expected direction for the SI-R total score and each subscale, with the clinical group and the subclinical group scoring higher than the healthy control group, and the clinical group scoring higher than



the subclinical group (see Table 2). Similarly, there were large and significant differences between groups on both the composite CIR rating,  $F(2, 82) = 72.62, p < .001, \eta^2 = .64$ , and the participant's maximum CIR score,  $F(2, 72) = 38.84, p < .001, \eta^2 = .49$ , in the expected direction (see Table 2).

The last item of the depression subscale of the DASS was missing for most participants ( $n = 68$ ) due to human error. Missing items were replaced using multiple imputation based on the other items of the depression subscale. The results yielded from multiple imputation were then compared to those generated using mean imputation. All of the substantive interpretations were equivalent between group comparisons run with multiple and mean imputation. Therefore, group averages on the depression subscale of the DASS were computed and reported using mean imputation for ease of interpretation. There were no significant differences on the depression, anxiety, and stress subscales of the DASS.

Lastly, 29% of the sample neglected to bring at least one item required for the personal task. There were no significant between-group differences in the number of personal objects participants forgot to bring to the laboratory,  $F(2, 82) = 0.58, p = 0.56$ . The maximum number of objects forgotten was 11 for the control and clinical group, and 8 for the subclinical group. The majority of participants (71%) brought all of the required personal items to the laboratory.

Table 2

*Means and Standard Deviations of Self-Report Measures*

Measure	Hoarding <i>M (SD)</i>	Subclinical <i>M (SD)</i>	Control <i>M (SD)</i>	<i>F</i>	<i>p</i>	$\eta^2$
<b>SI-R</b>						
Clutter	21.55 (5.82)	13.43 (4.35)	6.40 (3.57)	74.67***	< .001	.65
Discarding	17.90 (3.62)	13.50 (4.43)	6.91 (5.02)	40.73***	< .001	.50
Acquisition	16.65 (5.24)	10.77 (4.66)	6.77 (3.46)	32.68***	< .001	.44
Total	55.95 (11.65)	37.57 (10.90)	19.45 (9.69)	77.33***	< .001	.65
<b>DASS</b>						
Depression	12.14 (9.74)	8.65 (6.96)	7.54 (8.35)	0.96	.14	.05
Anxiety	8.85 (6.96)	5.8 (7.11)	5.22 (5.62)	1.67	.14	.05
Stress	15.45 (9.92)	12.80 (9.08)	11.31 (7.82)	1.16	.25	.03
Total	36.44 (24.44)	27.25 (16.52)	24.09 (18.71)	1.62	.11	.05
<b>CIR</b>						
Composite	3.55 (0.80)	2.13 (0.54)	1.52 (0.51)	72.62***	< .001	.64
Highest Rating	5.45 (1.79)	3.4 (1.65)	1.97 (0.82)	38.84***	< .001	.49

*Note.* SI-R = Savings Inventory Revised; DASS = Depression Anxiety Stress Scales; CIR = Clutter Image Rating Scale.

Depression and DASS total scores generated using single imputation to replace missing item.

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

**Preliminary Analyses**

I conducted several tests to verify whether the parametric assumptions underlying ANOVA were met for this data set before running the main analyses. I examined normality by

examining data distributions and running Shapiro-Wilk tests. Moreover, heterogeneity of variances was determined through Levene's test of equal variances. Measures such as data transformations and non-parametric tests were taken to correct for violated assumptions when appropriate and will be discussed in more detail later.

Table 3

*Comparison of Groups on Categorization Tasks*

Task	Hoarding <i>n</i> = 20 <i>M</i> ( <i>SD</i> )	Subclinical <i>n</i> = 30 <i>M</i> ( <i>SD</i> )	Control <i>n</i> = 35 <i>M</i> ( <i>SD</i> )
Trivial			
# Categories	6.55 (2.19)	6.47 (2.19)	5.54 (1.31)
Time (secs)	94.00 (55.70)	75.17 (34.31)	61.80 (20.76)
Pre-SUDS	21.70 (18.24)	17.67 (13.19)	16.34 (12.28)
Peak-SUDS	39.08 (27.51)	24.07 (12.88)	22.66 (15.28)
Typical			
# Categories	6.15 (1.27)	6.10 (1.60)	5.54 (1.27)
Time (secs)	86.70 (54.59)	61.67 (28.16)	60.17 (30.12)
Pre-SUDS	22.60 (17.09)	16.83 (9.47)	16.49 (12.82)
Peak-SUDS	35.40 (22.74)	21.43 (11.13)	21.49 (16.31)
Personal			
# Categories	7.05 (2.82)	7.57 (2.62)	7.05 (2.82)
Time (secs)	91.45 (60.56)	69.37 (27.95)	58.89 (23.88)
Pre-SUDS	25.10 (21.43)	18.77 (13.07)	15.60 (12.62)
Peak-SUDS	36.90 (27.21)	26.30 (12.80)	21.57 (15.83)

## Categories

**Aim 1: To examine whether individuals with subclinical and clinical symptoms of hoarding exhibit an underinclusive categorization deficit.**

*Research Question 1: Do individuals with subclinical and clinical symptoms of hoarding create a larger number of categories than healthy controls? If so, does this difference depend on the type of objects being sorted?*

A 3 (Group [subclinical hoarding, clinical hoarding, healthy control] x 3 Task [trivial items, typically hoarded items, personal items]) mixed model ANOVA was conducted to examine the main effects of group and task and their interaction on the number of categories participants created when sorting stimuli. Mauchly's test of sphericity revealed that the assumption of sphericity for repeated measures ANOVA had been violated. Therefore, a Greenhouse-Geisser correction was applied to the main effect of task and the Group x Task interaction. Results indicated that there was a significant main effect of group,  $F(2, 74) = 3.14, p = .049, \eta^2 = 0.08$ , a main effect of task,  $F(1.75, 143.06) = 2.18, p < .001, \eta^2 = 0.19$ , and no significant interaction,  $F(3.49, 143.06) = 0.78, p = .53, \eta^2 = 0.02$ .

Tukey-Kramer post-hoc tests revealed that the subclinical group ( $M = 6.71, SD = 1.64$ ) created a larger number of categories than the control group ( $M = 5.76, SD = 1.63, p = .06, d = 0.58, 95\% CI [0.08, 1.08]$ ), but not significantly more than the clinical group ( $M = 6.58, SD = 1.64, p = .96, d = 0.08, 95\% CI [-0.64, 0.49]$ ). Moreover, the clinical group did not create a significantly larger number of categories than the control group ( $p = .18, d = 0.50, 95\% CI [-0.05, 1.06]$ ).

## Latency

**Aim 2: To examine whether individuals with subclinical and clinical symptoms of hoarding are more indecisive than healthy controls when sorting objects.**

*Research Question 2: Do individuals with subclinical and clinical symptoms of hoarding take longer to complete sorting tasks than healthy controls? If so, does this difference depend on the type of objects being sorted?*

The data collected on latency were positively skewed, and the homogeneity of variance assumption was not met. A logarithmic function was used to transform data to adjust for positive skew and unequal variances across groups. Analyses run with and without transformed data yielded similar interpretations. The following results utilize untransformed data to facilitate interpretation. Moreover, Mauchly's test of sphericity revealed that the assumption of sphericity for repeated measures ANOVA had been violated. Therefore, a Greenhouse-Geisser correction was applied to the main effect of task and the Group x Task interaction.

A 3 x 3 Group [subclinical hoarding, clinical hoarding, healthy control] x Task [trivial items, typically hoarded items, personal items]) mixed model ANOVA was conducted to examine the main effects of group, task, and their interaction on the time taken to complete sorting tasks. Results revealed a significant main effect of group,  $F(2, 82) = 5.96, p = .004, \eta^2 = 0.13$ . There was no significant effect for task,  $F(1.71, 140.22) = 2.19, p = 0.12, \eta^2 = 0.03$ , or the Group x Task interaction,  $F(3.42, 140.22) = 0.62, p = 0.62, \eta^2 = 0.01$ . Games-Howell post hoc tests on the time taken across tasks revealed that the clinical group ( $M = 90.71, SD = 31.61$ ) took significantly longer to complete sorting tasks than the healthy control group ( $M = 60.28, SD = 31.62, p = .04, d = 0.96, 95\% CI [0.38, 1.54]$ ) but not longer than the subclinical group ( $M = 68.73, SD = 31.62, p = .18, d = 0.69, 95\% CI [0.11, 1.27]$ ). Moreover, the subclinical group did

not take significantly more time to complete tasks than the control group ( $p = .33$ ,  $d = 0.27$ , 95% CI [-0.22, 0.76]).

## **Distress**

**Aim 3: To examine differences between groups in reactivity to sorting tasks.**

*Research Questions 3: Do individuals with subclinical and clinical symptoms of hoarding experience more distress during sorting than healthy controls? Are there differences in the extent to which sorting tasks are distressing to individuals with subclinical and clinical symptoms of hoarding? Is distress moderated by the type of stimuli being sorted?*

The data collected on distress were positively skewed, and the homogeneity of variance assumption was not met. A logarithmic function was used to transform the peak distress variables to correct for positive skew and unequal variances across groups. Analyses run with and without transformed scores resulted in equivalent interpretations. Therefore, the results are reported with untransformed data to facilitate interpretation. Moreover, Mauchly's test of sphericity revealed that the assumption of sphericity for repeated measures ANOVA was violated. Therefore, a Greenhouse-Geisser correction was applied to the main effect of task and the Group x Task interaction.

A 3 (Group [subclinical hoarding, clinical hoarding, healthy control] x 3 Task [trivial items, typically hoarded items, personal items]) mixed model ANOVA was conducted to examine the main effects of group and the interaction of group and task on pre-task distress scores. Results revealed a significant main effect of group,  $F(2, 82) = 5.22$ ,  $p = .007$ ,  $\eta^2 = 0.11$ . There was no significant effect for task,  $F(1.67, 137.29) = 2.64$ ,  $p = 0.08$ ,  $\eta^2 = 0.03$ , or the Group x Task interaction,  $F(3.35, 137.29) = 1.14$ ,  $p = 0.34$ ,  $\eta^2 = 0.03$ . Games-Howell post hoc tests revealed that the clinical group ( $M = 37.12$ ,  $SD = 17.22$ ) reported higher peak distress than the

control group ( $M = 21.91, SD = 17.21, p = .04, d = 0.88, 95\% CI [0.31, 1.46]$ ), but not higher than the subclinical group ( $M = 24.71, SD = 17.21, p = .11, d = 0.72, 95\% CI [0.14, 1.30]$ ).

Moreover, the subclinical group did not report more peak distress than the healthy control group ( $p = .71, d = 0.16, 95\% CI [-0.32, 0.65]$ ).

To investigate whether these findings could be due to general differences in distress levels between groups, the same analysis was conducted on pre-task distress scores. There was no significant effect for task,  $F(1.72, 141.67) = 0.98, p = 0.37, \eta^2 = 0.01$ , group,  $F(2, 82) = 1.83, p = 0.17, \eta^2 = 0.04$ , or the Group x Task interaction,  $F(1.72, 141.67) = 0.93, p = 0.93, \eta^2 = 0.02$ .

***Research Question 4: To what degree did the current study replicate Luchian et al.'s findings on underinclusive categorization and indecisiveness?***

Luchian et al. (2007) used independent samples *t*-tests to analyze their results. To investigate whether this study directly replicated Luchian et al.'s findings, independent samples *t*-tests comparing the subclinical group and the healthy control group were performed on categories created and latency during the trivial task. Unlike Luchian et al., the current tests are two-tailed to reflect the inconsistency in the literature about the direction of differences on this task for individuals with hoarding symptoms. The log transformed latency data was used in the following analysis. Means for latency data were back transformed to original units to facilitate interpretation.

The subclinical group ( $M = 6.47, SD = 2.19$ ) created more categories than the healthy control group ( $M = 5.43, SD = 1.31$ ),  $t(63) = 2.35, p = .02$ . There was no significant difference between the subclinical ( $M = 74.03$ ) and healthy control groups ( $M = 63.82$ ) on latency,  $t(63) = 1.76, p = .08$ .

### ***Correlations***

Two-tailed Pearson correlation coefficients were computed between the SI-R total score and outcomes measures averaged across the three sorting tasks. A logarithmic transformation was applied to correct for severe positive skew in average peak distress and average time. Correlations between the SI-R total score and average number of piles were small in size and not statistically significant,  $r(83) = .21, p = .06$ . Correlations between the SI-R total score and average time,  $r(83) = .29, p = .006$ , and average peak distress,  $r(83) = .42, p < .001$ , were medium in size and significant.



## Discussion

Although research on compulsive hoarding disorder has increased substantially over the past decade, there is still very little known about the mechanisms responsible for the development and maintenance of hoarding tendencies. Frost and Hartl's (1996) proposal of underinclusive categorization provided a potentially important new means of understanding why disorganization is inherent in hoarded homes and why people who hoard often struggle to discard seemingly trivial objects. However, the few experimental studies that have examined underinclusive categorization amongst people who hoard have been highly inconsistent. Consequently, it remains unclear whether categorization deficits are associated with hoarding, and therefore whether this deficit should continue to be studied as a potential mechanism for hoarding behaviors such as clutter and difficulty discarding.

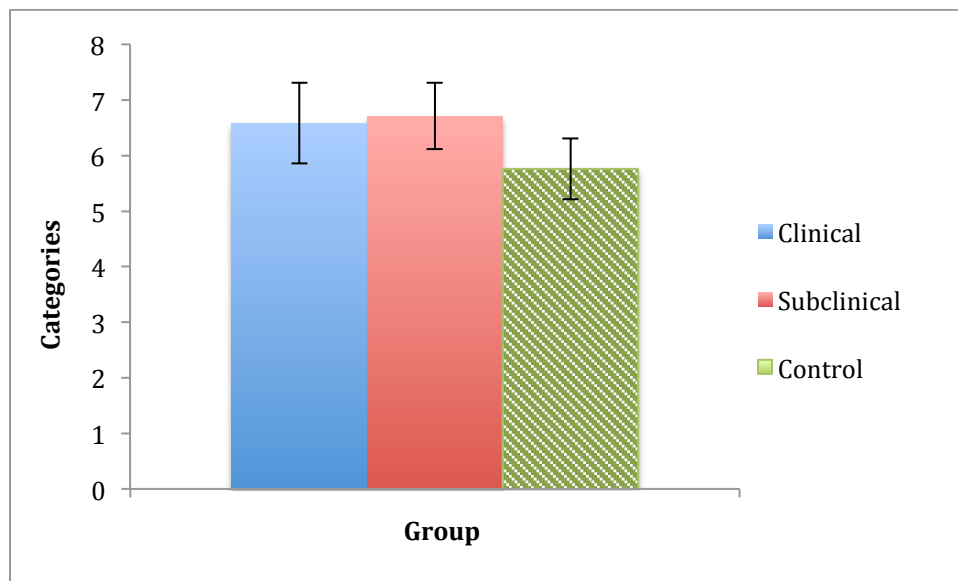
The inconsistent pattern of research on this topic may stem from differences in the populations recruited and the stimuli employed in past studies. Luchian et al. (2007) provided compelling evidence supporting Frost and Hartl's (1996) proposition with their finding that packrats (i.e., nonclinical hoarders) exhibited underinclusive categorization when sorting a selection of non-personal items of little or no value. However, the results of subsequent studies recruiting clinical samples suggest that hoarding is either not associated with underinclusive categorization (Grisham et al., 2010; Hayward, 2011) or that this relationship is moderated by whether the objects are of personal value (Wincze et al., 2007). The current study endeavored to provide insight into whether methodological differences are responsible for the inconsistency of previous research by directly comparing the performance of individuals with subclinical and clinical symptoms of hoarding on three different sorting tasks that have appeared in the previous literature but have not yet been compared between these groups. Moreover, the current study

applied more rigorous inclusion criteria to define and characterize the subclinical group than was applied in the Luchian et al study. This improvement will help to clarify whether Luchian et al.'s results could have been influenced by the inconsistent clinical presentation of their packrat group. Similarly to previous studies, the current study examined the number of categories created in unstructured sorting tasks, latency to complete sorting tasks, and distress levels, to assess underinclusiveness, indecisiveness, and discomfort with sorting, respectively.

The primary aim of this study was to compare the performance of the clinical and subclinical groups on the degree to which they exhibited underinclusive categorization. The overall pattern of evidence suggests that the clinical group and the subclinical group displayed a similar level of underinclusive categorization. As can be observed in Figure 1, the significant effect of group found in the current study appears to be primarily driven by the lower number of categories created by the healthy control group. The effect sizes of comparisons between the healthy control group and the subclinical group,  $d = 0.58$ , 95% CI [0.08, 1.08], and clinical hoarding group,  $d = 0.50$ , 95% CI [-0.05, 1.06], were similar in size and had overlapping confidence intervals. Given these similar effect sizes, it is probable that the post hoc test comparing the clinical group and the healthy control group was not significant due to lack of power. This relative lack of power may stem from the smaller sample size of the clinical group ( $n = 20$ ) in comparison to the subclinical group ( $n = 30$ ) and the control group ( $n = 35$ ).

Figure 1

*Categories Created Across Sorting Tasks by Group*



*Note.* Error bars represent 95% confidence intervals.

While it seems that the impact of underinclusive categorization on sorting tasks was similar for the subclinical and clinical hoarding groups, it was not strong. The difference between the subclinical group and the control group was only marginally significant, and the effect sizes between the hoarding groups and the control group were medium in size. As would be expected given this finding, correlations between the SI-R total score and the average number of categories created across tasks were small in size and not significant ( $r = .21$ ). One potential reason why the subclinical and clinical groups did not display a greater degree of underinclusive categorization may be that unstructured sorting tasks are not as difficult and complex as sorting through possessions in a hoarded home. A more difficult task that more closely simulates the challenges of organizing in a highly cluttered environment may yield more insight into how underinclusive categorization influences compulsive hoarding.

When considering statistical significance alone, these findings support for the odd pattern

of previous research wherein Luchian et al. (2007) found evidence of underinclusive categorization for a sample of individuals identifying as packrats, while studies involving clinical samples have produced null or mixed results (Grisham et al., 2010; Hayward, 2011; Wincze et al., 2007). Moreover, I also replicated Luchian et al.'s finding concerning the number of categories generated in the trivial task using the same independent samples *t*-test analyses they used. Given these results, it is likely Luchian et al.'s findings were not an anomaly, and that individuals with subclinical symptoms do exhibit tendencies towards underinclusive categorization. However, as previously discussed, this effect was not strong and was similar in size to the clinical group. Therefore, it probable that a more difficult task that more strongly elicits underinclusive categorization will yield similar effects for both the clinical group and subclinical group.

Past research has also been inconsistent about whether the type of stimuli being sorted moderates the relationship between hoarding and underinclusive categorization. The current study found no significant interaction between group and task on the number of categories created during sorting tasks. Contrary to Wincze et al. (2007) and consistent with Grisham et al. (2010) and Hayward (2011), this result suggests that if underinclusive categorization is present in hoarding, it is not restricted to personally relevant objects. Furthermore, the clinical group differed less from the healthy control group in the personal task ( $d = 0.31$ ) than in the trivial ( $d = 0.67$ ) and typically hoarded tasks ( $d = 0.61$ ). This pattern is largely incongruent with Wincze et al.'s (2007) conclusion that "the underinclusive categorization hypothesized to be characteristic of compulsive hoarding only occurs for personally relevant objects" (p. 70). Since the current study required participants to bring in their "favorite" versions of commonly used possessions, the effect of personal relevance on categorization and hoarding should have been even more

pronounced in the current study. Therefore, it is unlikely that the inconsistency of these studies is due to the different types of stimuli being used.

A secondary aim of the current study was to determine whether the subclinical and clinical groups display more indecisiveness than the healthy control group when categorizing objects. Indecisiveness is of interest because it is an established characteristic of compulsive hoarding and may contribute to difficulty organizing possessions by making sorting decisions more onerous. The results indicate that the clinical group took longer to sort objects than both the healthy control group ( $d = 0.96$ ) and the subclinical group ( $d = 0.69$ ). The clinical group took significantly longer to complete tasks than the healthy control group and the effect size for this comparison was large in size. In terms of statistical significance, the subclinical group fell between the healthy control and clinical groups, not significantly different from either. However, the effect sizes for these comparisons indicate a small difference between the subclinical and healthy control group ( $d = 0.27$ ), and a medium to large difference between the clinical and subclinical group ( $d = 0.69$ ). The lack of statistical significance of the medium-sized difference between the clinical and subclinical group is likely due to the lower power of the Games-Howell post-hoc test. Games-Howell post-hoc tests were chosen due to the violation of homogeneity of variance assumption underlying ANOVA. After collecting additional data, this statistical violation, if it still exists, will be less critical and more powerful post-hoc tests can be used.

Past research on clinical samples that has used sorting latency as a measure of indecisiveness has yielded mixed results with clinical groups taking more time than healthy control groups to sort particular stimuli in some studies and not in others (Grisham et al., 2010; Hayward, 2011; Wincze et al., 2007). One reason for these inconsistencies is the type of data analysis employed and interpreted between studies. Grisham et al., and Wincze et al.'s primary

analyses tested group differences on each task instead of using an omnibus method of analysis more suitable for evaluating task as a moderator. If they had, they may have found that there was no significant effect of interaction similarly to this study and not gone on to interpret group differences on each task.

The current findings indicate that the type of objects being sorted did not moderate sorting latency, and that the clinical group was generally more indecisive than the healthy control group when categorizing. Consistent with this interpretation, correlations between the SI-R total score and average distress were significant and close to medium in size ( $r = .29$ ). This result provides further support for Frost and Hartl's (1996) proposition that hoarding is associated with indecisiveness. The finding that the subclinical group did not take significantly longer than the healthy control group to sort objects conflicts with Luchian et al.'s (2007) latency results. A non-significant effect was also found when replicating Luchian et al.'s independent samples *t*-test analysis. The differences between the inclusion criteria of my study and that of Luchian et al. (2007) make it difficult to determine whether this inconsistency is the result of an unreliable effect or a population differences. Given that Luchian et al.'s inclusion criterion for their nonclinical hoarding group was identification as a packrat, it is possible that several of their nonclinical participants were severe enough to meet criteria for compulsive hoarding. If so, then these participants may have influenced their findings by elevating the mean latency score of the subclinical group.

Notably, comparisons on latency involving the clinical group should be interpreted with caution because the clinical group was significantly older than both other groups. The finding that the clinical group took longer than other groups to complete tasks may be confounded with the general slowing of reaction time with age (Fozard, Verduyssen, Reynolds, Hancock, &

Quilter, 1994). Unfortunately, age could not be statistically controlled due to violation of the homogeneity of regression slopes assumption necessary for ANCOVA. Accordingly, the most important next step in this research (now underway) is to recruit additional participants to rectify the imbalance in age distributions between groups.

The third aim of the current study was to examine differences in distress experienced between groups as a means of further understanding why organizing possessions is difficult for individuals with compulsive hoarding. The clinical group reported higher peak distress while sorting items than both the subclinical and control groups. The effect sizes for these comparisons were medium to large in size (clinical:  $d = 0.88$ , 95% CI [0.31, 1.46]; subclinical:  $d = 0.72$ , 95% CI [0.14, 1.30]). Similarly to latency, it is probable that the lack of statistical significance for the comparison between the subclinical and clinical group is due to the use of less powerful post-hoc tests to compensate for the violation of the homogeneity of variance assumption underlying ANOVA. The finding that the clinical group found sorting tasks to be more distressing than other groups is consistent with previous research wherein clinical groups reported higher post-task distress than healthy controls (Grisham et al., 2010; Hayward, 2011). Moreover, the SI-R total score and average peak distress were moderately correlated in the current study, which further supports a relationship between these variables ( $r = 0.42$ ). No significant between-group differences were found for pre-task SUDS ratings. Therefore, findings on peak distress were not the result of pre-existing group differences in levels of general distress.

The non-significant difference between the subclinical group and healthy control group ( $d = 0.16$ , 95% CI [-0.32, 0.65]) is consistent with Luchian et al.'s finding that packrats did not differ from healthy controls on pre-post change scores on the PANAS. Both Luchian et al.'s non-significant findings on the PANAS and the current study's finding on peak distress, are not

consistent with Luchian et al.'s (2007) additional finding that packrats rated sorting tasks as more difficult and stressful than healthy controls. It is possible that individuals with nonclinical symptoms of hoarding perceived sorting tasks to be more challenging than healthy controls, but was not enough to be emotionally distressing.

Overall, the results of this study do not provide strong support for Frost and Hartl's (1996) proposition that underinclusive categorization is an important mechanism underlying the disorganization and excessive difficulty discarding objects associated with compulsive hoarding. One manner in which Frost and Hartl (1996) suggested that underinclusive categorization influences hoarding is through a process called churning. They proposed that one of the ways disorganized mounds of objects in hoarded homes form is through a cyclical process wherein people who hoard attempt to sort their possessions but require clear-cut exemplars to place objects into categories. Unable to find these exemplars, they place objects in temporary locations until this process is repeated and other uncategorized objects become piled on top of them. Churning is a very destructive process because it prevents progress from being made even when individuals expend substantial and repeated efforts trying to reduce clutter in their homes. The findings that the compulsive hoarding group displayed more indecisiveness than healthy controls, and found sorting tasks more distressing than healthy controls, suggests that churning and disorganization in hoarded homes is more likely to stem from behavioral avoidance.

Frost and Hartl (1996) proposed that the saving behavior characteristic of hoarding might be a form of behavioral avoidance whereby people who hoard can avoid the chore of having to weigh the value of possessions when making discarding decisions, the risk of making incorrect decisions about discarding objects, and the emotional upset of losing possessions. Consistent with this proposition, people who hoard have been found to exhibit greater experiential



avoidance and difficulty with emotion regulation than healthy controls (de la Cruz et al., 2013; Hayward, 2011). Experiential avoidance is defined as the tendency to avoid unwanted internal experiences such as thoughts and emotions and is thought to underlie several different types of psychopathology (Hayes et al., 2004). The increased temptation for people who hoard to avoid or delay making decisions about possessions is also supported by the consistent finding that people who hoard have lower confidence in their decision making abilities (Fitch, 2011; Frost & Gross, 1993; Grisham et al., 2010; Steketee et al., 2003; Tolin & Villavicencio, 2011; Wincze et al., 2007), are more concerned over mistakes (Frost & Gross, 1993), and are less tolerant of uncertainty (Tolin et al., 2008). Moreover, abnormal difficulty with decision-making about personal possessions is also evident in neurological research. According to a recent study by Tolin et al. (2012), compulsive hoarders exhibit hyperactivity in their anterior cingulate cortex and insula when making decisions about whether to shred *their own* low cost paper items (e.g., mail). Tolin et al. suggest that hyperactivity in these regions may hinder decision-making by producing a greater sense of outcome uncertainty.

Another question raised by the pattern of results in this study is how to conceptualize the subclinical group in relation to compulsive hoarding. Each member of the subclinical group reported that clutter interfered with their ability to fully utilize their homes and that they experienced some difficulty with discarding objects. The subclinical group also scored significantly higher than the control group, and significantly lower than the clinical group, on the SI-R and the CI-R. These individuals clearly experience notable difficulty with the same problems as compulsive hoarders but their symptoms have not yet become clinically severe. Due to a lack of research on the trajectory and prodromal presentation of hoarding, it is unclear whether these individuals are likely to develop more severe symptoms over time. Moreover, the

symptom presentation of individuals in the subclinical group may be qualitatively different from compulsive hoarding. If so, then their difficulty with clutter may stem from different mechanisms than the problems of individuals with compulsive hoarding.

There were also notable differences in how the subclinical group and clinical group performed on sorting tasks. As previously discussed, the clinical group and the subclinical group displayed similar tendencies towards underinclusive categorization when sorting objects. However, dissimilarly from the clinical group, the subclinical group was neither more distressed nor more indecisiveness than the healthy control group when sorting objects. Moreover, the effect sizes for comparisons between the subclinical group and clinical group on distress ( $d = 0.72$ ) and latency were medium to large in size ( $d = 0.69$ ). Given these results, it is plausible that indecisiveness and distress separate compulsive hoarders from individuals who manage to restrict their difficulties with clutter and discarding from progressing to the point of substantial impairment.

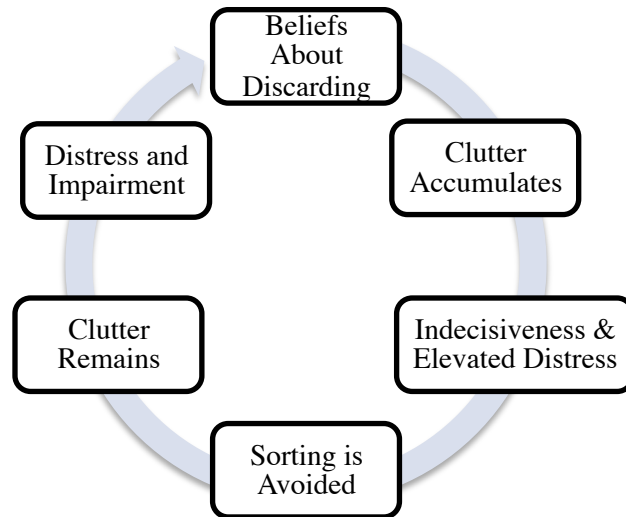
Based on the current study and past research, I propose the following theoretical cycle to explain why subclinical individuals, who also struggle with clutter and difficulty discarding possessions, are able to restrict their clutter from progressing to the point where it causes them significant impairment and distress (see Figure 2). One common feature of the clinical and subclinical groups that emerged during the clinical interviews is that they have a higher threshold for discarding objects due to their beliefs about discarding. Anecdotally, common themes for both groups seemed to include keeping things they may possibly want in the future even though they have no immediate use for them and keeping things with sentimental value. Similarly to individuals with compulsive hoarding, individuals in the subclinical group are likely to keep a larger volume of possessions than the average person due to this higher threshold. However, I

propose a subclinical individual would be better able to make discarding decisions when clutter accumulates to an undesirable extent due to normal levels of decisiveness and distress when making these decisions (see Figure 2). This is the point in the cycle where the subclinical and clinical groups diverge. In the same situation, an individual with compulsive hoarding would experience more distress or indecisiveness. This distress may stem from difficulty weighing the value of possessions against other considerations, the risk of making incorrect decisions, the emotional upset of losing possessions (Frost & Hartl, 1996) or may be secondary to depression. Due to a reduced willingness to tolerate this distress (i.e., experiential avoidance), the individual with compulsive hoarding would choose to keep the item as a means of avoiding decision-making. Eventually, as this cycle is repeated, clutter would accumulate to the point of impairing functioning (see Figure 2.1).

Research into the characteristics of individuals with subclinical symptoms of hoarding may provide insight into the core difficulties that lead to impairment in compulsive hoarding. Identifying the factors that separate compulsive hoarding from individuals who struggle with clutter and discarding but manage to prevent these problems from progressing may help to identify targets for treatment. The model proposed in Figure 2 suggests two of these potential targets are tolerance for distress and indecisiveness. However, more research is necessary to validate and add to this model.

Figure 2

*Cycle of Clinical Hoarding*



**Limitations**

Similarly to previous studies on underinclusive categorization and hoarding, a home visit was not conducted in the present study; such a visit would confirm assignment to group and permit formal diagnosis of hoarding disorder. The CIR was chosen as a substitute tool for assessing level of clutter because of the high correlations between clinician and patient ratings of home clutter (Frost, Steketee, Tolin, & Renaud, 2008). However, participants with low levels of insight into the extent of their hoarding problems may have underrepresented the extent of their impairment and the volume of clutter in their homes. Therefore, although more practical, the use of a self-report measure such as the CIR for assigning participants to a clinical hoarding group is not ideal. A second limitation is that 29% of participants forgot to bring at least one of the 20 personal objects used in the personal sorting task to the laboratory. The average number of forgotten possessions ranged from  $M = 0.6$  to  $M = 1.09$  between groups. The lack of personal

ownership of items in these situations is not thought to have influenced results because there were no significant between-group differences in the number of items forgotten.

### **Future Directions**

Future research should continue to investigate the mechanism underlying disorganization in hoarded homes. The unstructured sorting tasks used in this study and past research on this topic may not accurately capture the organizational challenges present in hoarded homes. The sorting tasks in this study provide participants with a finite number of items to compare and a clear sorting space. Individuals with compulsive hoarding must engage in abstract thinking about all the items they may or may not have hidden in other areas of the home, and are probably under an increased amount of cognitive load and distress. Moreover, objects are often considered one at a time when organizing in the home. In the sorting tasks used in the current study, items are laid out side by side to facilitate comparison of multiple objects at once. Future research should endeavor to design tasks that more accurately mirror the real life conditions under which individuals with compulsive hoarding attempt to organize their possessions. For example, a more realistic task could involve having participants categorizing many (more than 20) objects on an individual basis within a cluttered environment.

Moreover, no empirical research has directly evaluated why the decision making process is so onerous for individuals with compulsive hoarding. A better understanding of the types of considerations taken into account when making discarding decisions may help to determine why individuals with compulsive hoarding err on the side of keeping objects despite the impact on their lives. Frost and Hartl (1996) made two propositions about decision-making in compulsive hoarding that could provide such information but are yet to be formally tested. Firstly, they proposed that individuals who hoard consider the value of their possessions in isolation from the

larger context of their lives and clutter problems. Secondly, Frost and Hartl proposed that individuals who hoard have little knowledge of what most people consider appropriate to save and are concerned that trivial objects have unknown importance. Once we have a better understanding of the decision-making process in compulsive hoarding, then treatment protocols can use this information to promote more adaptive decision-making.

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## Appendix

### Task Instructions

*Script for categorization task.* “I am now going to have you participate in a grouping task. I am interested in how people divide objects into categories or subcategories. I am going to give you a box of [20 items (or the possessions you brought in today)], and I would like you to separate these items into different piles in a way that makes sense to you. A pile can have as few or many objects that you want to place in it; there are no right or wrong ways to complete this task. I would like to see how long it takes you to do this, naturally, so I’ll be using my stopwatch, but you should take as much time as you’d like. Tell me when you are finished. Any questions?”

(Adapted from Wincze, Steketee and Frost, 2007).