COMPULSIVE HOARDING AND THE THEORY OF VALUE: AN ECONOMIC MODEL OF EXCESSIVE ACCUMULATION

by

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Abstract

Hoarding disorder is a complex form of psychopathology that is characterized by excessive accumulation of items and extreme difficulty parting with possessions. It affects 2% to 6% of the population and is associated with significant distress, impairment, and cost to affected individuals, their family and friends, and society. Hoarding disorder is a new diagnosis. Theoretical models and treatment protocols are, therefore, emergent.

Valuing of items is notably abnormal in hoarding disorder and the theory of value from economics provides a suitable framework for examining this phenomenon. Individuals with hoarding disorder accumulate a much larger number of items than do most people, and many of those items are objectively worthless. Revealed preference suggests that excessive accumulation of items can be explained by overvaluation of items relative to other goods. Also, in hoarding, often multiple units of the same item are kept when one would suffice. This could be explained by attenuated diminishing marginal value. Finally, hoarding is associated with extreme difficulty parting with possessions, which is consistent with an enhanced endowment effect. The current research assembles the phenomena of abnormal valuing into a coherent theoretical model and conducts initial empirical investigations to test predictions from the theory.

Valuing of everyday household items, diminishing marginal value, and the endowment effect were examined among 128 participants: 43 with hoarding disorder, 46 with subclinical levels of hoarding symptoms, and 36 healthy controls. Participants attended one lab session and completed a clinical
interview, computer-based questionnaires, and three valuing tasks. Data were analysed using ANOVA and regression models.

Hoarding symptoms and cognitions were both positive predictors of the number of no-cost and sentimental items that participants attributed with some value. Hoarding was a unique predictor of attributing value to sentimental items, whereas, hoarding was confounded with other aspects of psychopathology in predicting valuing of no-cost items.

These results suggest that individuals with hoarding disorder are particularly adept at finding value in items that others would consider to be worthless. This could be an important focus for treatment. Avenues for future research are suggested in the areas of hoarding disorder, behavioural economics, and item ownership.
Preface

This work was conducted in the Centre for Collaborative Research on Hoarding (CCRH) in the Psychology Department at The University of British Columbia under the supervision of Dr. Sheila Woody. I developed the theoretical framework, designed the research, implemented data collection, analysed the data, and wrote this dissertation. Undergraduate research assistant members of the CCRH assisted with data collection. This research was approved by the UBC Behavioural Research Ethics Board, UBC BREB #H12-02794.
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Chapter 1: Introduction

1.1 Overview

Compulsive hoarding is a complex psychological problem that is characterized by extreme accumulation of items in homes and/or workspaces to the extent that these spaces can no longer be used for their intended purpose. The key features of compulsive hoarding are extreme difficulty discarding possessions and disorganized clutter. In most cases, individuals with hoarding problems also engage in excessive acquisition via shopping, gathering items that are unwanted by others, and, less commonly, stealing (Frost, Steketee, & Tolin, 2011).

Compulsive hoarding affects approximately 2-6% of the general population (Steketee & Frost, 2014), and is associated with significant health and safety concerns for the individual, their family and friends, and society as a whole (Frost, Steketee, & Williams, 2000; Tolin, Frost, Steketee, & Fitch, 2008; Tolin, Frost, Steketee, Gray, & Fitch, 2008). The current edition of the Diagnostic and Statistical Manual of Mental Disorders is the first to include hoarding disorder as a distinct form of psychopathology (American Psychiatric Association, 2013). Accordingly, both empirical investigations of the factors contributing to compulsive hoarding and theoretical models of the disorder are nascent. Furthermore, even the best treatment strategies involve substantial treatment resources over a long period of time and result in only modest symptom reduction and improvement in functioning (for a review, see Woody & Steketee, 2014). The study of compulsive hoarding is, therefore, ripe for novel perspectives
and approaches that will contribute to a better understanding of this form of psychopathology and, eventually, to improved outcomes for affected individuals.

Valuing of items is one process that seems notably abnormal among individuals with hoarding tendencies. The acquisition and keeping of items that seem to be of little or no objective value has been identified as a prominent feature of compulsive hoarding (Frost & Hartl, 1996). One interpretation of this feature of hoarding is that individuals with hoarding tendencies have more difficulty valuing items in comparison to individuals without these tendencies. Yet, this feature of compulsive hoarding has received almost no empirical attention. The purpose of the current research is, therefore, to investigate aspects of valuing that may be abnormal among individuals with hoarding tendencies.

A coherent theoretical framework is required to investigate these questions of valuing. Economics provides a theory of value (Debreu, 1959) that is fundamental to the discipline and is suitable for application to questions of valuing in compulsive hoarding. The theory of value is logically coherent, and predictions from this theory are well established and empirically validated (Blundell, Browning, & Crawford, 2003; Horowitz, List & McConnell, 2007; Kahneman, Knetsch, & Thaler, 1990; Mankiw, Kneebone, & McKenzie, 2011; Samuelson, 1953; Thaler, 1980).

My aim in the current research was to use the theory of value from economics to understand perturbations in valuing items as an aspect of the psychopathology of compulsive hoarding. I first developed a model to describe how certain valuing processes might be involved in different facets of compulsive
hoarding. The model is based on theories and phenomenological empirical
evidence about compulsive hoarding and includes specific predictions drawn
from the theory of value. I then used this original theoretical model as a
framework for understanding valuing in compulsive hoarding and to support
focused multidisciplinary investigations into this topic. Ultimately, the goals of this
research were to provide a coherent theoretical understanding of abnormal
valuing processes associated with compulsive hoarding and lay the foundation
for the consolidation of this knowledge in theoretical models of compulsive
hoarding, as well as in treatment protocols.

In Chapter 1 of this thesis, I first provide an introduction to compulsive
hoarding: its nosology, features, impact, and treatment. I then present a rationale
for applying certain principles and concepts from the theory of value, proposing
specific testable predictions arising from my theoretical framework. The next
section of the introduction is a literature review, outlining the main theoretical
perspectives on compulsive hoarding and highlighting aspects of these theories
specific to the question of valuing. I discuss the extant empirical work in relation
to valuing of items among individuals with hoarding tendencies, including
consideration of the gaps in, and limitations of, this previous empirical work. I
present the method in Chapter 2, including an overview of the design, the
procedure, the tasks and measures used, a description of the participants, and
an overview of the data analyses. I present the results in Chapter 3. Results
include the sample characteristics and psychometric properties of the measures,
as well as between-groups and regression analyses conducted on the data from
each of three valuing tasks. In Chapter 4, I discuss the implications of the results and present directions for future research.

1.2 Compulsive Hoarding

1.2.1 Historical overview of the nosology of compulsive hoarding.

Compulsive hoarding has not always been clearly defined or identified as a distinct form of pathology in the clinical and research literatures. The earliest mentions of pathological hoarding occur in psychoanalytic considerations of the anal character (e.g., Abraham, 1921; Freud, 1908; Jones, 1912). Parsimony, which was one of three personality features of the anal character, was defined as the desire to gather, collect, and hoard, along with difficulties separating from items that have neither practical use nor monetary value. In other early theories, hoarding was thought to represent an attempt to exert control over the environment in order to produce feelings of safety and security (Fromm, 1947; Salzman, 1973). Hoarding has also been identified as an obsessional trait (Cooper, 1970) and as a sub-type of obsessive-compulsive disorder (Rachman & Hodgson, 1980).

These early perspectives are reflected in the diagnostic nosology of mental illness. In the previous (4th) edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000) compulsive hoarding was not recognized as a distinct form of mental illness. Rather, being “unable to discard worn-out or worthless objects even when they have no sentimental value” was one of the diagnostic criteria for obsessive-compulsive personality disorder (OCPD; American Psychiatric Association, 2000,
The manual also stated that, when hoarding behaviour is severe and hoarding obsessions or compulsions are present, a diagnosis of obsessive-compulsive disorder (OCD) should be considered (American Psychiatric Association, 2000). Hoarding is also included as a symptom dimension or subtype of OCD on most current structured interviews and self-report questionnaires of OCD symptoms. As a result, until recently, much of the empirical research considered compulsive hoarding in the context of either OCPD or OCD.

These perspectives continue to be reflected in the latest (5th) edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), in that the diagnostic criteria for OCPD have not changed from the previous version of the manual, and the current version continues to include the provision that a diagnosis of OCD should be given if an individual has obsessions that are typical of OCD and the obsessions lead to compulsive hoarding behaviours (American Psychiatric Association, 2013).

There has, however, been considerable research to suggest that hoarding is a syndrome distinct from both OCPD and OCD (see Mataix-Cols et al., 2010 and Pertusa et al., 2010 for detailed discussions of this topic). As a result, in addition to mention of hoarding in the contexts of OCPD and OCD, the DSM-5 includes a new, separate diagnosis of hoarding disorder. This formalization of clear diagnostic criteria will undoubtedly contribute to greater consistency in the definition of compulsive hoarding in the research and treatment communities, which should, in turn, improve the quality of work on this topic on both fronts.
**1.2.2 Hoarding disorder.** A key feature of hoarding disorder is persistent difficulty discarding or parting with possessions, regardless of their objective value. This difficulty discarding is due to the perceived need to save items and emotional distress associated with discarding them, rather than some other factor like the psychomotor retardation that can be associated with major depressive disorder. Another prominent feature of hoarding disorder is the accumulation of possessions that congest and clutter living spaces so that use of the space for intended purposes is substantially compromised. Hoarding can also be accompanied by excessive acquisition in the form of collecting, buying, or stealing items that are not needed or for which there is no available space. Indeed, in a large, community-based sample, nearly 75% of individuals with hoarding disorder experienced compulsive buying (Mueller, Mitchell, Crosby, Glaesmer, & de Zwaan, 2009). In a different study, approximately 60% of participants with hoarding disorder experienced problems with compulsive buying and excessive acquisition of free things (Frost, Steketee, & Tolin, 2011). The same study found that almost 10% of individuals with hoarding disorder also had problems with kleptomania. Recently it has been argued that 80% to 100% of people with hoarding problems engage in excessive acquisition (Steketee & Frost, 2014). Despite this, excessive acquisition is formally recognized as a diagnostic specifier of hoarding disorder, with the hallmark feature being difficulty discarding or letting go of possessions that are not needed or used (Steketee & Frost, 2014).
1.2.3 Features associated with compulsive hoarding. In addition to the diagnostic criteria for hoarding disorder, certain demographic, as well as cognitive and behavioural factors, are associated with compulsive hoarding. There is also considerable comorbidity between hoarding disorder and other forms of mental illness.

1.2.3.1 Demographic features. Gender, age, income, and level of education are the demographic features of hoarding that have received research attention and are relevant to the current research.

1.2.3.1.1 Gender. There is mixed evidence with respect to the gender prevalence of hoarding. Fullana and colleagues (2010) found that, among a sample of individuals with OCD, there was no difference in the prevalence of hoarding symptoms between men and women. In contrast, there were twice as many women as men in a sample of individuals with OCPD who endorsed the hoarding criterion (Samuels, Bienvenu, Grados et al., 2008). In studies using established criteria for compulsive hoarding, one study found that prevalence was twice as high among men as among women (Iervolino et al., 2009), whereas, two other studies found no difference in prevalence between men and women (Bulli et al., 2013; Mueller et al., 2009). On the basis of this evidence, current opinion is that there is no difference in the prevalence of hoarding disorder between women and men (Steketee & Frost, 2014).

Further, there is limited and conflicting research on gender differences in how hoarding is manifested. In one study of individuals with OCD, men, but not women, with hoarding symptoms had higher levels of other OCD symptoms than
did men without hoarding symptoms (Samuels, Bienvenu, Pinto et al., 2008). The same study found gender differences in the comorbidity of hoarding with other Axis I and II disorders, as well as personality features. In another study of individuals with OCD, women with hoarding symptoms had a greater number of comorbidities than did men (Wheaton, Timpano, LaSalle-Ricci, & Murphy, 2008). In contrast, another study with a similar sample failed to find gender differences in comorbidities (Labad et al., 2008). In the only study to date conducted among individuals selected for their hoarding symptoms, OCD was the only common comorbid condition for which there was a gender difference (i.e., OCD comorbidity was more frequent among men than among women; Frost, Steketee, & Tolin, 2011).

1.2.3.1.2 Age. Generally, research suggests that the onset of hoarding symptoms occurs in late childhood through the 20s, with moderate to severe hoarding emerging in the 20s and 30s (American Psychiatric Association, 2013; Ayers, Saxena, Golshan, & Wetherall, 2010; Grisham, Frost, Steketee, Kim, & Hood, 2006; Landau et al., 2011; Pertusa et al., 2008). Participants in clinical research studies are, however, usually in their 50s (American Psychiatric Association, 2013), which may suggest that there is a delay between the onset of clinically significant hoarding and the development of insight.

The results cited above suggest that the severity of hoarding increases over time. However, the empirical evidence on this topic is mixed. Whereas some studies have found an association between severity of hoarding symptoms and age (LaSalle-Ricci et al., 2006; Samuels, Bienvenu, Grados et al., 2008; Tolin et
al., 2010; Torres et al., 2012), others have not (Bulli et al., 2013; Cromer et al.,
2007; Fontenelle et al., 2004; Fullana et al., 2010; Mueller et al., 2009; Reid et al,
2011; Timpano, Keough, Traeger, & Schmidt, 2011; Tolin, Frost, Steketee, Gray,
& Fitch, 2008; Wheaton et al., 2008). Finally, there is some limited evidence that
the course of hoarding is chronic and unremitting (Ayers et al., 2010; Grisham et
al., 2006; Tolin et al., 2010). The lifespan trajectory of hoarding disorder and
hoarding symptoms is an area that requires further investigation.

1.2.3.1.3 Income. There is also limited and conflicting research on the
association between income and hoarding difficulties. In one population-based
study, hoarding was more prevalent among lower income participants (Samuels,
Bienvenu, Grados, et al., 2008), whereas, another population-based study found
no difference in income between hoarding and non-hoarding participants
(Wheaton et al., 2008). Also, no difference in income was found between
participants diagnosed with hoarding disorder and those diagnosed with OCD
(Frost, Steketee, & Tolin, 2011). Income is an important consideration in the
current research because it could have an influence on value attributed to items.

1.2.3.1.4 Level of education. Although hoarding samples have had lower
levels of education than healthy controls and collectors in a couple of studies
(Landau et al., 2011; Nordsletten, de la Cruz, Billotti, & Mataix-Cols, 2013), the
majority of studies have found no difference in level of education between
hoarding groups and various comparison groups (i.e., OCD without hoarding,
anxiety disorder patients, healthy controls; Frost, Steketee, & Tolin, 2011; Hartl,
Duffany, Allen, Steketee, & Frost, 2005; Pertusa et al., 2008; Torres et al., 2012; Wheaton et al., 2008).

1.2.3.2 Cognitive and behavioural features. Cognitive and behavioural features of compulsive hoarding have been the topic of a sizeable body of research (see Woody, Kellman-McFarlane, & Welsted, 2014 for a review of cognitive performance in compulsive hoarding). Only those features that are relevant to the current dissertation are presented here.

Difficulty making decisions has been proposed as a key factor in the cognitive-behavioural model of compulsive hoarding (Frost & Hartl, 1996). Research evidence suggests moderate to high correlations between perceived indecisiveness and hoarding symptom severity (Frost & Gross, 1993; Steketee, Frost & Kyrios, 2003), as well as higher levels of perceived indecisiveness among individuals with hoarding disorder than among healthy controls (Grisham, Norberg, Williams, Certoma, & Kadib, 2010; Steketee et al., 2003; Tolin & Villavicencio, 2011; Wincze, Steketee, & Frost, 2007).

On performance-based measures, decision-making latency on discarding and sorting tasks is generally longer among hoarding participants than among clinical and healthy controls (Grisham et al., 2010; Luchian, McNally, & Hooley, 2007; Tolin, Kiehl, Worhunsky, Book, & Maltby, 2009; Tolin et al., 2012; Wincze et al., 2007). These studies do not, however, reliably control for depression, which is associated with slowed decision-making. Moreover, no consistent group differences have been found on tasks measuring the ability to make advantageous decisions (i.e., Iowa Gambling Task, Cambridge Gambling Task;
Broadly, therefore, these studies do not present a convincing case that decision-making difficulties are a form of cognitive impairment specific to hoarding. However, the extant studies largely do not address the forms of decision-making about objects that have been hypothesized to play a role in hoarding disorder. Difficulties valuing items may be such an aspect of decision-making that is abnormal in compulsive hoarding.

Lack of insight (i.e., awareness of the severity of hoarding symptoms) has been noted as another cognitive feature of compulsive hoarding (Steketee & Frost, 2014). Clinicians and family members regularly report that their clients and family members have limited insight that interferes with treatment seeking and continuation (Abramowitz, Franklin, Schwartz, & Furr, 2003; De Berardis et al., 2005; Frost, Krause, & Steketee, 1996; Mataix-Cols, Rauch, Manzo, Jenike, & Baer, 1999; Tolin, Fitch, Frost, & Steketee, 2010). In contrast, in an internet study of hoarding, the majority of participants reported interest in seeking treatment (Tolin, Frost, Steketee, & Fitch, 2008), although this result may reflect a selection bias. This is another topic with ample room for further investigation.

1.2.3.3 Neurobiology. There has been a reasonable amount of interest in the neurobiological correlates and mechanisms of compulsive hoarding. Indeed, the neurobiological differences between individuals with OCD whose most prominent symptom was hoarding and those whose most prominent symptom
was something other than hoarding (e.g., checking) was a key argument for the
definition of a distinct diagnosis of hoarding disorder (Mataix-Cols et al., 2010).

Early studies examined the neurobiology of compulsive hoarding among
individuals with OCD whose most prominent symptom was hoarding. One of
these studies found reduced glucose metabolism in the posterior cingulate cortex
and dorsal anterior cingulate cortex (dACC) among individuals whose most
prominent OCD symptom was hoarding as compared to other individuals with
OCD (Saxena et al., 2004). The same study found that the severity of hoarding
was negatively correlated with metabolism in the dACC. These areas have been
shown to be associated with reinforcement, decision making, implicit learning,
detecting salient stimuli, and category learning (Packard & Knowlton, 2002; Ell,
Marchant, & Ivy, 2006).

In contrast to this study of the neurobiological correlates of hoarding
disorder during resting state, other studies have been conducted under
conditions of symptom provocation. For example, An and colleagues (2009)
showed pictures of items to participants, and asked them to imagine that the
items were theirs and that they had to discard them. Participants with OCD and
hoarding symptoms showed greater activation in bilateral anterior ventromedial
prefrontal cortex, medial temporal structures, the thalamus, and the sensorimotor
cortex than did health control participants and participants with OCD without
hoarding symptoms. Further, levels of anxiety induced by the task were
negatively correlated with activity in the left dorsal anterior cingulate gyrus,
bilateral temporal cortex, bilateral dorsolateral/medial prefrontal regions, basal
ganglia, and parieto-occipital regions. These results are discussed by the authors of the study in the context of potential impaired decision-making, evaluation of complex and abstract reinforcers, visual processing of emotional stimuli, and difficulties with emotion regulation and planning.

In a similar study, Tolin and colleagues (2009) compared individuals meeting criteria for hoarding disorder with matched healthy controls while they made decisions whether to discard their own real paper items, and whether to discard real paper items provided by the experimenter. Discarded items were shredded within view of the participants. In this study, participants with hoarding disorder showed increased activation in lateral orbitofrontal cortex and parahippocampal gyrus during decision making, as compared to healthy controls. Activity in the lateral orbitofrontal cortex has been associated with the evaluation of punishments (Kringelbach, 2005; Kringelbach & Rolls, 2004). Further, decisions to keep personal possessions were associated with greater activity in superior temporal gyrus, middle temporal gyrus, medial frontal gyrus, anterior cingulate cortex, precentral gyrus, and cerebellum, as compared to decisions to discard personal possessions. These regions have been associated with motor control and executive function (Radua, van den Heuvel, Surguladze, & Mataix-Cols, 2010; Talati & Hirsch, 2005).

The same group of researchers extended their investigations, using a slightly modified procedure (Tolin, Stevens, Villavicencio et al., 2012). In order to isolate decision-making from discarding, shredding was deferred to the end of the study. In this study, participants with hoarding disorder showed lower activity
in the anterior cingulate cortex and insula, as compared to other participant
groups, when making decisions about items that did not belong to them.
However, when they were making decisions about items that did belong to them,
these areas showed hyperactivation as compared to the other groups. These
finding suggest abnormalities in identifying the emotional significance of stimuli,
generating appropriate emotional responses, and regulating affective state at
baseline and during decision-making about personal items (Slyne & Tolin, 2014).

Finally, in a small study using a simulated decision making task,
individuals with hoarding disorder showed abnormal hemodynamic response in
the right superior/middle frontal gyrus, left insula/putamen, posterior cingulate
gyrus, precuneus, left hippocampus, lingual gyrus/cuneus, and thalamus, as
compared to healthy controls (Tolin, Stevens, Nave, Villavicencio, & Morrison,
2012).

Overall, neuroimaging studies of hoarding implicate a range of frontal and
temporal brain regions that may modulate subcortically driven predispositions to
acquire and save (Slyne & Tolin, 2014). Neural activity in hoarding disorder
appears distinctly different from that in OCD (Saxena & Rauch, 2000), and may
involve hypoactivity during resting-state and hyperactivity during decision-making
(Slyne & Tolin, 2014).

1.2.3.4 Comorbidity. Approximately 75% of individuals with hoarding
disorder have a comorbid mood or anxiety disorder (American Psychiatric
Association, 2013). Major depressive disorder (MDD) appears to be the most
common comorbid condition, with upwards of 50% of individuals with hoarding
disorder also meeting criteria for MDD (American Psychiatric Association, 2013; Frost, Steketee, & Tolin, 2011). Comorbidity with depressive disorders in general is also very high (Tolin et al., 2012; Wheaton et al., 2008). Significant positive correlations between depressive symptoms and the severity of hoarding symptoms have also been reported (Abramowitz, Wheaton, & Storch, 2008; Coles, Frost, Heimberg, & Steketee, 2003; Wheaton et al., 2008).

Anxiety disorders are also common among individuals with hoarding disorder, with a number of studies finding that more than 50% of people with hoarding disorder have at least one comorbid anxiety disorder (e.g., Frost, Steketee, & Tolin, 2011; Tolin et al., 2012). Social anxiety disorder (SAD) and generalized anxiety disorder (GAD) are the most common comorbid anxiety disorders with rates of SAD ranging from 6.7% (Fontenelle et al., 2004) to 71% (Samuels et al., 2002) and rates of GAD ranging from 13.3% (Grisham et al., 2007) to 44.7% (Samuels, Bienvenu, Pinto et al., 2008). Rates of panic disorder and post-traumatic stress disorder are generally much lower (Wheaton & Van Meter, 2014).

Hoarding is also comorbid with other obsessive-compulsive and related disorders, as well as impulse control disorders. Hoarding symptoms are quite common in samples of individuals with OCD (18% to 42%; Hanna, 1995; Samuels et al., 2002; Wheaton et al., 2008). Although hoarding symptoms occur as a manifestation of OCD in a small number of cases (5%; Pertusa, Frost, & Mataix-Cols, 2010), in most cases hoarding symptoms among individuals with OCD represent comorbid hoarding disorder (Wheaton & Van Meter, 2014). Rates
of OCD among individuals with hoarding disorder range from 37.5% to 56.7% among samples recruited from patient populations (Grisham et al., 2007; Pertusa et al., 2008; Tolin, Meunier, Frost, & Steketee, 2011) and from 0% to just less than 18% in samples recruited from the community (Frost, Steketee, & Tolin, 2011; Samuels, Bienvenu, Grados, et al., 2008). The high rate of hoarding without comorbid OCD is one of the reasons that hoarding disorder was recently established as a distinct diagnosis. In one study of individuals with OCD, other obsessive-compulsive and related disorders (i.e., trichotillomania, excoriation, and nail biting) were more common among individuals with hoarding symptoms than among individuals with other OCD symptoms (Samuels et al., 2002).

Obsessive-compulsive personality disorder (OCPD) is the personality disorder most typically associated with hoarding disorder (Wheaton & Van Meter, 2014). Quite high rates of OCPD have been found among individuals with hoarding disorder (e.g., 45%, Samuels et al., 2002; 56.8%, Landau et al., 2011). Notably, one study found that, even excluding the difficulty discarding criterion of OCPD, up to 33% of individuals with hoarding disorder still met criteria for OCPD (Landau et al., 2011). Other personality disorders appear to be less common, although not uncommon, among individuals with hoarding disorder (Wheaton & Van Meter, 2014).

1.2.4 Impact and cost of compulsive hoarding. Compulsive hoarding is associated with significant costs to affected individuals, their families and friends, and society as a whole.
At the individual level, hoarding is associated with increased impairment and disability. For example, individuals with hoarding problems report high levels of emotional distress (Frost & Gross, 1993), impairment in activities of daily living (Frost, Hristova, Steketee, & Tolin, 2013), and lower quality of life (Saxena et al., 2011). In addition, nearly 2/3 of one sample reported losing at least one workday per month due to psychiatric impairment, and hoarding participants averaged 7 impairment days during a given one month period (Tolin, Frost, Steketee, Gray, & Fitch, 2008). This number of work impairment days in a month is equivalent to the number reported by individuals with psychotic disorders and is significantly greater than the number reported by women with anxiety, mood, and substance use disorders. Individuals with hoarding difficulties also used mental health services at five times the rate among women in the general population (Tolin, Frost, Steketee, Gray, & Fitch, 2008).

Hoarding is also associated with increased risk to physical health. Some of this health risk comes from exposure to unsanitary conditions (Steketee & Frost, 2014). In addition, in one study, individuals with hoarding difficulties were nearly three times more likely to be overweight than were their family members, and they were significantly more likely than women in the general population to report a range of chronic and severe medical problems (Tolin, Frost, Steketee, Gray, and Fitch, 2008).

Financial and housing problems are also common among individuals with compulsive hoarding. In one study, almost 40% of the individuals who self-identified as compulsive hoarders reported receiving annual incomes below the
poverty line, and 6% reported having been fired from a job because of hoarding (Tolin, Frost, Steketee, Gray, & Fitch, 2008). In the same sample, more than 20% of hoarding participants did not file an income tax return in at least one of the five previous years, presumably due to the inability to find important documents.

Nearly 8% of the same hoarding participants, and over 12% of participating family members, reported having been evicted or threatened with eviction because of hoarding (Tolin, Frost, Steketee, Gray, & Fitch, 2008). In a separate study, nearly 1/4 of clients seeking help from a housing advocacy organization met criteria for hoarding disorder based on a results from a clinical interview and a validated cut-off score on a measure of hoarding symptoms (Rodriguez et al., 2012).

Risk of fire and safety concerns are impacts of hoarding that have received considerable attention. A survey of Massachusetts Board of Health officers found that 64% reported at least one complaint of hoarding during a 5-year target period (Frost et al., 2000). These health officers also reported that, on average, the extent to which hoarding is a public health hazard was moderate to severe. Unsanitary conditions and fire hazards were cited as the reason for complaints in 88% and 67% of cases, respectively. And, in 3 cases during the study period, hoarding directly contributed to the death of an individual in a house fire (Frost et al., 2000). A different study conducted in Melbourne, Australia found that, during the previous decade, although less than 0.025% of house fires involved hoarding, 24% of fire-related deaths occurred in hoarded homes (Lucini, Monk, & Szlatenyi, 2009).
Hoarding clearly has an impact that goes beyond the affected individual. One study found that 0.1% - 3.0% of individuals with hoarding difficulties, had had a child or elder removed from the home (Tolin, Frost, Steketee, Gray, & Fitch, 2008). In a separate study, living with a family member with hoarding problems prior to age 21 was associated with elevated levels of childhood distress (i.e., having a less happy childhood, more difficulty making friends, greater embarrassment about the home, not having others visit them), as well as family arguments and strain (Tolin, Frost, Steketee, & Fitch, 2008). In addition, family members of individuals with hoarding difficulties reported high levels of rejecting attitudes towards the individual with hoarding difficulties. The levels of rejecting attitudes reported by family members of individuals with hoarding difficulties are higher than those reported elsewhere by family members of individuals with schizophrenia (Kreisman, Simmens, & Joy, 1979) and obsessive-compulsive disorder (Amir, Freshman, & Foa, 2000).

In addition to these impacts on the family, hoarding is also associated with costs to society as a whole. Frost et al. (2000) found that nearly 80% of hoarding cases investigated by health departments involved multiple agencies and required multiple visits by health officials. One case was reported in which a health department spent $16,000 cleaning out a house and storing the occupant’s possessions only to find that the same house was again problematic 18 months later. The San Francisco Task Force on Compulsive Hoarding (2009) estimated that the cost of hoarding to landlords and social service agencies was over $6 million annually. Moreover, the study conducted in Melbourne, Australia
found that the cost of house fire damage was eight times higher in hoarded homes than in homes without significant clutter (Lucini et al., 2009).

Compulsive hoarding is, therefore, a relatively prevalent and costly psychological problem with negative impacts on the affected individual, the affected individual’s family and friends, and society as a whole. It is a phenomenon that demands both research and clinical attention.

1.2.5 Treatment of compulsive hoarding. Pharmacotherapy and psychotherapy are the two main forms of treatment for compulsive hoarding. Pharmacotherapy for compulsive hoarding has most often involved the use of serotonin reuptake inhibitors (SRIs), sometime in combination with other medications, among individuals diagnosed with OCD. Some studies have found that individuals with hoarding symptoms have a poorer response to these medications than do individuals with other forms of OCD (Black et al., 1998; Cullen et al., 2007; Mataix-Cols et al., 1999; Matsunaga et al., 2009; Stein et al., 2008; Winsberg, Cassic, & Koran, 1999). Other studies have found no significant difference in response to antidepressant medications (SRIs and tricyclics) between individuals with hoarding and non-hoarding OCD (Alonso et al., 2001; Erzegovesi et al., 2001; Ferrão et al., 2006; Saxena, Brody, Maidment, & Baxter, 2007). Across all studies, results suggest, however, that only about 1/3 of individuals treated with SRIs for hoarding respond to treatment. There is, therefore, considerable room for additional forms of treatment to improve outcomes for a larger proportion of individuals with hoarding difficulties.

Psychotherapy for compulsive hoarding began with the application of
effective treatments for OCD to the treatment of compulsive hoarding. With this approach, individuals with hoarding symptoms were significantly more likely to prematurely drop out of treatment than were individuals with non-hoarding OCD, and the presence of hoarding symptoms was associated with poorer response to treatment (Abramowicz et al., 2003; Rufer, Fricke, Moritz, Kloss, & Hand, 2006).

In response to the low success rates of standard OCD treatment for compulsive hoarding, cognitive-behavioural therapy (CBT) for hoarding was developed (Hartl & Frost, 1999; Steketee, Frost, Wincze, Greene, & Douglas, 2000). This treatment is based on the CBT model of compulsive hoarding and targets hoarding specific issues. Across numerous studies, CBT for hoarding has produced positive results (Cermele, Mendez-Pallitto, & Pandina, 2001; Hartl & Frost, 1999; Muroff et al., 2009; Shafran & Tallis, 1996; Steketee et al., 2000; Steketee, Frost, Tolin, Rasmussen, & Brown, 2010; Tolin, Frost, & Steketee, 2007; Turner, Steketee & Nauth, 2010). This treatment is, however, time and cost intensive. In some studies drop out rates have been high (e.g., 29%; Tolin et al., 2007), and hoarding symptom reductions are in the 25% to 40% range. With most clients remaining fairly symptomatic following even this intensive and costly treatment, there is obvious room for improvement. A better understanding of the etiological and maintaining factors of compulsive hoarding will lead to evidence-based modifications of the approach to treatment.

1.3 Compulsive Hoarding and the Theory of Value

Several features of compulsive hoarding appear to reflect abnormal valuing processes. First, individuals with hoarding tendencies acquire and keep a
larger number of items than individuals without hoarding tendencies would keep in the same amount of space (Frost & Hartl, 1996). Also, compulsive hoarding is associated with the acquisition of and difficulty discarding items that others consider to be of little or no value (Frost & Hartl, 1996). Finally, individuals with hoarding tendencies seem to have particular difficulty discarding possessions as compared to items they do not own (Tolin et al., 2009).

The current research is focused on three questions that follow from these observed features of compulsive hoarding. First, why do individuals with elevated hoarding tendencies accumulate a larger number of possessions as compared to individuals without hoarding tendencies? Second, why do individuals with hoarding tendencies acquire and have difficulty discarding items that others would consider to be of little or no value? Finally, why do individuals with hoarding tendencies have particular difficulty discarding possessions as compared to items they do not own?

The economic theory of value is a suitable framework to address these questions. In modern economics, this theory traces its origin to Debreu (1959). The theory of value is based on two core tenets. First, individuals prefer some items to others. Second, limited resources restrict individuals’ choices, so they cannot have an unlimited number of preferred items. Both of these tenets apply to the analysis of compulsive hoarding because, together, they indicate the choices individuals will make about which items, goods, and resources to accumulate, and in what quantities this will occur.

The first tenet, the economic concept of individual preferences, is thought
to be widely applicable, with few theoretical restrictions on the types of preferences individuals may have. Debreu (1959) argued that there are, however, at least two restrictions that must apply to all types of preferences. Preferences must be complete in the sense that individuals have preferences over all items. Therefore, individuals have a preference for any item in relation to another item or good (e.g., space, time). It is recognized that examples exist where preferences may not be complete but these examples are typically extreme and not thought to be relevant to the analysis of preferences over items.

Preferences also must be transitive, in the sense that individuals can rank desired outcomes, even allowing for all outcomes to be identical in rank (Debreau, 1959). Transitivity is most commonly illustrated by an example. Suppose that an individual prefers chocolate to wine and also prefers wine to bananas. Transitivity implies that this individual prefers chocolate to bananas. If this individual preferred bananas to chocolate then there is no preferred item, and the choices made by this individual should cycle across the three items and never arrive at a single choice. Transitivity does not imply that individuals cannot equally prefer items. It is logically possible that individuals value two (or more) items identically, in which case they are said to be indifferent between these items.

The concept of individual preference can be graphically represented as an indifference curve that reflects the various points at which an individual would be indifferent between (i.e., would equally prefer) varying amounts of two distinct goods or sets of goods (see Figure 1).
The second tenet of the theory of value is that scarcity of resources necessarily restricts individual choices. This restriction of choices is reflected in the theory of value in that it supposes that individuals cannot possess unlimited items. Assuming that each item has some type of cost (e.g., monetary price to be paid, time to acquire, space needed to store), individuals can choose any set of items that does not exceed their available resources. The theory of value represents the restriction of choices as a budget constraint, and the set of items, goods, and resources that an individual can possess is commonly referred to as the feasible set.
So, as seen in Figure 1, the two tenets of the theory of value combine to explain individual choices (i.e., which goods are consumed and in what quantities). The budget constraint represents the maximum combined amounts of Good X and Good Y that it is feasible for the individual to consume. The feasible set is any combination of Good X and Good Y that is below the budget constraint line. The indifference curve represents all the combined quantities of Good X and Good Y with which an individual would be equally happy. The individual will consume quantities of Good X and Good Y at the point where the budget constraint meets the indifference curve (i.e., the point at which the individual achieves the outcome with the highest possible idiosyncratic value that does not exceed available resources).

1.3.1 Valuing and overvaluing in compulsive hoarding. Returning to the first question posed in the current research: Why do some individuals (i.e., those who hoard) accumulate so many more things than do other individuals (i.e., those who do not hoard)? The theory of value suggests that the answer may lie in overvaluing of items.

The theory of value implies that the value ascribed by an individual to an item can only be measured in relative terms. In absolute terms, value is not meaningful except with respect to the individual’s preferences, which are unobservable. The theory of value assumes that individuals implicitly value items according to their preferences, so a valuation is meaningful when it reflects relative ranking among those preferences. For instance, consider asking an individual, “How much do you value a glass of water?”. If the answer is, “A lot.”,
no meaningful information is obtained. The theory of value implies that to be a meaningful observation of preferences, a relative question must be asked: How does the value attributed to the glass of water compare to the value attributed to other things? Does this individual value the glass of water more than, less than, or equal to a glass of grape juice, for example? Economists frequently frame this relative question as how much of a particular item (e.g., money, time away from other activities to collect the water) is equivalent to the value of the glass of water. The notion of relative value in the theory of value implies that choices reveal preferences and that the amount of value attributed to a choice is revealed when the cost of the choice is observed in terms of reference items (e.g., money, time, effort; Samuelson, 1953).

The theory of revealed preference provides the rationale for operationalizing preferences as the value of a good in terms of money or in terms of the amount of another good traded. This theory considers preferences to be revealed by consumption behaviour. Behavioural economists study revealed preference by setting up experimental auctions involving trade-offs between one good and another (goods-goods trades) or between money and a good (money-goods trades) in order to produce indifference curves for various goods. Via these experiments, researchers are able to observe the relative value an individual places on a good, in terms of either money or another good, for various quantities of the target good.

Empirical investigations of relative value often use goods-money trades to establish the value of items. Money has two desirable features in these
experiments. First, it is commonly used in daily life, so there is a general understanding of its use and agreement on its value. Second, it is readily divisible: one dollar is equivalent to one hundred cents. Thus, fine gradations of relative value can be determined.

Another proposition of the theory of value is that items will be acquired or kept when the perceived cost of an item is lower than idiosyncratic valuation of the item. That is, individuals acquire and keep items up to the limit of their budget constraints, taking into consideration the perceived cost of the item, in terms of other items and goods that must be forsaken. For example, an individual may attribute a value of $20 to a book. The individual will acquire or keep the book if its cost (in monetary terms as well as in terms of other things that must be given up in order to acquire or keep it, such as space or time to shop) is less than $20. Generally, the perceived value of an additional unit of an item is less than the perceived value of the previous unit of the same item such that marginal (i.e., additional) value decreases as the number of units of an item increases.

Graphically, this is represented as a downward sloping marginal value curve (see Figure 2).

Extending this example to compulsive hoarding, if an individual overvalues books (i.e., perceives the value of the book to be $30), the marginal value curve shifts upwards. It then crosses below the perceived cost line much further along the number of items axis. This is, again, the point at which the individual stops acquiring; at a much larger number of items when items are overvalued than when they are not (see Figure 2).
The current research investigates whether individuals with hoarding tendencies overvalue items, in monetary terms, as compared to individuals without hoarding tendencies. As noted above, another interpretation of cost in the context of hoarding is loss of living space because of the accumulation of items. Measuring an individual’s valuation of living space is, however, confounded by many factors and difficult to do in practice. Money is a suitable and accepted measure of value as discussed above.

1.3.2 Diminishing marginal value in compulsive hoarding. Next, consider the question: Why do individuals with hoarding tendencies acquire and have difficulty discarding multiple units of items that others would consider to be
of little or no value? That is, why do hoarders tenaciously refuse to discard items that others would easily throw out as garbage? And, why do they acquire many multiples of the same or similar items? The theory of value would suggest that individuals acquire a limited number of units of any item at least in part because they perceive diminishing value to each additional unit. The idea that the value of an item diminishes with each additional unit is labeled diminishing marginal value. Applied to compulsive hoarding, the theory of value would suggest that individuals with elevated levels of hoarding tendencies acquire many units of an item because they do not perceive as great a diminishing marginal value to additional units as do individuals with lower levels of hoarding tendencies.

Diminishing marginal value is an operationalization of diminishing marginal utility. Diminishing marginal utility is such a well-established and validated concept in economics that it is widely referred to as a law (Mankiw et al., 2011). Utility is defined as the level of satisfaction or happiness that a consumer derives from a bundle of goods, and marginal utility is the increase in utility that a consumer gets from an additional unit of a given good (Mankiw et al., 2011). Utility functions differ within individuals for different goods and across individuals for the same good (Davenport, 1913). Evidence for diminishing marginal utility is widespread. Most commonly, it has been demonstrated in examinations of the relation between income and happiness (e.g., Diener, Sandvik, Seidlitz, & Diener, 1993; Veenhoven, 1989). Evidence for diminishing marginal utility has also been found in laboratory settings (Horowitz et al., 2007), and there is evidence of a specific brain architecture associated with encoding diminishing
marginal utility (Pine et al., 2009). The theory of revealed preference (Samuels, 1953) provides the justification for operationalizing utility as perceived monetary value.

As noted previously, there is evidence that compulsive hoarding is associated with increased sentimental valuing of, or attachment to, items. There is also some evidence that individuals with hoarding tendencies assign higher unspecified value to items, as compared to individuals without hoarding tendencies (Frost et al., 1998). Anecdotal evidence also suggests that individuals with hoarding tendencies view all items as unique. Accordingly, one item cannot substitute for another, so one would predict no diminishing marginal value.

Finally, anecdotal evidence also suggests that individuals with hoarding difficulties tend to use a restricted frame of reference when considering the value of an item. That is, they tend to determine the value of an item in isolation from any consideration of how the item fits in with other items they already own. Taken together, these considerations suggest that compulsive hoarding may be associated with an attenuated, or flattened, diminishing marginal value curve. If compulsive hoarding is, indeed, associated with a flattened diminishing marginal value curve, this might help to explain why individuals with hoarding difficulties often collect multiples of items that others perceive to be of little or no worth.

Figure 3 shows the number of items that would be consumed by an individual with diminishing marginal value. The figure also shows an increase in the number of items consumed by an individual with overvaluation but no attenuated diminishing marginal value, and a much larger increase in the number
of items consume with overvaluation and reduced diminishing marginal value.

Figure 3. Hypothesized Marginal Value Curves for Non-Hoarders, and for Hoarders without and with Attenuated Diminishing Marginal Value

The current research examines whether diminishing marginal value is attenuated among individuals with hoarding tendencies relative to those who do not exhibit such tendencies.

1.3.3 The endowment effect in compulsive hoarding. Finally, consider the question: Why is it so difficult for individuals who have problems with hoarding to part with excess possessions, despite the apparent costs of keeping them? The theory of value would suggest that individuals with elevated hoarding tendencies value the act of possessing an item more than do individuals without
elevated hoarding tendencies. The endowment effect refers to the bias of individuals to value identical items higher if they possess the item than if they do not possess the item. One outcome of this effect is that it is more difficult for most people to part with items than to resist acquiring the same items in the first place. Thus, the endowment effect may be informative in the study of hoarding disorder (Tolin & Villavicencio, 2011), and the theory of value suggests that an exaggerated form of the endowment effect might help to explain why individuals with hoarding problems have relative difficulty disposing of items.

The endowment effect (Thaler, 1980) refers to the phenomenon by which people usually require a higher price to give up something they own than the price they would be willing to pay to acquire it (Weber, 2010). In terms of utility, a foregone gain has lower utility value than a similar sized loss (Franciosi, Kujal, Michelitsch, Smith, & Deng, 1996). The endowment effect is supported by a series of behavioural experiments (Kahneman et al., 1990). The phenomenon has been attributed to loss aversion in which losses are weighted more than gains in decision making about trades (Kahneman et al., 1990; Kahneman, Knetsch & Thaler, 1991; Kahneman & Tversky, 1979; Tversky & Kahneman, 1991) and to ownership (Strahilevitz & Loewenstein, 1998).

Some research suggests that the endowment effect is influenced by attributes of the goods under consideration and by individual difference variables. For example, Horowitz and McConnell (2002) found that the endowment effect was larger for goods that are not often traded (e.g., home postal delivery) than for market goods (e.g., cans of Coke) and money. Consistent with this, Hjorth &
Fosgerau (2011) found evidence of a larger endowment effect for commuter travel time (a good that is not often traded) than for commuter travel costs (a good that is often traded). This finding is also consistent with evidence that experience with trading a good reduces the endowment effect (Johnson, Gächter, & Herrmann, 2006). The perceived importance of a good is another attribute of goods that has been found to affect (i.e., increase) the endowment effect (Johnson et al., 2006). With respect to individual differences, age and income have been associated with increased endowment effects (Hjorth & Fosgerau, 2011; Johnson et al., 2006) and level of education has been negatively associated with the endowment effect (Hjorth & Fosgerau, 2011). The impact of these individual difference variables on the endowment effect are considered in the current research.

The endowment effect has been operationalized both as goods-money trades and as goods-goods trades. Goods-money trades test the endowment effect by eliciting the average minimum selling price that people are willing to accept for an item and the average maximum buying price people are willing to pay for the same item. A significantly higher willingness to accept than willingness to pay is considered evidence of the endowment effect. Less commonly, goods-goods trade tests of the endowment effect have examined the percentage of individuals willing to trade an item that they own for an item that they do not own. In these experiments, willingness to trade of less than 50% has been cited as evidence of the endowment effect (for a review see Kahneman et al., 1990).
Experimental evidence using goods-goods trades suggests a willingness to trade of typically 10%, meaning only 10% of participants are willing to trade an item they already own for one of similar value that they do not own (Knetsch, 1989). This suggests that the endowment effect is nearly universal under goods-goods trade conditions. An enhancement of the endowment effect under these conditions is, therefore, unlikely to contribute to a better understanding of abnormal valuing processes in compulsive hoarding. A goods-money trade procedure avoids this limitation and is, therefore, used in the current research.

The effect of the endowment effect on marginal value curves is to shift them higher for owned items, and I hypothesize that this shift will be greater for hoarders than for non-hoarders. This would result in an individual with hoarding tendencies keeping a far greater number of possessions and “accidentally” acquired items than would be kept by an individual without hoarding tendencies. Good examples of accidentally acquired possessions are unsolicited flyers and soy sauce packages that come with take-out meals. An enhanced endowment effect would help to explain why hoarders having greater difficulty disposing of such possessions than do individuals without hoarding difficulties.

As seen in Figure 4, the endowment effect increases the number of items consumed by a small amount. There is, however, a much larger increase in the number of items consumed with a larger endowment effect, which is what I hypothesize occurs in compulsive hoarding.
1.3.4 Intertemporal choice. In contrast to the valuing processes outlined above, some decisions involve choices between current and future outcomes. For example, acquiring an item today may preclude having the resources to acquire another item tomorrow, and acquiring an item today might interfere with savings such that a more valuable item cannot be acquired at a later date.

Discounted utility theory (Fishburn & Rubinstein, 1982; Loewenstein & Prelec, 1992; Weinstein & Stason, 1977) prescribes that the value of a reward decreases over time. For example, an individual offered $10 today or $15 today will undoubtedly choose $15 today. However, the same individual offered $10 today
or $15 in one year might choose $10 today even though $15 in one year is a more valuable reward (i.e., it is more valuable than $10 plus the interest that would accrue on $10 over one year). This has been labelled delay discounting, and the rate at which value decreases over time is called the discount rate.

Although there is empirical evidence for individual discount rates (e.g., Hausman, 1979; Landsberger, 1971), there is also evidence that discount rates are larger for gains than for losses (e.g., Benzion, Rapopot, & Yagil, 1989; Loewenstein, 1988). For example, someone might prefer to gain $10 today rather than gaining $15 in one year, indicating a discount rate of greater than 50%. The same person might, however, prefer to lose $10 today rather than losing $15 in one year, indicating a discount rate of less than 50%. The phenomenon of discount rates being larger for gains than for losses is termed the sign effect.

Delay discounting and the sign effect could be helpful in understanding excessive acquisition and difficulty discarding in hoarding disorder. For example, if hoarding were associated with an increased discount rate, an item with a perceived value of $10 today would have a lower perceived value much sooner for individuals with hoarding disorder than for individuals without the condition. This could be associated with increased acquiring of items in the present moment in order to avoid lower perceived rewards in the future. Also, the discount rate for losses could be reduced in hoarding such that a perceived loss of $10 today would continue to be valued at $10 much longer by someone with hoarding disorder than by someone without the condition. This could result in greater difficulty parting with possessions because the perceived loss would be
greater for a longer period of time. In combination, an increased discount rate for gains and a decreased discount rate for losses in hoarding would result in a larger sign effect overall.

Although there is theoretical justification for investigating whether these phenomena are associated with hoarding disorder, that task is not undertaken in the current dissertation. First, the main focus of this dissertation is on current moment decision-making rather than on intertemporal choice. Second, in the clinical literature, delay discounting has usually been investigated within the construct of impulsivity associated with drug abuse. Indeed, individuals with drug use problems typically show increased discount rates as would be expected in hoarding disorder. However, in studies of delay discounting among individuals with drug use problems, delay discounting is consistently associated with increased impulsivity (see Bickel & Marsch, 2001 for a review). Whereas impulsivity may be a key difficulty associated with drug abuse, individuals with hoarding disorder are typically considered to be risk averse. Delay discounting may, therefore, not be the most appropriate conceptualization of change in value over time among individuals with hoarding disorder.

### 1.4 Valuing and Compulsive Hoarding

As discussed above, I argue that valuing is distorted in compulsive hoarding. Hoarders acquire and keep more items than would others. Often, others would consider these items to be of little or no value. Hoarders also often acquire and keep multiples of the same type of item whereas others would have only one. Finally, hoarding is associated with extreme difficulty parting with
possessions that others would easily let go. All of these features of compulsive hoarding suggest that hoarders value items differently than do others.

I argue that this distorted valuing may take the form of overvaluation of items, attenuated diminishing marginal value, or an enhanced endowment effect. Although explicit consideration of valuing has been ignored by all major theories of hoarding, abnormal valuing is implicit in such theories and deserves systematic attention.

What follows is, first, a brief overview of the main theories of compulsive hoarding. Then, I show that valuing is implicit in these theories and pull together elements from theories of compulsive hoarding that suggest valuing deserves greater attention as an important feature of the condition. Finally, I review the small number of empirical studies that have considered aspects of valuing in compulsive hoarding.

1.4.1 Theories of compulsive hoarding. Early theories of compulsive hoarding included psychodynamic, biological, and evolutionary perspectives. Although each of these perspectives brought attention to important elements and features of compulsive hoarding, each had notable limitations such that they have been replaced by a more complete, coherent, and empirically oriented cognitive-behavioural theory of compulsive hoarding. What follows is a brief review of these theories.

1.4.1.1 Early perspectives on compulsive hoarding. The earliest theories of compulsive hoarding were psychodynamic in orientation and viewed hoarding as part of the anal character, consisting of parsimony, orderliness, and
obstinacy (e.g., Abraham, 1921; Freud, 1908; Jones, 1912). Parsimony included the desire to gather, collect, and hoard, along with difficulties separating from items that have neither practical use, nor monetary value. Another rendition of these characterological theories contended that hoarding was associated with withdrawal and remoteness from other people, compulsiveness, suspiciousness, extreme desire for order, and concerns about cleanliness and punctuality. Individuals with hoarding problems were thought to obtain a sense of security from collecting and saving objects and to form attachments to possessions, rather than people (Fromm, 1947). These theories brought attention to some hitherto unrecognized aspects of hoarding (e.g., attachment, need for control, orderliness, and perfectionism), some of which have been incorporated into the cognitive-behavioural model. The lack of empirical evidence supporting such characterological theories of hoarding, however, and the absence of effective treatments informed by these theories, has meant that they have not been widely adopted (Kyrios, Steketee, Frost, & Oh, 2002).

Biological models of compulsive hoarding behaviour have also been proposed, although these theories are largely extensions of OCD research and animal studies, and rarely refer specifically to human compulsive hoarding behaviour. Animal studies usually refer to food hoarding behaviour and to cortical abnormalities involving the nucleus accumbens or the prefrontal cortex, whereas human OCD studies have implicated a range of neurophysiological abnormalities. Although this line of research would suggest the potential for pharmacological treatment of human hoarding behaviour, as discussed earlier,
this type of treatment has thus far been largely ineffective. Although exclusively biological theories of compulsive hoarding among humans have generally been marginalized (Kyrios et al., 2002), there is ample current interest in biological mechanisms that contribute to compulsive hoarding and research in this area is ongoing.

Evolutionary perspectives may also offer some insight into compulsive hoarding behaviour in humans. Like biological theories, these theories are informed by animal models of food hoarding, and liken human hoarding behaviour to instinctive nesting behaviours and evolved competition for scarce resources (e.g., Preston, 2014). Like earlier psychodynamic theories and biological models, evolutionary perspectives can be useful in some situations in that they bring attention to some previously unrecognized factors influencing compulsive hoarding. Their generalizability is, however, limited by the heterogeneity of types of objects hoarded by humans, the absence of competition for scarce resources in some human hoarding situations, and the failure of these models to adequately account for affective, sociocultural, and historical factors that also seem to contribute to compulsive hoarding among humans (Kyrios et al., 2002). In addition, evolutionary theories of compulsive hoarding imply that hoarded items should have some reproductive utility but, given the reduced marriage rates among individuals with compulsive hoarding (Samuels et al., 2002; Steketee, Frost, & Kim, 2001), it seems likely that human hoarding probably has negative utility for reproduction.

Although these theories have brought to light certain factors that
contribute to a better understanding of hoarding behaviour, they do not provide a comprehensive model of compulsive hoarding among humans. Their useful contributions have, therefore, been subsumed within a more complete model of compulsive hoarding – the cognitive-behavioural model – which is currently the dominant perspective from which most empirical research is being conducted.

1.4.1.2 Cognitive-behavioural model of compulsive hoarding. Frost and Hartl first proposed a model of compulsive hoarding in 1996 as a framework for future research efforts. This model uses a cognitive-behavioural framework to explain some of the same phenomena that I examine from a behavioural economics perspective: Why do people who hoard find it so difficult and upsetting to part with possessions? Why do hoarders acquire and keep items that others would consider to be worthless? What factors contribute to excessive acquisition in compulsive hoarding? Since this preliminary model was proposed, it has served as the primary theoretical framework for empirical investigations into compulsive hoarding.

Based on anecdotal, observational, and limited empirical evidence, this model views compulsive hoarding as a multi-faceted problem, stemming from information processing deficits, problems with emotional attachment, behavioural avoidance, and erroneous beliefs about the nature of possessions. Frost and Hartl (1996) suggest that compulsive hoarding is associated with information processing deficits in three areas: decision-making, categorization/organization, and memory.
In the realm of decision-making, Frost and Hartl (1996) point to indecisiveness and perfectionism, particularly fear of making mistakes, as key contributors to decision-making deficits among individuals with hoarding difficulties. They also note that estimates of the instrumental and sentimental value of possessions, beliefs about the consequences of discarding, and altered cost/benefit analysis are other aspects of decision-making that contribute to compulsive hoarding behaviour.

In terms of categorization/organization, Frost and Hartl (1996) propose that hoarding is associated with under-inclusive categorization (i.e., the tendency to narrowly define category boundaries, resulting in smaller size and greater number of categories). Various features of under-inclusive categorization are noted. First, each object is seen as unique such that no other object can substitute for another and the value of each object is increased. Also, all aspects of an object are considered before sorting or discarding can take place, which contributes to indecisiveness. Frost and Hartl also propose that hoarding is associated with a restricted frame of reference when considering the value of a possession. As a result, the value of each item is determined in isolation with very little consideration given to how the item fits into the larger context of what is needed and what is already owned or available for use. Difficulties discarding, difficulties organizing/sorting, clutter, churning (i.e., the process of picking up items and moving them around without reducing the extent of clutter or increasing the level of organization), and mixing of important and unimportant objects are thought to be consequences of under-inclusive categorization.
Frost and Hartl (1996) note two aspects of memory that are relevant to problems with hoarding: poor memory confidence and overestimation of the importance of remembering or archiving information. It is proposed that individuals with hoarding problems may perceive the consequences of not remembering as more likely and more severe than individuals without hoarding problems. They may also over-include items in the category of important and, therefore, necessary to remember items. Memory deficits are thought to contribute to difficulties discarding and to difficulties organizing and putting things away.

With respect to problems with emotional attachment, Frost and Hartl (1996) propose that hoarding is associated with increased saving for sentimental reasons and greater emotional attachment to possessions. This is termed “hypersentimentality,” and Frost and Hartl argue that hoarding is associated with two types of emotional attachment to possessions: pure sentimentality and emotional attachment to possessions for their value as safety signals.

Finally, Frost and Hartl (1996) propose that behavioural avoidance and beliefs about possessions contribute to and maintain hoarding behaviour. Indecisiveness and perfectionism contribute to avoidance of decision-making and emotional attachment to possessions contributes to avoidance of the emotional upset of discarding. Excessive accumulation of items can also, eventually, contribute to avoidance of the physical, cognitive, and emotional effort that would be involved in organizing and getting rid of things. Frost and Hartl argue that beliefs about the necessity of maintaining control over possessions, responsibility
for possessions, the necessity for perfection, the importance of memory, and emotional attachment to possessions all serve to maintain and exacerbate compulsive hoarding.

1.4.1.3 Updates to the cognitive-behavioural model of compulsive hoarding. Since the cognitive-behavioural model of compulsive hoarding was first presented by Frost and Hartl in 1996, reviewers have continued to agree that information processing deficits, problems with emotional attachment, beliefs about the nature of possessions, and behavioural avoidance are key mechanisms that contribute to the development and maintenance of compulsive hoarding (Gilliam & Tolin, 2010; Grisham & Barlow, 2005; Steketee & Frost, 2003; Tolin, 2011). Theorists generally agree on decision-making, categorization/organization, and memory as three main information processing deficits associated with compulsive hoarding, although problems with attention have been added as a fourth type (Gilliam & Tolin, 2010; Grisham & Barlow, 2005; Steketee & Frost, 2003; Tolin, 2011; Woody et al., 2014).

Recent models also continue to recognize problems with emotional attachment to possessions as an important factor contributing to compulsive hoarding. In the newer models, however, emotional attachment to possessions is either linked with beliefs about the nature of possessions as forms of maladaptive cognitive processes associated with compulsive hoarding (Gilliam & Tolin, 2010; Steketee & Frost, 2003; Tolin, 2011) or suggested as a mediator in the relationship of information processing deficits and maladaptive beliefs about possessions with symptoms of compulsive hoarding (Grisham & Barlow, 2005).
Beliefs about emotional attachment to possessions, memory-related concerns, responsibility for possessions, and desire for control over possessions continue to be identified as key beliefs about the nature of possessions that serve to maintain hoarding behaviour (Gilliam & Tolin, 2010; Steketee & Frost, 2003). As noted above, however, some reviewers have differentiated emotional attachment to possessions from maladaptive beliefs about possessions (Grisham & Barlow, 2005) and few reviewers continue to identify perfectionism as a separate key belief domain (e.g., Tolin, 2011).

Finally, behavioural avoidance continues to be identified in theoretical models of compulsive hoarding as an important factor (Steketee & Frost, 2003; Tolin, 2011). Some reviewers suggest, however, that behavioural avoidance acts as a mechanism, much like excessive emotional attachment to possessions, in the relationship between information processing deficits or maladaptive beliefs about possessions, and hoarding behaviours (Gilliam & Tolin, 2010; Grisham & Barlow; 2005). Tolin (2011) has added behavioural disinhibition, as well as poor problem recognition and motivation as maladaptive behaviour patterns characteristic of compulsive hoarding.

The cognitive-behavioural model of compulsive hoarding, therefore, presents a comprehensive consideration of cognitions and beliefs associated with compulsive hoarding, as well as of the role of avoidance in the psychopathology of compulsive hoarding. The model is, however, less specific and complete on issues of affect, valuing, and excessive accumulation. My theory addresses these aspects of compulsive hoarding and presents a logical
and inclusive framework for their consideration. What follows is a discussion of aspects of valuing implicit in theories of compulsive hoarding and of the limited empirical work related to the topic.

1.4.2 Valuing in compulsive hoarding. Distorted valuing is an important, previously ignored, factor in the etiology and maintenance of compulsive hoarding. The meager (and often indirect) extant empirical evidence generally supports the idea that abnormal valuing is an aspect of cognitive processing among individuals with hoarding difficulties. After I review the small literature on this topic, I will note gaps and limitations below.

1.4.2.1 Elements of valuing in theories of compulsive hoarding.
Overvaluation of items is implied in the very definition of compulsive hoarding. Fundamentally, a key element in the definition of compulsive hoarding is the acquisition of and failure to discard a large number of items, some of which others would perceive as being useless or of limited value (Frost & Hartl, 1996; Gilliam & Tolin, 2010; Grisham & Barlow, 2005). In order for hoarding to be considered clinically significant, excessive accumulation must compromise the use of living spaces for their intended purposes, and the individual must experience distress or impairment as a result of the over-accumulation. The excessive accumulation of (worthless) items, at the expense of other goods (e.g., space, ease of living) suggests that items are generally overvalued.

In addition, excessive emotional attachment to possessions is widely recognized as one of the key features of compulsive hoarding (Frost & Hartl, 1996; Gilliam & Tolin, 2010; Grisham & Barlow, 2005; Steketee & Frost, 2003;
Tolin, 2011). It has been observed that individuals with compulsive hoarding give sentimental value to seemingly worthless items even though the items may not be associated with a memorable experience (Frost & Hartl, 1996).

The cognitive-behavioural model of compulsive hoarding also identifies information processing deficits as important to the etiology and maintenance of hoarding (Frost & Hartl, 1996; Grisham & Barlow, 2005). Misinterpretation of the value of possessions may be associated with these information-processing deficits. For example, Frost and Hartl (1996) recognize that decisions about discarding seem to be based on estimates of an item’s value. Also, although Frost and Gross (1993) found that reasons for saving and the types of items saved did not seem to differ between individuals with and without hoarding difficulties, individuals with hoarding difficulties do seem to define a wider range of types and number of items as valuable enough to acquire and keep (Frost & Hartl, 1996; Grisham & Barlow, 2005). Individuals with hoarding difficulties may also exhibit a higher threshold for deciding to discard an item than do individuals without hoarding problems. Finally, hoarding may be associated with the belief that the value of a possession can change over time. Even though an item may be perceived as useless at the moment, the individual believes that it may be needed in the future (Frost & Hartl, 1996).

Deficits of categorization and organization may also contribute to problematic valuing in compulsive hoarding. Under-inclusive categorization conveys a greater sense of uniqueness of each item (Frost & Hartl, 1996; Steketee & Frost, 2003), and thus of perceived value. Also, clutter implies mixing
of important and unimportant items. When items are mixed, all items that are mixed together assume the same high value because valuable items are not separate from valueless ones. Finally, individuals with hoarding difficulties seem to determine the value of an item in isolation from what is already owned and the amount of space available for storing items. The value of saving and the cost of discarding are considered, but not the cost of saving or the value of discarding (Frost & Hartl, 1996).

Beliefs about emotional attachment to possessions are also defined such that they imply overvaluation of items (Gilliam & Tolin, 2010; Grisham & Barlow, 2005; Steketee & Frost, 2003). Further, behavioural avoidance in compulsive hoarding is comprised of avoidance of decision-making due to the difficult task of weighing the myriad factors that contribute to an item’s value and avoidance of emotional upset due to parting with valued possessions (Frost & Hartl, 1996; Steketee & Frost, 2003; Tolin, 2011).

Thus, theories of compulsive hoarding imply distorted valuing of items but these elements have yet to be specifically identified as having to do with item valuation and organized into a coherent theoretical model.

1.4.2.2 Empirical investigation of valuing in compulsive hoarding.

There has been limited empirical work on the topic of distorted valuing of items in compulsive hoarding. What follows is a review of this literature, including identification of gaps and limitations.

1.4.2.2.1 Reasons for saving. A small set of studies has examined reasons for saving associated with compulsive hoarding. Reasons for saving can
be understood as a proxy for the type of value that individuals place on their possessions. This work stems from work by Lita Furby (1978) on the motivations for possessive behaviour in humans, which found instrumental and sentimental reasons for acquiring and keeping possessions (i.e., items have instrumental and sentimental value, therefore, they are acquired and kept).

In an early case study, Frankenburg (1984) observed that her patient exhibited both instrumental and sentimental uses for her possessions. The patient reported using her possessions as a source of comfort and as instruments for rapport-building and distance-keeping in her interpersonal relationships. For example, Frankenburg observed that her patient used discussions of her “collection” as an avenue for building connection with her and as a way of avoiding discussions of more intimate issues. In another study of a small number of cases, Seedat and Stein (2002) found that 60% of their hoarding participants reported valuing their items for sentimental reasons. Ethnographic case studies have also identified instrumental and sentimental reasons for acquiring, saving, and having difficulties discarding (Andersen, Raffin-Bouchal, & Marcy-Edwards, 2008; Cherrier & Ponnor, 2010).

Both sentimental and instrumental reasons for saving have also been reported in empirical studies of compulsive hoarding. For example, when self-identified “pack rats” and chronic savers were asked to rate their thoughts when deciding whether to throw something away, the most prevalent thought was, “I might need this someday”, followed in descending order by, “This is too good to throw away”, “This means too much to me to throw away”, and, “This may be
worth something someday” (Frost & Gross, 1993), demonstrating that participants valued their items for both sentimental and instrumental reasons. In a separate study, Frost and colleagues (Frost, Hartl, Christian, & Williams, 1995) found, in both an undergraduate university sample and a sample of individuals who self-identified as “pack rats” or chronic savers, that scores on a measure of hoarding behaviour were significantly and positively correlated with valuing items for emotional reasons like feeling attached to them and deriving emotional comfort from them (In contrast, see Hartl et al., 2005 for equivocal results on hoarding and emotional comfort derived from possessions). Also, in a sample of individuals with clinically significant hoarding symptoms, but not OCD, emotional attachment to possessions and the intrinsic value of possessions (e.g., items are valuable or may come in handy in the future) were the only reasons cited for hoarding (Pertusa et al., 2008). This was in contrast to the hoarding plus OCD group, one quarter of which reported hoarding due to obsessions and compulsions.

Emotional attachment to possessions also emerged as one of four belief factors in a factor analysis of hypothesized attitudes and beliefs among a mixed sample of individuals with compulsive hoarding, individuals diagnosed with OCD without hoarding symptoms, and community controls (Steketee et al., 2003). In this study, individuals with hoarding problems endorsed higher levels of emotional comfort derived from possessions, identification with possessions, and perceived value of possessions than individuals diagnosed with OCD without hoarding problems and community control participants. Further, emotional
attachment to possessions was significantly and positively correlated with hoarding behaviour, although, emotional attachment to possessions was not a significant predictor of hoarding behaviour above and beyond the significant effects of age, OCD symptoms, indecisiveness, and the three other hoarding-related belief factors—memory, control, and responsibility (Steketee et al., 2003). In another study, participants in the hoarding group reported greater emotional attachment to possessions than did participants in both clinical and healthy comparison groups (Grisham, Steketee, & Frost, 2008). And, in an online, questionnaire-based study among undergraduate university students, level of hoarding symptoms was significantly and positively correlated with level of attachment to possessions (Haws, Naylor, Coulter, & Bearen, 2012). Finally, in a behavioural study that measured participants’ emotional responses and attitudes towards a key chain that they were given, initial attachment to the keychain was significantly and positively correlated with hoarding symptoms and hoarding-related cognitions (Grisham et al., 2009).

In conclusion, this set of studies examines the types of valuing that are associated with compulsive hoarding and generally finds that hoarding, like human possessiveness in general, is associated with sentimental and instrumental reasons for saving. One limitation of this work is that only two studies have compared hoarding groups to others (i.e., clinical and healthy control groups) and one of those studies found that sentimental valuing of items was not a significant predictor of hoarding behaviour above and beyond other demographic and clinical factors. Further, although these studies address the
types of value that may contribute to hoarding behaviour, they do not address the economic aspects of valuing that are the basis for my model of excessive accumulation in hoarding. Nor do they address the important question of valuing processes and how they might operate differently between hoarding and non-hoarding groups.

1.4.2.2 Value attribution. Only one study has directly examined valuing of items in compulsive hoarding, and this involved general, non-relative valuing. Frost and colleagues (1998) asked participants to rate the value they would likely assign to an item on an unspecified 7-point scale. Among female undergraduate students, the value assigned to an imagined, partially read newspaper or magazine was positively correlated with the number of reasons given for saving the item and negatively correlated with the reported likelihood of discarding it. The value given to the item was also positively associated with a measure of hoarding behaviour, as well as with a measure of compulsive buying. The same study reported that a sample of self-identified hoarders assigned significantly higher values to the newspaper or magazine than did a sample of non-faculty university employees. These results suggest that compulsive hoarding may be associated with assigning greater undefined value to possessions and that greater valuing of possessions may be associated with more reasons for saving an item and reduced likelihood of discarding.

One limitation of this study is that the operationalization of “value” was not specified or standardized to a reference point. This is an important weakness because, as noted above, value is meaningless without comparison to a
reference good. The value measured in this study was, therefore, subjective to each participant, eliminating the possibility of comparisons between participants.

1.4.2.2.3 Monetary valuing among “Acquirers”. The association between monetary valuing and hoarding-like behaviour (i.e., acquiring and saving) has been examined in only one study (Preston, Muroff, & Wengrovitz, 2009). In this study, undergraduate students were presented with computerized photographs of 214 everyday household items, half of which participants rated in terms of monetary value using whole numbers including $0, and half of which participants rated in terms of usefulness on a scale of 1 (“not at all useful”) to 7 (“extremely useful”). Participants also engaged in a series of computerized acquiring and discarding tasks. On the basis of cluster analysis of their acquiring and discarding decisions during the study, participants were grouped into Acquiring, Intermediate, and Spartan clusters. No significant differences were found between the groups for either price or usefulness estimates.

This study has a number of important limitations that the current research will address. First, no mechanism was used to elicit “true” values for the items. The behavioural economics research literature supplies such a mechanism that will be used in the current research. The use of photographs of items rather than real items also limits the validity of the results as research suggests that touch increases one’s sense of ownership of an item as well as the value that one attributes to the item (Peck & Shu, 2009). Touching objects appears to be an important aspect of the phenomenon of hoarding and with everyday decisions to discard or not (e.g., bringing in the junk mail to put in the recycling). Finally, the
The task used in this study includes a number of items that could confound emotional reactions, particularly disgust, with the valuation task. This is problematic because some evidence suggests emotional reactions to items may mediate the relationship between touch and perceived value of an item (Peck & Shu, 2009), and other studies find lower values attributed to unpleasant and emotionally contaminated objects (Brenner, Rottenstreich, Sood, & Bilgin, 2007; Lerner, Small, & Loewenstein, 2004).

In addition to these specific limitations of the study by Preston and colleagues (2009), there are ways in which simple monetary valuing of items does not adequately capture differential valuing as it is thought to exist in compulsive hoarding. In particular, simple monetary valuing does not incorporate the aspect of a higher threshold at which acquiring stops and discarding begins that appears to characterize compulsive hoarding. Monetary valuing also does not capture the restricted frame of reference (i.e., failure to consider items already owned, space available for items, need for item, costs of acquiring, benefits of discarding) that is proposed as a factor contributing to overvaluation of individual items (Frost & Hartl, 1996). As discussed above, the concept of diminishing marginal utility addresses both of these limitations. Finally, monetary valuing does not identify an endowment effect, which may be particularly salient for compulsive hoarders.

The current research addresses these limitations and takes a systematic approach to the investigation of ways in which valuing may be abnormal among individuals with compulsive hoarding tendencies.
1.4.2.3 **Potential confound variables and a moderator.** In the current research, a set of demographic and clinical variables was examined as potential confounds. In addition, state affect was considered as a potential moderator.

1.4.2.3.1 **Potential confound variables.** In the current research, gender, age, level of education, income, depression, anxiety, and intolerance of uncertainty are considered as variables that may be confounded with hoarding. If this were the case, variance attributed to hoarding could, instead, be attributable to the confound variable. Strategies used to mitigate this potential problem are presented in Chapter 2. What follows is a brief rationale for why these variables are considered as potential confound variables in the current research.

As discussed above, there is some evidence that gender is associated with differences in how hoarding is experienced, and there is mixed evidence about the association between age and hoarding severity. Although the majority of studies have found no difference in level of education between hoarding groups and various control groups, others have found such a difference. Moreover, there is limited and conflicting research on the association between income and hoarding difficulties. Individuals with hoarding difficulties may or may not have lower incomes and the causal direction of the relationship, if any, is unknown. Because these demographic variables may be confounded with hoarding and because they may also be associated with the valuing processes of interest in the current research, they are examined as potential confound variables.

Further, as discussed above, depression is often comorbid with hoarding,
and mood congruency (Mayer, Gaschke, Braverman, & Evans, 1992) would suggest that depressed individuals value items differently than those who are not depressed. There is no known empirical work on the association between depression and the valuing processes of interest in the current research, although, there is some evidence that negative mood is associated with differential valuing of items. For example, in one study, participants who were induced to feel sad were willing to pay more for a water bottle than were participants who received a neutral mood induction (Cryder, Lerner, Gross, & Dahl, 2008). Depression is, therefore, treated as another potential confound in the current research.

Anxiety may also act as a confound in the relationship between hoarding and valuing processes. Hoarding is often comorbid with anxiety disorders and there is evidence that anxiety may be associated with valuing processes. For example, one study of willingness to pay for air pollution abatement via increased taxes in Israel found that trait anxiety was a significant negative predictor of willingness to pay, suggesting that anxiety may decrease buying prices (Zeidner & Shechter, 1988). In another study conducted in Norway, willingness to pay for Tamiflu (an influenza treatment medication) under a scenario of influenza pandemic was higher among anxious (operationalized as self-report of taking precautions beyond being careful with personal hygiene) than non-anxious individuals (Gyrd-Hansen, Halvorsen, & Kristiansen, 2008).

The rationale for considering intolerance of uncertainty as a potential confound variable is based on theoretical considerations and limited empirical
evidence. Theoretically, behavioural and emotional avoidance have been hypothesized to contribute to hoarding behaviours (Frost & Hartl, 1996; Steketee & Frost, 2003). And, intolerance of uncertainty has been proposed as an individual difference variable that contributes to avoidance behaviours (Buhr & Dugas, 2002). Empirically, one recent study among undergraduate students found that intolerance of uncertainty significantly predicted hoarding severity above and beyond the effects of depression, general worry, and non-hoarding symptoms of OCD (Oglesby et al., 2013).

Intolerance of uncertainty has not yet been empirically linked to valuing processes but it has been noted that emotional states like uncertainty may motivate the accumulation of resources and that, in modern society, uncertainty about having money or access to goods in the future could stimulate current excessive accumulation of potentially scarce goods (Vickers & Preston, 2014). In economics, it has been proposed that individuals save currently due to uncertainty about future income (precautionary savings; Skinner, 1987). If there is doubt about the future value of, or access to, money savings, savings may take the form of durable goods. Individuals with elevated levels of intolerance of uncertainty could, therefore, be particularly prone to precautionary savings, especially in the form of durable goods.

Because depression, anxiety, and intolerance of uncertainty may be associated with hoarding in the current sample, they are examined as potential confounding variables.

1.4.2.3.2 State affect as a moderator of the endowment effect. There is
good evidence that state affect moderates the endowment effect. For example in a study by Lerner and colleagues (2004), participants who received a sadness induction subsequently gave up significantly more money to acquire a package of highlighter pens than did participants who received a neutral induction. Sadness also decreased willingness to accept (selling price), such that the endowment effect was reversed (i.e., buying prices were significantly higher than selling prices). Further, in two studies among undergraduate students, each using a different mood induction technique (i.e., retrospective recall of pleasant and unpleasant emotional experiences and audiovisual mood induction), Lin and colleagues (Lin, Chuang, Kao, & Kung, 2006) found that negative affect eliminated the endowment effect for a mug that was present under conditions of positive affect. In contrast, Zhang and Fishbach (2005) found that, among a sample of undergraduate students, buyers of a Uniball pen who received a negative affect induction offered less than buyers who received neutral and positive affect inductions. They also found that negative affect decreased selling prices relative to neutral and positive affect. Selling prices were significantly higher than buying prices under conditions of negative and neutral affect induction, whereas, there was no significant difference between selling and buying prices under conditions of positive affect induction. Negative affect induction, therefore, increased the endowment effect, whereas, positive affect eliminated it.

These results suggest, therefore, that affect moderates the endowment effect, although the direction of the effect remains to be clarified. Because
hoarding is known to be accompanied by significant levels of negative affect, moderation of the endowment effect by affect could mask an effect of hoarding.

1.5 Summary and Hypotheses

To reiterate, hoarding is a complex psychological disorder that has only recently been recognized as a distinct form of psychopathology. As such, theoretical models, empirical investigation, and treatment protocols are still in early stages of development, leaving the door open for novel approaches. Abnormal valuing of items is evident in many aspects of compulsive hoarding but has not yet received systematic empirical investigation. The theory of value from economics provides a coherent theoretical framework for such an endeavour.

First, the two main tenets of the theory of value suggest that excessive accumulation of items occurs when an individual overvalues items relative to other goods (e.g., space, time, money). The first hypothesis of the current research is, therefore, that hoarders value items more highly than do non-hoarders, and that higher levels of hoarding symptoms and hoarding cognitions are associated with higher values placed on items.

Second, the concept of diminishing marginal value explains why individuals stop acquiring or begin discarding items (i.e., the cost of acquiring or keeping one more unit exceeds its marginal value). The second hypothesis of the current research is that hoarding is associated with reduced diminishing marginal value. This would help to explain why hoarders acquire and keep multiples of the same item and why they often acquire and keep items that others consider to be of little or no value.
Finally, the third hypothesis of the current research is that hoarding is associated with an enhanced endowment effect. The endowment effect refers to the common phenomenon of individuals valuing their own possessions more than they value the possessions of others, even when they are exactly the same items. An enhanced endowment effect in hoarding would help to explain the extreme difficulty that hoarders experience in parting with their possessions.

In addition, the potential confounding effects of demographic and clinical variables, as well as possible moderation of the endowment effect by mood, are evaluated and taken into account when relevant in relation to each of these hypotheses.

The next chapter of this thesis presents the methods used to examine these hypotheses.
Chapter 2: Method

2.1 Design Overview

The current research was a laboratory-based study. Participants were recruited from the community and attended one session at the Centre for Collaborative Research on Hoarding at UBC. Participants completed a clinical interview, computer-based paper and pencil questionnaires, and three behavioural valuing tasks.

Participants were recruited into hoarding, subclinical, and healthy control groups, and they were assessed with a clinical interview. In addition to between-groups comparisons, regression analyses were used to examine the extent to which hoarding symptoms and hoarding cognitions predicted performance on the three valuing tasks. Further details of the between-groups and regression analyses are provided below in the relevant sections.

2.2 Procedure

2.2.1 Recruitment. Flyers and posters were distributed to community locations (i.e., libraries, community centres) and advertisements were placed in a community newspaper. Participants were also drawn from an established research registry held by the Centre for Collaborative Research on Hoarding. Individuals were invited to phone or email the Centre for Collaborative Research on Hoarding. When interested individuals contacted the lab, a research assistant provided a brief description of the study and asked whether the caller was still interested in participating after having learned more about it. For individuals who
were still interested in participating, a preliminary phone screen was conducted immediately or scheduled for another time that was more convenient for the potential participant.

2.2.2 **Phone screen.** The preliminary phone screen was conducted to ensure that interested individuals met inclusion and exclusion criteria, and to provide a preliminary determination of group membership. Potential participants who met the inclusion and exclusion criteria were scheduled to participate in the study.

2.2.3 **Laboratory session.** The laboratory session took place in a standard clinical psychology research room. There were few items in the room, and doors, windows, and blinds were shut to minimize distractions and noise.

Upon arriving at the lab, participants received verbal and written information about the study and were encouraged to ask any questions they might have. They then signed a consent form if they were in agreement to participate.

Following informed consent, a clinical psychology graduate student conducted a clinical interview and administered a pictorial clutter rating scale to assess severity of hoarding features. Next, participants completed a series of computer-based questionnaires. These were two hoarding-related self-report questionnaires, three additional self-report questionnaires (one for symptoms of anxiety and depression, one measuring intolerance of uncertainty, and another for rating positive and negative affect), and a demographics questionnaire. Participants then completed the three behavioural valuing tasks in the following
order: Item Valuation Task (IVT), Diminishing Marginal Value Task (DMVT), and Endowment Effect Task (EET). Immediately prior to completing the EET (after the task had been explained to the participant and after the participant had completed the practice trials, but before the real EET trials), participants returned to the computer to complete a brief rating of their current emotional state.

Participants received compensation for their participation and a full debriefing before leaving the lab.

2.2.4 Study personnel. Clinical psychology graduate students and undergraduate research assistants implemented the study procedures. A clinical psychology graduate student always conducted the clinical interview because it requires advanced clinical skills and training in psychopathology and diagnosis. Undergraduate research assistants were trained and supervised by clinical psychology graduate students to administer all other study procedures. This graduate student’s research supervisor, who is a faculty member in the Department of Psychology at UBC and a registered psychologist, provided overarching supervision.

2.3 Measures and Tasks

2.3.1 Measures. A brief description and some psychometric information about each measure used in the current research are provided below.

2.3.1.1 Hoarding Rating Scale-Interview (HRS-I; Tolin, Frost & Steketee, 2010). The HRS-I is a 5-item semi-structured interview that assesses the key features of compulsive hoarding. The first three items measure clutter, difficulty discarding, and excessive acquisition, and the last two items address
distress and interference associated with hoarding behaviour. Each item is scored on a scale from 0 (not at all) to 8 (extreme) such that total scores range from 0 to 40 with higher scores representing more severe hoarding symptoms. The HRS-I is commonly used in current research to assess the severity of hoarding (e.g., Frost, Steketee, & Tolin, 2011; Grisham et al., 2010; Tolin, Villavicencio, Umbach, & Kurtz, 2011).

The HRS-I has excellent internal consistency when administered in the lab ($\alpha = .97$ and inter-item correlations ranging from $r = .77$ to .91) and in the home ($\alpha = .96$ and inter-item correlations ranging from $r = .76$ to .96). Test-retest (1-12 weeks) and cross-context (clinic vs. home administration) reliability is also high with correlations ranging from $r = .85$ to $r = .94$ for corresponding items and a correlation of $r = .96$ for the total score (Tolin, Frost & Steketee, 2010).

The HRS-I also has good construct, convergent, and discriminant validity. In one study, hoarding participants scored significantly higher on all items and on the total score than did OCD or control participants, who did not differ from each other. Further, a receiver operating characteristic analysis suggested good discrimination between hoarding and OCD participants (Tolin, Frost, & Steketee, 2010). Scores on each HRS-I item, as well as the total score, correlate significantly and positively with scores on each of the Clutter Image Rating Scale (CIR), Savings Inventory-Revised (SI-R), and the Obsessive-Compulsive Inventory-Revised (OCI-R) hoarding subscale in both clinical and home settings (Tolin, Frost, & Steketee, 2010).
In terms of discriminant validity, stronger correlations were found between convergent subscales ($r = .25$ to $.70$) than between divergent subscales ($r = 0.02$ to $0.20$) on the HRS-I and the SI-R. An exception to this trend is that the HRS-I difficulty discarding item was significantly correlated with the SI-R clutter severity subscale ($r = .31$ in the clinic and $r = .35$ in the home). The HRS-I did not show significant correlations with most subscales on the OCI-R as assessed in the clinic and at home ($r \leq .08$ for checking, $r \leq .15$ for neutralizing, $r \leq .05$ for obsessions, and $r \leq -.13$ for washing). HRS-I scores did correlate significantly with the OCI-R ordering subscale in the clinic and at home ($0.34 \leq r \leq .40$), but the strengths of those correlations were modest and substantially lower than the correlations between the HRS-I and other measures of hoarding in the clinic and at home ($r \geq .72$ with the CIR total score, $r \geq .91$ with the SI-R total score, and $r \geq .80$ with OCI-R hoarding). The HRS-I items and total score correlated significantly with depression and anxiety as measured by the Beck Depression Inventory-II (BDI) and the Beck Anxiety Inventory (BAI) in the clinic and at home ($r \geq .60$ and $r \geq .33$, respectively), although those correlations were also substantially lower than those with other hoarding measures (see above; Tolin, Frost, & Steketee, 2010).

2.3.1.2 Clutter Image Rating Scale (CIR; Frost, Steketee, Tolin, & Renaud, 2008). The CIR is a novel assessment tool designed to provide a more objective measure of clutter than can be obtained by descriptive reports. It does so by asking participants to rate the level of clutter in the rooms of their home in comparison to a series of standardized photos of a bedroom, a living room, and a
kitchen. There are nine photos in each series, ranging from a room with no clutter to a room filled nearly to the ceiling with various items that would typically be found in a hoarded home (e.g., papers, clothes, food containers). A scaling technique was used in the development of the CIR so that the nine photos of each room are equally distant from each other in terms of the amount of clutter depicted. Participants are asked to select the picture that best represents the amount of clutter in each of the depicted three rooms of their homes. Clutter is considered to be clinically significant if a rating of 4 or more is provided for any room (Steketee & Frost, 2007) and a composite score is calculated by taking the mean rating across the three rooms.

Internal consistency of the CIR is good with intercorrelations among the three rooms ranging from \( r = .41 \) (bedroom/kitchen) to \( r = .72 \) (living room/kitchen; Frost et al., 2008).

Frost and colleagues (2008) established test-retest reliability for this measure by having participants provide CIR ratings, first in the clinic, then at home. Correlations ranged from \( r = .62 \) to \( r = .81 \) for corresponding rooms, with an average of \( r = .73 \). The clinic/home correlation for the composite score was \( r = .82 \). Inter-rater reliability was established using correlations between participants’ ratings in the clinic and clinicians’ ratings in the home. These correlations ranged from \( r = .69 \) to \( r = .81 \) for corresponding rooms, with an average of \( r = .75 \). The participant/experimenter correlation for the composite score was \( r = .78 \) (Frost et al., 2008).
The CIR also demonstrates strong convergent and discriminant validity. Frost and colleagues (2008) found that the CIR composite score was highly correlated with scores on both the SI-R clutter subscale \((r = .72)\) and the HRS (questionnaire format of the HRS-I) clutter ratings \((r = .82)\), and was more weakly correlated with other subscales on these measures \((r = .37 \text{ to } .56)\). Some data also suggest that the CIR may be less susceptible to report bias than are self-report questionnaires (Frost et al., 2008) and that it is sensitive to treatment effects (Tolin et al., 2007).

**2.3.1.3 Saving Inventory-Revised (SI-R; Frost, Steketee, & Grisham, 2004).** The SI-R is a 23-item self-report questionnaire with subscales measuring the severity of each of the three main components of compulsive hoarding: difficulty discarding, clutter and excessive acquisition, as well as the distress and impairment associated with each component. Each item is rated on a 5-point scale from 0 to 4, with 0 representing the low end of severity and 4 representing the high end. The total SI-R score reflects overall hoarding severity and scores on each of the subscales reflect the severity of each of the components.

Frost and colleagues (2004) found that the SI-R demonstrated good test-retest reliability \((r = .86)\) in a small sample of participants. The measure also demonstrated good internal consistency for the overall measure \((\alpha = .92)\), as well as for each of the subscales \((\alpha > .87)\). Frost and colleagues also established convergent validity with respect to hoarding related beliefs and attitudes, and Frost and colleagues (2008) found good convergent validity with respect to functional impairment resulting from clutter, as well as self- and observer-rated
clutter in the home. Discriminant validity has been established in relation to positive and negative affect, as well as with respect to the severity of OCD symptoms (Frost et al., 2004). Finally, there was a large and statistically significant difference between the total SI-R score obtained by individuals diagnosed with OCD who reported hoarding symptoms (M = 53.7, SD = 14.9) and those who did not (M = 24.0, SD = 12.0; Frost et al., 2004).

2.3.1.4 Saving Cognitions Inventory-Revised (SCI-R; Steketee et al., 2003). The SCI-R is a 24-item self-report questionnaire designed to assess thoughts and beliefs associated with saving behaviour. The SCI-R has four subscales: emotional attachment to possessions, concerns about memory, need for control over possessions, and responsibility towards possessions. Participants rate the extent to which each thought or belief influences their decision about whether to discard a possession on a 7-point Likert scale, ranging from 1 (“not at all”) to 7 (“very much”).

The SCI-R demonstrates good to excellent internal consistency for each of the four subscales (α = .86 to α = .95) and for the total score (α = .96). The SCI-R total demonstrates good convergent validity with the Savings Inventory, a precursor to the SI-R, (r = .80) and each of the subscales demonstrates adequate convergent validity with subscales of the same measure (r = .60 to r = .75). In contrast, the SCI-R demonstrated lower correlations with measures of anxious and depressive symptoms (BAI and BDI; r = .39 to r = .55), suggesting good discriminant validity. Finally, individuals with compulsive hoarding scored significantly higher on the SCI-R total, as well as on each of the subscales, than
did individuals with non-hoarding OCD and community controls (Steketee et al., 2003).

2.3.1.5 Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS is a 20-item self-report measure of positive and negative affect. Participants rate the extent to which they have experienced each of 20 mood states during a specified time period. For the purposes of the current research, the time period, “right now, at the present moment” was used. Each mood state is rated on a 5-point scale, ranging from 1 (“very slightly or not at all”) to 5 (“extremely”). The PANAS was used in the current research to assess current mood state and was administered immediately prior to the EET.

During development of the PANAS, selection of the 20 mood state descriptors was based on factor and reliability analyses, which supported two subscales: positive affect and negative affect. The PANAS subscales demonstrate good internal consistency (α = .88 for positive affect and α = .87 for negative affect). Test-retest reliability over an 8-week time period was r ≥ .68 for each subscale. The PANAS subscales also demonstrated good convergent and discriminant validity in relation to measures of general distress and dysfunction, depressive symptomatology, and state anxiety (Watson et al., 1988).

2.3.1.6 Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995). The DASS is a 42-item, self-report questionnaire comprised of three separate 14-item scales designed to measure the three related negative emotional states of depression, anxiety, and stress. Participants indicate the
extent to which each item has applied to them during the past week. Responses are given on a 4-point Likert-type scale ranging from 0 (“Did not apply to me at all”) to 3 (“Applied to me very much, or most of the time”). The depression and anxiety scales of the DASS were used in the current research to control for symptoms of depression and anxiety in various analyses.

Factor analyses of the DASS in both clinical and non-clinical samples have repeatedly produced a three-factor structure that corresponds to the constructs of depression, anxiety, and stress (Clara, Cox, & Enns, 2001; Crawford & Henry, 2003; Lovibond & Lovibond, 1995). High internal consistencies have been reported for each of the depression (α = .96), anxiety (α = .89), and stress (α = .93) scales that make up the DASS (e.g., Brown, Chorpita, Korotitsch, & Barlow, 1997). The DASS scales have also demonstrated good reliability over a two-week period in a small clinical sample (r = .71, r = .79, and r = .81 for the depression, anxiety, and stress scales, respectively; Brown et al., 1997). Further, there is evidence of convergent and discriminant validity: scores on the DASS depression scale correlate strongly with scores on the BDI (r = .74) and scores on the DASS anxiety scale correlate strongly with scores on the BAI (r = .81). Lower correlations were found between the DASS depression subscale and the BAI (r = .54), and between the DASS anxiety subscale and the BDI (r = .58; Lovibond & Lovibond, 1995).

**2.3.1.7 Intolerance of Uncertainty Scale-Short Form (IUS-S; Carleton, Norton, & Asmundson, 2007).** The IUS-S is a 12-item self-report questionnaire that measures emotional, cognitive and behavioural reactions to ambiguous
situations, implications of being uncertain, and attempts to control the future. It is
the short form of the 27-item Intolerance of Uncertainty Scale (Fressont,
Rhéaume, Letarte, Dugas, & Ladouceur, 1994). The IUS-S has two subscales:
the 7-item prospective anxiety subscale, which measures fear and anxiety about
future events, and the 5-item inhibitory anxiety subscale, which captures
uncertainty that inhibits action or experience. Each item is rated on a 5-point
Likert scale, ranging from 1 (“not at all characteristic of me”) to 5 (“entirely
characteristic of me”).

The IUS-S demonstrates excellent internal consistency for the total scale
(α = .91) and good internal consistency for each of the subscales (αs = .85).
Convergent and discriminant validity have been demonstrated in relation to the
BDI, the BAI, the Generalized Anxiety Disorder Questionnaire-IV, and the Penn
State Worry Questionnaire. Pearson correlations (rs) ranged from .54 to .61,
which are in the range that would be expected for scales measuring related but
not identical constructs (Carleton et al., 2007).

2.3.1.8 Demographics questionnaire. The demographics questionnaire
is a brief, self-report instrument designed for this study (see Appendix A). It was
used to assess gender, age, level of education, and individual income. Income
brackets were chosen so that incomes would be normally distributed if
participants in this study were a representative sample of the population of British
Columbia (Statistics Canada, 2013).

2.3.2 Valuing tasks. This section starts with a presentation of the
procedure that was used across the three valuing tasks to elicit true values from
participants (i.e., the Becker DeGroot Marschak (BDM) mechanism; Becker, DeGroot, & Marschak, 1964). Then, each of the three valuing tasks is described.

Each valuing task involved trades of money and items between the participant and the experimenter. Participants’ prices were compared to the experimenter’s prices and items were bought and sold according to commonly understood rules of trade (further details of these are given for each task in the relevant sections below). The result of each trade was called the “outcome”. Outcomes were recorded and used to implement the BDM mechanism.

2.3.2.1 The Becker-DeGroot-Marschak (BDM) mechanism (Becker et al., 1964). An important feature of tasks in behavioural economics research is the method used to elicit “true” perceived values from participants. The concern is that the process of valuing items may be costly to participants, perhaps because of cognitive processing effort, and that, as a result, participants may randomly guess the value of items rather than reporting their “true” value to them. Under ideal conditions, participants receive incentives such that they are motivated to truthfully reveal the price at which they value an item rather than reporting some other price. The BDM mechanism is an established method that provides an incentive to participants to value objects truthfully (Friedman & Sunder, 1994; Guala, 2005). It was originally used to elicit values for lotteries (Becker et al., 1964) but has since been applied to concrete objects (e.g., plants; Boyce, Brown, McClelland, Peterson, & Schulze, 1992).

There are two essential components to this mechanism: (a) random drawing of experimenter prices against which participant prices are compared
and on the basis of which trades are enacted and (b) belief by participants that some unidentified trades will subsequently be enacted via a random lottery procedure. So, under the BDM mechanism, participants are asked to report either a minimum selling price or a maximum buying price, depending on the research question. The experimenter subsequently draws a price from a random probability distribution. For a reported minimum selling price, if the randomly drawn price is equal to or greater than the participant's minimum selling price, the item is exchanged for the drawn price. For a reported maximum buying price, if the randomly drawn price is equal to or less than the participant's maximum buying price, the item is exchanged for the drawn price. For example, if a participant indicates that his minimum selling price for a mug is $10 and the experimenter randomly generates and offer price of $10.50, the participant gives the mug to the experimenter and the experimenter gives $10.50 to the participant. If the randomly generated offer price is $9.50, the participant keeps the mug and receives no money from the experimenter. In a buying condition, if the participant indicates that the maximum amount she is willing pay to buy the mug from the experimenter is $10 and the experimenter randomly draws an asking price of $10.50, the experimenter keeps the mug and no money is exchanged. If the experimenter randomly draws an asking price of $9.50, the participant pays the experimenter $9.50 and the experimenter gives her the mug.

This mechanism is considered incentive-compatible because the participant has no incentive to report a lower (higher) price than she is willing accept (offer) to sell (buy) the item (Davis & Holt, 1993). For example, consider
an individual who truthfully values a mug in her possession at $10. If she reports valuing the mug at, say $8, there is some chance, because of the random draw, that she will be required to sell the mug for less than she feels it is worth, which she will not wish to do. Conversely suppose that she reports valuing the mug at $12 even though her true value is $10. There is now some chance that the randomly drawn price will be above $10 but below $12. In this case, she will not be able to sell the mug (at this very attractive price) even though she would wish to do so. The BDM is similarly incentive compatible when a participant is acting as a buyer. Thus, the BDM mechanism is designed to provide participants with an incentive to report their true valuation of an item.

The BDM mechanism also requires that participants believe that there is some probability that their choices will lead to actual trades. It does not require that all choices lead to trades. This aspect of the BDM has been implemented using a random lottery procedure. With this procedure, only a certain proportion of randomly determined trades are enacted (e.g., Grether & Plott, 1979). The essential features of this component of the BDM mechanism are that participants believe at least some of their valuing decisions will result in real outcomes and that they are unaware of which trades these are. Again, the purpose of the BDM is to elicit “true” perceived values from participants rather than random guesses.

In the current research, the BDM mechanism was implemented using the following procedures. Experimenter prices for each item were randomly generated prior to commencement of the study. These randomly generated prices ranged from $0 to 200% of the amount paid to purchase the item (i.e.,
twice the retail price). For low value used items that were not purchased, the randomly generated prices ranged from $0 to $2. Participants were told that experimenter prices were randomly generated and thus did not reflect how much an item was worth or how much the experimenter thought it was worth. Prior to completing the valuing tasks, the experimenter demonstrated to participants that giving a higher or a lower price than an item was truly worth to them could result in disadvantageous outcomes.

A random lottery procedure was implemented by telling participants that, after they had completed all three tasks, they would win the outcomes of an unknown subset of the trials that they had completed during the study. At the end of the study, participants rolled a set of dice. The number rolled was matched to a set of predetermined trials. The experimenter looked up the outcome of each of the trials in the set that had been won and participants were compensated for participating in the study with those outcomes. The lottery procedure was explained to participants before they completed the valuing tasks and was repeated intermittently throughout the tasks so that participants remained aware that the outcome of any trade could be one that would become real to them in the sense of taking it home at the end of the study.

2.3.1.2 Item Valuation Task (IVT). Participants were given and allowed to examine 36 everyday household items. Items for this task were chosen on the basis of belonging to one of 9 categories of typically hoarded items (i.e., toiletries, clothing, reading material, office supplies, food, sentimental items, tools/hardware, containers, and items that typically come in multiples). The
purpose of this selection was to provide a range of items that are potentially overvalued by individuals with hoarding tendencies. Also, within each category, items represented a range of purchase costs from no cost to moderate cost. The purpose of this selection was to provide a distribution of retail values and to provide items that would be found in many homes regardless of socioeconomic standing (see Appendix B for a list of the items that were used for this task).

The experimenter handed individual items to participants and stated that the default outcome of each trial was that the participant would keep the item unless she or he sold it back to the experimenter. Participants were asked to indicate the minimum price at which they would be willing to sell each item to the experimenter, ranging from $0 up to as high a price as the participant thought an item was worth. The minimum selling price is an operationalization of each item’s value to the participant. For each trial, participants stated their minimum selling prices and the experimenter recorded them. The experimenter then compared the participant’s selling price to the randomly generated offer price that was displayed for the experimenter. If the experimenter’s offer price was equal to or greater than the participant’s selling price, the experimenter recorded that the participant had sold the item back to experimenter and would receive cash in the amount of the experimenter’s offer price if the trial was included in the lottery set at the end of the study. If the experimenter’s offer price was lower than the participant’s selling price, the experimenter recorded that the participant would keep the item.

The procedural steps for administering this task were as follows: First, the
experimenter explained the task to the participant and answered any questions. If asked, the experimenter answered questions concerning attributes of the items (e.g., “What is this?”, “What is this made of?”). The experimenter did not, however, answer questions related to the item’s cost or value.

Once all procedural questions were answered, the participant engaged in two practice trials in order to ensure that the task and its rules had been understood. The experimenter then answered any further questions and reminded participants that they would keep the outcomes (i.e., item or money) of some randomly determined trials from this task.

Participants were then presented with the 36 items, one-by-one, and asked to state their minimum price to sell that item back to the experimenter. A single randomly determined item order was used for every participant so that any order effects would be the same for each participant, regardless of group. After each trial, the outcome was recorded and the item was removed from view so the participant could focus on the next item.

**2.3.1.3 Diminishing Marginal Value Task (DMVT).** The DMVT was used to measure how an individual’s perceived value of an item (operationalized as minimum selling price) changes as a function of that individual’s endowment of the item (i.e., how many of the item the individual possesses). Diminishing marginal utility implies that the minimum selling price should decrease as endowment increases.

The DMVT required participants to provide a minimum selling price for one unit of each of six items at three different endowment levels (5 units, 2-4 units,
and 1 unit). Each participant, therefore, provided 18 ratings. Two types of items were used for this task: items for which diminishing marginal value has been previously demonstrated (i.e., a mug and a flashlight) and items that are representative of types of items that are typically hoarded (i.e., a bar of soap, a permanent marker, a key chain, and a pair of socks). The particular endowment levels (i.e., 5, 2-4, and 1 unit(s)) were chosen because previous research has shown that participants exhibit diminishing marginal value at these endowment levels (Horowitz et al., 2007). As with the IVT, trials were presented in a single randomly determined order for all participants so that any possible effect of order was the same for all participants.

Procedural steps for this task were as follows. First, participants were endowed with 5, 2-4, or 1 unit(s) of an item (endowment levels varied across trials). They were then asked to indicate their minimum selling price for one unit of the item. The experimenter compared the participant’s asking price to the experimenter’s randomly generated offer price. If the experimenter’s buying price was equal to or greater than the participant’s stated selling price, the experimenter recorded the outcome that the participant sold one unit of the item to the experimenter and received the experimenter’s offer price in cash. The participant also kept any remaining units of the item after having sold one to the experimenter. If the randomly generated buying price was less than the participant’s stated selling price, the recorded outcome was that the participant kept all units of the item and received no money. As results of the trade were recorded, participants were reminded that some trades would be enacted once
the procedure was completed. Emphasis was placed on the fact that participants did not know which outcomes they would “win” and that they should, therefore, think of each trial as a “fresh start” regardless of the results of the previous trade.

2.3.1.4 Endowment Effect Task (EET). The current research used a within-subjects, goods-money task to test the endowment effect. Goods-money endowment effect tasks involve comparisons between prices asked by participants to sell items and prices offered by participants to buy the same items. A within-subjects procedure requires that each participant act as both the buyer and the seller of each item. The task described below is an adaptation of a within-subjects goods-money trade task developed by Kachelmeier and Shehata (1992).

As sellers, participants were given an item and told that it was theirs to keep unless they sold it back to the experimenter. Participants were then asked to tell the experimenter their minimum selling price for the item. The experimenter recorded the amount and compared it to their randomly generated offer price. If the offer price was equal to or exceeded the participant’s selling price, the outcome of the trial was that the experimenter paid the offer price to the participant and took the item. Otherwise, the outcome was that the participant kept the item.

As buyers, participants were shown items and allowed to inspect them. Participants were given either $5 or $10, depending on the market value of the item. Participants were then asked to indicate the maximum amount that they would be willing to pay (i.e., their best offer) to buy the item from the
The experimenter recorded the amount and compared it to the randomly generated selling price. The ranges from which selling prices were randomly generated were the same as those from which buying prices were generated for the IVT and the DMVT. If the participant’s buying price equalled or exceeded the experimenter’s selling price, the participant paid the selling price to the experimenter, got the item, and kept any remaining money. Otherwise, the experimenter kept the item and no money was exchanged.

Procedural steps for the EET were as follows: First, the experimenter explained the participant’s role in the task and answered any questions. Then, two practice trials were conducted, one with the participant acting as the seller and one with the participant acting as the buyer. Any further questions were answered to ensure that the participant fully understood the task and its rules.

The participant then engaged in repeated trials of the task until he or she had acted as both the buyer and the seller for each item. As with the IVT and the DMVT, a single item order was randomly generated prior to the start of the study and the same order was used for all participants.

Two categories of items were used for this task: items for which an endowment effect has been found in the economics literature (i.e., mug, mechanical pencil, gourmet chocolate bar) and items that are representative of typically hoarded items and that may represent the type of item that an individual could acquire by accident (i.e., bar of soap, free community newspaper, package of soy sauce).
Two items appeared in all three behavioural tasks (a mug and a bar of soap) to enable estimates of measurement error across the three tasks.

2.4 Participants

Participants were eligible for the study if they were 19 to 65 years old and fluent in English. They were excluded if they reported an organic brain problem related to clutter or difficulty discarding or psychosis.

The phone screen was used to screen participants into the study and to make a preliminary determination of group. Age and English fluency were assessed and participants were asked about the extent to which they had clutter and difficulty discarding. In order to be screened into the study, individuals had to report either 1) problems with clutter or difficulty discarding or 2) no problems with clutter or difficulty discarding as well as no current use of medications or recent consultation of a health professional for mental health issues.

One hundred and thirty-two people were screened in and completed the study. Data from two participants were excluded because they subsequently reported organic brain problems that were possibly relevant to their hoarding behaviour. Data from one other participant were excluded because she subsequently reported a diagnosis of schizophrenia and demonstrated a poor ability to understand the valuing tasks. She also reported that she was not giving true values for the items because she was in financial need and a previous participant had told her how to do the tasks in order to get cash outcomes. Data from a fourth participant were excluded because, although she was placed in the healthy control group based on information obtained in the phone screen and
during the clinical interview, she obtained a score in the extremely severe range on the DASS depression subscale. All other participants included in the healthy control group had moderate or lower DASS depression scores. There were, therefore, 128 participants included in the final sample.

Of these 128 participants, 43 were in the hoarding group, 37 were in the healthy control group, and 45 were in the subclinical hoarding group. Three participants were not assigned to a diagnostic group (details below). The cut-off for inclusion in the hoarding group was a score of 4 (moderate) or greater on the two items of the HRS-I that reflect the key diagnostic features of hoarding disorder (i.e., clutter and difficulty discarding) and on at least one of the HRS-I distress or impairment items. Participants who obtained scores of 2 or 3 on the two HRS-I key items were included in the subclinical hoarding group. Inclusion criteria for the healthy control group required scores of 0 (absent) or 1 (minimal) on the same items.

Data from three participants were not included in between-groups analyses because their responses on the HRS-I did not meet the inclusion criteria for one group or another (e.g., participant reported moderate levels of clutter and no difficulty discarding). Data from these participants were, however, retained for use in regression analyses.

Scores on the HRS-I ranged from 13 to 38 in the hoarding group, from 6 to 19 in the subclinical group, and from 0 to 9 in the healthy control group. Although there was very little overlap between the healthy control and subclinical group
total HRS-I scores, as expected there was some overlap between the subclinical and the hoarding group scores.

Means and standard deviations for each group on the HRS-I total score and each of its items are presented in Table 1. The hoarding group is comparable to the Tolin, Frost, & Steketee (2010) sample, which had a mean HRS-I total score of 24.2 (SD = 5.7) and very comparable mean scores on each of the HRS-I items. The hoarding samples reported in Steketee et al. (2010) had HRS-I total scores that were somewhat higher than the present sample, with means of 29.5 (SD = 5.5) and 29.9 (SD = 4.5).

Table 1

*HRS-I Scores, M (SD), by Group*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Full Sample N = 128</th>
<th>Healthy Control N = 36</th>
<th>Subclinical N = 46</th>
<th>Hoarding N = 43</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRS-I, total</td>
<td>12.56 (8.74)</td>
<td>2.03 (1.93)</td>
<td>11.96 (3.22)</td>
<td>22.14 (5.13)</td>
</tr>
<tr>
<td>Clutter</td>
<td>2.88 (1.97)</td>
<td>0.47 (0.51)</td>
<td>2.72 (0.58)</td>
<td>5.02 (1.10)</td>
</tr>
<tr>
<td>Diff. Disc.</td>
<td>2.96 (2.08)</td>
<td>0.53 (0.51)</td>
<td>2.85 (0.79)</td>
<td>5.26 (1.12)</td>
</tr>
<tr>
<td>Acquiring</td>
<td>1.77 (1.79)</td>
<td>0.25 (0.60)</td>
<td>1.65 (1.20)</td>
<td>3.26 (1.87)</td>
</tr>
<tr>
<td>Distress</td>
<td>2.58 (2.03)</td>
<td>0.61 (0.99)</td>
<td>2.59 (1.34)</td>
<td>4.14 (1.89)</td>
</tr>
<tr>
<td>Impairment</td>
<td>2.38 (1.95)</td>
<td>0.17 (0.45)</td>
<td>2.15 (1.10)</td>
<td>4.47 (1.10)</td>
</tr>
</tbody>
</table>

*Note.* 1^ Full sample Ns ranged from 127 to 128. HRS-I = Hoarding Rating Scale-Interview, Diff. Disc. = Difficulty Discarding.

2.5 Data analysis overview

2.5.1 Missing data and data entry errors. The data were first examined for missing values and possible data entry errors. Due to experimenter error, five of the computer-based measures (CIR, SI-R, PANAS, DASS, demographics questionnaire) were each not administered to between one and three
participants. No single participant failed to complete more than one measure. Because this was a very small amount of missing data (< 2%), analyses involving these measures were performed without the missing data (i.e., the participant with the missing data was excluded). In addition, one participant failed to complete the demographics questionnaire. This participant’s age and gender were obtained from the phone screen information, but education and income were left missing for this participant. Two additional participants were unaware of their parents’ levels of education so this data was also left missing.

On the IVT, due to experimenter error, two participants were unable to provide data for one item each. This occurred because the items were unavailable when these individuals participated in the study. Because each data point represented a very small amount of the data provided by the participant and because they were missing completely at random, these two missing data points were replaced with the sample means for the relevant items. This approach also had the benefit of not reducing the sample size for the main analyses.

Data entry errors were not an issue for any of the questionnaires used in the study because they were computer administered. Data entry errors were, however, a possibility for the valuing tasks because participant responses were manually entered into a computer by the experimenter in real time. The most likely data entry error in this situation was that the decimal point was omitted (e.g., $1.00 entered as 100). Data points were, therefore, considered errors when they were at least 100 times higher than the mean of all other data points for the same item. Two clear data entry errors were detected. For one participant, $200
was entered as the value given for a used birthday card ($M = 0.38, SD = 0.97$) and for a different participant, $50$ was entered as the value given for a used first place ribbon ($M = 0.45, SD = 0.90$). Given that the most likely data entry error was a missing decimal point, these values were corrected to $2.00$ and $0.50$, respectively.

2.5.2 Outliers and skewed distributions. Data distributions were examined for outliers and excessive skewness. Data points were considered to be outliers if they were more than 2.2 times the interquartile range above or below the mean (Hoaglin & Iglewicz, 1987). Where outliers were present, the data were Winsorized. When skewness of a distribution was greater than 1, the data were log transformed.

Analyses were performed with raw data and repeated with transformed distributions to ensure that outliers or a skewed distribution did not affect results. Results from analyses using raw data are reported unless otherwise noted.

2.5.3 Checking assumptions. The primary analyses in this research used generalized linear modelling (GLM). Scatter plots and statistical tests were used to examine conformity with the assumptions of GLM. Bivariate scatter plots appeared linear and, for the most part, homogeneity of variance was not violated. In some ANOVAs, Levene’s test indicated heterogeneity of variance. In these cases, because ANOVA is robust to violations of homogeneity of variance when group sizes are equal (Glass, Peckham, & Saunders, 1972), three additional data sets with randomly selected equal group sizes were created. The analysis was
repeated on each data set and results of these analyses are reported if they differ from results obtained from the original data set.

2.5.4 Main analyses. The data were examined using both ANOVA and regression models. ANOVA was used to examine whether there were differences among the groups in performance on the three valuing tasks, and regression was used to examine whether hoarding symptoms and cognitions predicted task performance. Various forms of ANOVA model were used based on the structure of the data from each task and are presented in the relevant sections of the next chapter. The general form of the regression equations was:

\[ Y_i = \alpha + \beta_1 \text{HB/HC}_i + e_i \]  

(1)

where \( \alpha \) represented a constant, \( \beta_1 \text{HB/HC}_i \) was each person’s score on the measure of hoarding symptoms or hoarding cognitions, and \( e_i \) was an error term. Separate regressions were performed for hoarding symptoms and hoarding cognitions in order to avoid problems with multicollinearity. These analyses were performed on only the outcome measures for which there were significant bivariate correlations with the predictor variable(s).

The issue of potential confound variables was addressed in the following way. First, demographic and clinical variables were examined for differences among groups, and bivariate correlations between potential confound variables and hoarding symptoms and cognitions were calculated. Significant results from these analyses suggested that a demographic or clinical variable could be confounded with a measure of hoarding. Then, in analyses examining the effects of hoarding on task performance, when there was a significant effect of hoarding,
the analysis was repeated, controlling for the potential confound variable. In ANOVAs this consisted of entering the confound variable(s) as covariate(s). In regression analyses, confound variable(s) were entered at step 1. Note is made in the text of this dissertation where results of analyses controlling for confound variables differ from results of uncontrolled analyses.

2.5.5 Power. An *a priori* power analysis was conducted using G*Power 3.1 to estimate necessary sample sizes. The largest number of participants required for any of the analyses was 102, or 34 participants per group. This result was obtained for the repeated measures ANOVA that was planned for the IVT data, \( f = 0.25, \alpha = 0.05, \text{power} = 0.8, \text{correlation among repeated measures} = 0.5 \). All other *a priori* power analyses yielded smaller sample sizes.
Chapter 3: Results

In this section, I first present the demographic and clinical characteristics of the sample. I then present a series of correlational analyses related to the reliability and validity of the measures used in this research. Finally, I present results pertaining to each of the valuing tasks.

3.1 Sample Characteristics

3.1.1 Demographic characteristics. Approximately 2/3 of participants were women (see Table 2). Gender distributions did not differ significantly among groups, $\chi^2 (2, N = 125) = 2.46, p = .29$, Cramer's $V = 0.14$.

Table 2

Demographic and Socio-Economic Characteristics of the Sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>Full Sample $N = 128^a$</th>
<th>Healthy Control $N = 36$</th>
<th>Subclinical $N = 46$</th>
<th>Hoarding $N = 43$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, $N$ (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>84 (66%)</td>
<td>21 (58%)</td>
<td>29 (63%)</td>
<td>32 (74%)</td>
</tr>
<tr>
<td>Men</td>
<td>44 (34%)</td>
<td>15 (42%)</td>
<td>17 (37%)</td>
<td>11 (26%)</td>
</tr>
<tr>
<td>Age, $M$ ($SD$)</td>
<td>43.81 (14.14)</td>
<td>43.69 (13.82)</td>
<td>40.07 (15.42)</td>
<td>48.40 (12.24)</td>
</tr>
<tr>
<td>Level of education, $N$ (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>28 (22%)</td>
<td>9 (25%)</td>
<td>9 (20%)</td>
<td>10 (24%)</td>
</tr>
<tr>
<td>College</td>
<td>26 (21%)</td>
<td>3 (8%)</td>
<td>9 (20%)</td>
<td>12 (29%)</td>
</tr>
<tr>
<td>Bachelor's</td>
<td>39 (31%)</td>
<td>10 (28%)</td>
<td>15 (33%)</td>
<td>13 (31%)</td>
</tr>
<tr>
<td>Graduate/professional</td>
<td>34 (27%)</td>
<td>14 (39%)</td>
<td>13 (28%)</td>
<td>7 (17%)</td>
</tr>
<tr>
<td>Income bracket, $N$ (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>less than $10,000</td>
<td>24 (19%)</td>
<td>5 (14%)</td>
<td>7 (15%)</td>
<td>11 (26%)</td>
</tr>
<tr>
<td>$10,000 to $19,999</td>
<td>27 (21%)</td>
<td>4 (11%)</td>
<td>10 (22%)</td>
<td>13 (31%)</td>
</tr>
<tr>
<td>$20,000 to $49,000</td>
<td>44 (35%)</td>
<td>14 (39%)</td>
<td>18 (39%)</td>
<td>11 (26%)</td>
</tr>
<tr>
<td>$50,000 to $99,999</td>
<td>24 (19%)</td>
<td>10 (28%)</td>
<td>9 (20%)</td>
<td>5 (12%)</td>
</tr>
<tr>
<td>$100,000 and over</td>
<td>3 (8%)</td>
<td>2 (4%)</td>
<td></td>
<td>2 (5%)</td>
</tr>
</tbody>
</table>
Participants ranged in age from 20 to 65 years old and were, on average, middle-aged (see Table 2). Results of a one-way ANOVA showed a significant difference among the groups for age, $F(2,122) = 3.98$, $p = .02$, $\eta^2_p = .06$, and post hoc comparisons revealed that the hoarding group was significantly older than the subclinical group, $p = .02$. The mean age of the healthy control group fell between those of the hoarding and subclinical groups, but was not significantly different from either of them.

Regarding participant level of education, only two participants (1.6%) reported receiving less than a high school diploma, so the elementary or middle school category was collapsed with the high school or equivalent category to facilitate analyses. Following this transformation, a Kruskal-Wallis test revealed no significant difference among the groups on level of education, $\chi^2 (2, N = 124) = 3.21$, $p = .20$, $\eta^2 = .03$ (see Table 2).

Current individual income bracket ranged from less than $10,000 to over $100,000 per year, with the largest number of participants reporting annual incomes in the $20,000 to $49,999 bracket and few participants reporting incomes of $100,000 and over. A Kruskal-Wallis test indicated income bracket differed significantly among the groups, $\chi^2 (2, N = 124) = 7.48$, $p = .02$, $\eta^2 = .06$, with post hoc comparisons showing that the healthy control group reported earning significantly more than did the hoarding group, $p = .02$. The subclinical group fell between the healthy control and hoarding groups, but was not significantly different from either of them.
3.1.2 Clinical characteristics. In addition to the HRS-I, which was used to set inclusion criteria for diagnostic groups, participants also completed the Clutter Image Rating (CIR) scale, the Saving Inventory-Revised (SI-R), and the Saving Cognitions Inventory-Revised (SCI-R). On the Clutter Image Rating (CIR) scale, composite scores (mean of bedroom, kitchen, and living room ratings) ranged from 1 to 6.67. In terms of CIR scores, the hoarding sample was quite similar to those reported in previous research (Frost et al., 2008; Grisham et al., 2010). As shown in Table 3, a one-way ANOVA followed by post hoc comparisons found that, as expected, the hoarding group had significantly higher scores than the subclinical group, which was significantly higher than the healthy control group on this measure.

On the SI-R, the hoarding group scored significantly higher than the subclinical group, which scored significantly higher than the healthy control group. The hoarding group SI-R scores in this study were very comparable to the Frost et al. (2004) sample, although the Grisham et al. (2010) community-based sample had a slightly higher mean SI-R total score (60.1, $SD = 18.0$).

For the Saving Cognitions Inventory-Revised (SCI-R), one-way ANOVAs revealed significant differences among the groups for total SCI-R as well as for each of the subscales. Post hoc pair-wise comparisons showed that the groups were significantly differentiated on the total score, as well as on all of the subscales except emotional attachment. For the emotional attachment subscale, the hoarding and the subclinical groups both scored higher than the healthy control group but were not significantly different from each other. This sample of
### Table 3

**Means, (Standard Deviations), and One-Way ANOVA Comparisons for Clinical Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Full Sample</th>
<th>Healthy Control</th>
<th>Subclinical</th>
<th>Hoarding</th>
<th>F</th>
<th>η²p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 128</td>
<td>N = 36</td>
<td>N = 46</td>
<td>N = 43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.39 (1.22)</td>
<td>1.32a (0.40)</td>
<td>1.98b (0.52)</td>
<td>3.64c (1.13)</td>
<td>97.83*</td>
<td>.62</td>
</tr>
<tr>
<td>SI-R total</td>
<td>39.04 (17.85)</td>
<td>18.69a (10.35)</td>
<td>41.04b (11.71)</td>
<td>53.98c (10.65)</td>
<td>101.61*</td>
<td>.63</td>
</tr>
<tr>
<td>Clutter</td>
<td>14.34 (8.19)</td>
<td>5.50a (4.49)</td>
<td>14.09b (5.50)</td>
<td>21.79c (4.96)</td>
<td>101.30*</td>
<td>.63</td>
</tr>
<tr>
<td>Difficulty discarding</td>
<td>13.48 (6.14)</td>
<td>6.64a (3.77)</td>
<td>15.24b (4.38)</td>
<td>17.60c (4.30)</td>
<td>72.43*</td>
<td>.55</td>
</tr>
<tr>
<td>Acquisition</td>
<td>11.21 (5.41)</td>
<td>6.56a (3.72)</td>
<td>11.71b (4.63)</td>
<td>14.60c (4.48)</td>
<td>33.93*</td>
<td>.36</td>
</tr>
<tr>
<td>SCI-R total</td>
<td>72.27 (33.03)</td>
<td>51.47a (22.86)</td>
<td>78.91b (29.79)</td>
<td>97.19c (29.49)</td>
<td>26.49*</td>
<td>.30</td>
</tr>
<tr>
<td>Emotional attachment</td>
<td>28.84 (15.54)</td>
<td>17.72a (10.73)</td>
<td>30.37b (13.98)</td>
<td>36.49b (15.51)</td>
<td>18.81*</td>
<td>.24</td>
</tr>
<tr>
<td>Control</td>
<td>13.27 (5.32)</td>
<td>10.28a (4.81)</td>
<td>13.24b (5.35)</td>
<td>15.98c (4.43)</td>
<td>13.30*</td>
<td>.18</td>
</tr>
<tr>
<td>Responsibility</td>
<td>19.45 (8.42)</td>
<td>13.58a (7.19)</td>
<td>19.54b (7.27)</td>
<td>24.26c (7.38)</td>
<td>21.04*</td>
<td>.26</td>
</tr>
<tr>
<td>Memory</td>
<td>15.71 (7.57)</td>
<td>9.89a (4.50)</td>
<td>15.76b (6.92)</td>
<td>20.47c (7.20)</td>
<td>26.53*</td>
<td>.30</td>
</tr>
<tr>
<td>DASS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>9.75 (9.79)</td>
<td>4.22a (5.13)</td>
<td>8.87b (8.78)</td>
<td>14.98c (10.83)</td>
<td>15.11*</td>
<td>.20</td>
</tr>
<tr>
<td>Anxiety</td>
<td>6.65 (7.17)</td>
<td>3.33a (3.99)</td>
<td>6.54b (6.49)</td>
<td>9.02b (8.05)</td>
<td>7.48*</td>
<td>.11</td>
</tr>
<tr>
<td>PANAS, PA</td>
<td>28.89 (7.58)</td>
<td>29.19 (8.27)</td>
<td>28.33 (7.32)</td>
<td>29.50 (7.16)</td>
<td>0.27</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>PANAS, NA&lt;sup&gt;c&lt;/sup&gt;</td>
<td>13.20 (5.01)</td>
<td>12.28 (2.99)</td>
<td>12.50 (2.67)</td>
<td>14.83 (7.55)</td>
<td>2.47</td>
<td>.04</td>
</tr>
<tr>
<td>IUS total</td>
<td>31.55 (10.16)</td>
<td>26.28a (9.70)</td>
<td>31.85b (8.60)</td>
<td>35.14b (9.87)</td>
<td>8.86*</td>
<td>.13</td>
</tr>
<tr>
<td>Prospective anxiety</td>
<td>19.38 (6.17)</td>
<td>16.86a (6.31)</td>
<td>19.89ab (5.40)</td>
<td>20.65b (6.09)</td>
<td>4.42*</td>
<td>.07</td>
</tr>
<tr>
<td>Inhibitory anxiety</td>
<td>12.17 (4.76)</td>
<td>9.42a (3.83)</td>
<td>11.96b (4.21)</td>
<td>14.49c (4.62)</td>
<td>14.40*</td>
<td>.19</td>
</tr>
</tbody>
</table>

*Note.* CIR = Clutter Image Rating Scale, SI-R = Saving Inventory Revised, SCI-R = Saving Cognitions Inventory Revised, DASS = Depression Anxiety Stress Scales, PANAS = Positive and Negative Affect Scale, PA = Positive Affect, NA = Negative Affect, IUS = Intolerance of Uncertainty Scale. Means with different subscripts within rows are significantly different at *p* < .05 based on post hoc pair-wise comparisons. *Means and standard deviations are reported for the full dataset, whereas, *F* and η²p statistics were obtained from transformed (log transformed and Winsorized) data in order to satisfy the homogeneity of variance assumption of ANOVA. * = *p* < .05.
hoarding participants scored somewhat lower than did a previous sample, which obtained a mean total SCI-R score of 104.0 (SD = 26.6; Steketee et al., 2003).

Groups also differed significantly on both DASS depression and anxiety. Post hoc pair-wise comparisons revealed that, for depression, scores in the hoarding group were significantly higher than scores in the subclinical group, which were significantly higher than scores in the healthy control group. On the measure of anxiety, scores in the hoarding group were significantly higher than scores in the healthy control group. Scores for the subclinical group fell between scores for the other two groups. They were significantly higher than scores in the healthy control group but not significantly different from scores in the hoarding group. There were no significant differences among the groups for either state negative or state positive affect.

On the Intolerance of Uncertainty Scale-Short form (IUS-S), one-way ANOVAs indicated that groups differed on each of the IUS-S subscales (see Table 3). Post hoc pair-wise comparisons showed that, for IUS-S total, the hoarding group scored significantly higher than the healthy control group. Scores for the subclinical group fell between those of the healthy control group and the hoarding group and were significantly higher than scores in the healthy control group but not significantly different from scores in the hoarding group. On the prospective anxiety subscale, scores in the hoarding group were significantly higher than scores in the healthy control group. Scores in the subclinical group fell between scores for the other two groups but were not significantly different from either of them. For inhibitory anxiety, scores in the hoarding group were
significantly higher than scores in the subclinical group, which were significantly higher than scores in the healthy control group.

### 3.2 Correlational Analyses

In this section I first present results of bivariate correlations among measures of hoarding symptoms, hoarding cognitions, and potential confound variables. The purpose of these analyses was to determine which demographic and clinical variables were potentially confounded with hoarding and should be controlled for in subsequent regression analyses. These correlations were also used as a preliminary indication of potential problems with multicollinearity in regression analyses. Then, I present results of correlational analyses conducted to examine the psychometric properties of the hoarding measures used in the current research.

#### 3.2.1 Examination of potential confound variables

Bivariate correlations among measures of hoarding symptoms, hoarding cognitions, and potential confound variables are presented in Table 4.

As expected, measures of depression, anxiety, and intolerance of uncertainty showed strong, positive correlations with measures of hoarding symptoms and hoarding cognitions. There was also a weak, negative correlation between income and hoarding symptoms. These results suggest that these variables may be confounded with hoarding. Therefore, in regression analyses, when a significant effect of hoarding was found, the data were re-analysed controlling for these confound variables. Results of these analyses are reported when they differ from results of uncontrolled analyses.
Table 4

Pearson Correlations (r) Between Hoarding Measures and Potential Confound Variables

<table>
<thead>
<tr>
<th></th>
<th>SCI-R</th>
<th>Demographics</th>
<th>DASS</th>
<th>IUS-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SI-R, total</td>
<td>.77*</td>
<td>.14</td>
<td>-.03</td>
<td>-.15</td>
</tr>
<tr>
<td>2. SCI-R, total</td>
<td>.15</td>
<td>.05</td>
<td>-.01</td>
<td>-.10</td>
</tr>
<tr>
<td>3. gender</td>
<td>.08</td>
<td>.13</td>
<td>.10</td>
<td>.03</td>
</tr>
<tr>
<td>4. age</td>
<td>.07</td>
<td>.19*</td>
<td>-.10</td>
<td>-.16</td>
</tr>
<tr>
<td>5. education</td>
<td>.22*</td>
<td>-.14</td>
<td>-.15</td>
<td>-.07</td>
</tr>
<tr>
<td>6. income</td>
<td>-.27*</td>
<td>-.17</td>
<td>-.11</td>
<td></td>
</tr>
<tr>
<td>7. DASS dep.</td>
<td>.69*</td>
<td>.47*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. DASS, anx.</td>
<td>.53*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. SI-R = Saving Inventory Revised, SCI-R = Saving Cognitions Inventory Revised, IUS-S = Intolerance of Uncertainty Scale Short. * = p < .05.

Also, as expected, there were moderate to strong positive correlations among the measures of depression, anxiety, and intolerance of uncertainty. These results suggest a potential problem with multicollinearity in regression analyses. When these variables were included together in regression analyses, further multicollinearity diagnostics were, therefore, performed.

3.2.2 Psychometric properties of hoarding measures. In this section, I examine the reliability and validity of measures of hoarding used in the current research (HRS-I, SI-R, CIR, and SCI-R). The internal consistency of each measure and all subscales was examined using inter-item correlations and Cronbach’s alpha. Convergent validity was examined using bivariate correlations among the measures of hoarding and related subscales. Bivariate correlations between the hoarding measures and measures of depression, anxiety, and intolerance of uncertainty provided the basis for examining discriminant validity.
Differences between correlation coefficients are also examined in relation to convergent and discriminant validity.

**3.2.2.1 Internal consistency.** On the HRS-I, inter-item correlations ranged from .52 (acquiring and distress) to .89 (clutter and difficulty discarding). Cronbach’s alpha for the five-item scale was .93. For the CIR scale, inter-item correlations ranged from .50 (bedroom and kitchen) to .64 (living room and kitchen) and Cronbach’s alpha was .77. These numbers are surprisingly high for measures with few items, and that are composed of items designed to measure separate constructs (e.g., clutter and difficulty discarding on the HRS-I, and clutter in the bedroom and clutter in the living room on the CIR scale).

The SI-R showed generally excellent internal consistency for the total score and subscales. Cronbach’s alpha for the full scale was .96. On the subscales, Cronbach’s alpha was .94 for the clutter subscale, .90 for the difficulty discarding subscale, and .85 for the acquiring subscale.

For the SCI-R, Cronbach’s alpha for the total scale was .96. For the emotional attachment, control, memory, and responsibility subscales Cronbach’s alphas were: .95, .78, .83, and .84, respectively. These results again suggest good to excellent internal consistency.

**3.2.2.2 Convergent and discriminant validity.** Table 5 shows bivariate correlations between all hoarding measures, DASS depression, DASS anxiety, and intolerance of uncertainty (IUS-S). All correlations were significantly different than zero.
### Table 5

**Convergent and Discriminant Validity of Hoarding Measures (Pearson’s r)**

<table>
<thead>
<tr>
<th></th>
<th>HRS-I</th>
<th>SI-R</th>
<th>CIR</th>
<th>SCI-R</th>
<th>DASS</th>
<th>IUS-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoarding Rating Scale-Interview</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Total score</td>
<td>.94</td>
<td>.95</td>
<td>.80</td>
<td>.82</td>
<td>.74</td>
<td>.65</td>
</tr>
<tr>
<td>2. Clutter</td>
<td>.89</td>
<td>.69</td>
<td>.76</td>
<td>.77</td>
<td>.66</td>
<td>.57</td>
</tr>
<tr>
<td>3. Difficulty Discarding</td>
<td>.72</td>
<td>.78</td>
<td>.74</td>
<td>.74</td>
<td>.60</td>
<td>.75</td>
</tr>
<tr>
<td>4. Acquiring</td>
<td>.60</td>
<td>.56</td>
<td>.52</td>
<td>.56</td>
<td>.56</td>
<td>.66</td>
</tr>
<tr>
<td>Saving Inventory-Revised</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Total score</td>
<td>.92</td>
<td>.91</td>
<td>.87</td>
<td>.72</td>
<td>.77</td>
<td>.40</td>
</tr>
<tr>
<td>6. Clutter</td>
<td>.74</td>
<td>.68</td>
<td>.76</td>
<td>.68</td>
<td>.68</td>
<td>.35</td>
</tr>
<tr>
<td>7. Difficulty Discarding</td>
<td>.75</td>
<td>.59</td>
<td>.72</td>
<td>.37</td>
<td>.27</td>
<td>.50</td>
</tr>
<tr>
<td>8. Acquiring</td>
<td>.54</td>
<td>.70</td>
<td>.38</td>
<td>.43</td>
<td>.55</td>
<td></td>
</tr>
<tr>
<td>9. Clutter Image Rating</td>
<td>.53</td>
<td>.34</td>
<td>.28</td>
<td>.32</td>
<td>.43</td>
<td>.46</td>
</tr>
<tr>
<td>10. Saving Cognitions Inv-Rev</td>
<td>.43</td>
<td>.46</td>
<td>.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DASS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Depression</td>
<td>.69</td>
<td>.47</td>
<td>.53</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As expected, there were strong, positive correlations among the hoarding measures. The clutter subscales of the HRS-I and the SI-R were strongly correlated with each other and with the CIR composite score. There was likewise a strong, positive correlation between the difficulty discarding subscales on the HRS-I and on the SI-R, supporting the convergent validity of these measures. Acquiring subscales on the HRS-I and SI-R showed weaker, but still adequate, correlations, $-3.30 \leq ZPF \leq -3.79$, $p \leq .001$. This is consistent with generally weaker correlations between scores on the SI-R acquiring subscale and scores on the HRS-I total, clutter, and difficulty discarding items, and between the HRS-I acquiring item and scores on the SI-R total, clutter, and difficulty discarding subscales than among other divergent scales on these two measures (e.g., HRS-I clutter and SI-R difficulty discarding, $-2.71 \leq ZPF \leq -5.05$, $p \leq .01$). These results reflect the clinical definition of hoarding, which includes clutter and difficulty discarding as key characteristics, and excessive acquisition as a related, but not central, feature.

Table 5 also shows small to moderate correlations between measures of hoarding and measures of depression, anxiety, and intolerance of uncertainty. The majority (79%) of these correlations were weaker than correlations among measures of hoarding, $t(122) \leq 9.13$, $ps < .05$ and $ZPF \leq 7.71$, $p < .05$. These results support the discriminant validity of the hoarding measures.

In summary, results support the convergent validity of these measures and their subscales. Scores for acquiring were not as highly correlated with other

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1 The relative strength of correlation coefficients was compared using methods and syntax published by Weaver and Wuensch (2013).
facets of hoarding, which is consistent with acquiring being a related, but not central, feature of hoarding. Finally, there is good discriminant validity between the hoarding measures and measures of depression, anxiety, and intolerance of uncertainty.

3.2.3 Valuing tasks. Given the novel application of methods from behavioural economics to the question of valuing among a community sample, including individuals with compulsive hoarding and given the adaptations made to methods previously used in behavioural economics studies, reliability of the method used in the current research to elicit item values from participants was of particular interest. In order to facilitate examination of this issue, participants provided minimum selling prices for two items (a mug and a bar of soap) that were administered across all three behavioural tasks. Reliability was conceptualized as the internal consistency of minimum selling prices within each item across tasks.

For the mug, Cronbach’s alpha was .77 with inter-item correlations ranging from .52 (DMVT/EET) to .69 (IVT/EET). For the bar of soap, Cronbach’s alpha was .80 with inter-item correlations ranging from .56 (IVT/DMVT) to .66 (DMVT/EET). These results suggest good reliability of the method used to elicit selling prices, at least for the two items that were consistent across the three tasks.

3.3 Item Valuation

Data from the IVT were the minimum selling prices indicated by participants for each of 36 everyday household items. A manipulation check was
performed in order to ensure that participants had generally understood the valuing task. There was a strong positive correlation between the market price and the perceived value of purchased items (i.e., excluding no-cost and sentimental items), \( r = .80 \).

### 3.3.1 Outcome measures.

Preliminary examination of the data revealed that distributions were not uniform across items. Specifically, for items in the no-cost price category, not surprisingly, a large portion (41% to 63%) of participants indicated their minimum selling price for the item was $0. In order to accommodate this inevitable floor effect and consequently skewed distributions, these data were dichotomized. A value of 0 was assigned to minimum selling prices of $0 and a value of 1 was assigned to minimum selling prices greater than $0. These were then summed within each participant across the nine items in the no-cost price category to create a total score indicating the number of no-cost items for which each participant indicated a value greater than $0. Cronbach’s alpha for this scale was .92, indicating excellent internal consistency.

Distributions for the four sentimental items, across all price categories, were also not consistent with distributions for other items in the same price categories. The frequency of assigning $0 to sentimental items was higher than for most other items in the IVT (13% to 36%) such that distributions for the sentimental items resembled those for the no-cost items. The data for sentimental items were, therefore, transformed in the same way as were data for the no-cost items. Cronbach’s alpha for this scale was .78, indicating good internal consistency.
All remaining IVT data in the very low- to moderate-cost categories were transformed into proportions by dividing the minimum selling price indicated by each participant by the actual retail price. This variable represents perceived value as a proportion of market price (perceived value index; PVI). PVI scores were further transformed as described below.

First, the mean PVI score across items was calculated for each participant. Cronbach’s alpha for this scale was .90, indicating excellent internal consistency. Next, a maximum PVI score was created for each participant in order to capture the possibility that overvaluation might be item specific, rather than a general phenomenon. Finally, the sum for each participant of PVI scores greater than 1.15 was examined. This is an indicator of the number of items each participant overvalued (greater than approximately one standard deviation above the mean), which allows for a 15% margin of error above market price in participants’ perceived values. Cronbach’s alpha for this scale was .72, indicating good internal consistency.

3.3.2 Descriptive statistics and between-groups comparisons.

Results of the following analyses are presented in Table 6.

3.3.2.1 No-cost items. Overall, participants assigned a non-zero value to just under half of the nine no-cost items. There was no significant difference among the groups. These data were first analysed using a Kruskal-Wallis test to accommodate their nonparametric distribution. They were also analysed using a one-way ANOVA, which did not change the results.
Table 6

*Results of Between-Group Comparisons: Item Valuation Task*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Full Sample M (SD)</th>
<th>Healthy Control Group M (SD)</th>
<th>Subclinical Group M (SD)</th>
<th>Hoarding Group M (SD)</th>
<th>Group Comparison</th>
<th>p</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 128</td>
<td>N = 36</td>
<td>N = 46</td>
<td>N = 43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No-cost items</td>
<td>4.40 (3.48)</td>
<td>3.97 (3.65)</td>
<td>4.65 (3.65)</td>
<td>4.42 (3.26)</td>
<td>χ² = 1.16</td>
<td>.56</td>
<td>η² = .01</td>
</tr>
<tr>
<td>Sentimental items</td>
<td>2.78 (1.36)</td>
<td>2.44 (1.44)</td>
<td>3.00 (1.23)</td>
<td>2.84 (1.34)</td>
<td>χ² = 3.66</td>
<td>.16</td>
<td>η² = .03</td>
</tr>
<tr>
<td>Mean PVI</td>
<td>0.81 (0.35)</td>
<td>0.83 (0.34)</td>
<td>0.86 (0.35)</td>
<td>0.74 (0.36)</td>
<td>F = 1.44</td>
<td>.24</td>
<td>η_p² = .02</td>
</tr>
<tr>
<td>Maximum PVI</td>
<td>3.30 (1.93)</td>
<td>3.59 (2.04)</td>
<td>3.32 (1.81)</td>
<td>3.03 (1.99)</td>
<td>F = 0.81</td>
<td>.45</td>
<td>η_p² = .01</td>
</tr>
<tr>
<td>PVI &gt; 1.15</td>
<td>4.39 (0.26)</td>
<td>4.72 (2.90)</td>
<td>4.78 (3.01)</td>
<td>3.67 (2.76)</td>
<td>F = 1.97</td>
<td>.14</td>
<td>η_p² = .03</td>
</tr>
</tbody>
</table>

*Note.* PVI = Perceived Value Index.
3.3.2.2 *Sentimental items.* Overall, participants gave a value greater than $0 to most of the four sentimental items. There was no significant difference among the groups.

3.3.2.3 *Perceived value index.* In the full sample, participants were willing to sell their items to the experimenter for 81% of market price. There was no significant difference among the groups. In the full sample, on average, participants’ maximum overvalued item was perceived to be worth 330% of the market price. There was no significant difference among the groups. In the total sample, participants overvalued (at least 15% above market price) approximately 18% of items. There were no significant differences among the groups.

3.3.3 *Regression analyses.* Regression analyses were performed to examine the extent to which hoarding symptoms and hoarding cognitions predicted performance on the IVT. These analyses were performed on only the outcome measures for which there were significant correlations between the predictor and the outcome variables. Correlations between the outcome measures and the measures of hoarding symptoms and hoarding cognitions are presented in Table 7.

Given the significant moderate to strong bivariate correlations among the control variables entered in these regression analyses (see Table 4), additional diagnostics were performed to assess for multicollinearity. Tolerance and VIF scores were within acceptable ranges. Re-rerunning the regression analyses, eliminating one predictor variable at a time, did not lead to remarkable change in regression coefficients. Finally, only one of the control variables (anxiety) in one
Table 7

*Pearson Correlations (r) between Item Valuation Task Outcome Measures and Measures of Hoarding Symptoms and Hoarding Cognitions*

<table>
<thead>
<tr>
<th></th>
<th>SI-R</th>
<th>SCI-R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Clutter</td>
</tr>
<tr>
<td>no-cost items</td>
<td>.19*</td>
<td>.18*</td>
</tr>
<tr>
<td>sentimental items</td>
<td>.25*</td>
<td>.23*</td>
</tr>
<tr>
<td>mean PVI</td>
<td>.06</td>
<td>.05</td>
</tr>
<tr>
<td>max. PVI</td>
<td>.02</td>
<td>.04</td>
</tr>
<tr>
<td>PVI &gt; 1.15</td>
<td>.04</td>
<td>.04</td>
</tr>
</tbody>
</table>

*Note.* SI-R = Saving Inventory-Revised, SCI-R = Saving Cognitions Inventory-Revised, PVI = Perceived Value Index. * = p < .05.
of the regression analyses (hoarding behaviours regressed on no-cost items) was a significant, unique predictor of the dependent variable. These results suggest that multicollinearity was not an issue of concern in the main regression analyses and that results of the regression analyses are interpretable.

### 3.3.3.1 No-cost items

Hoarding symptoms and cognitions generally correlated significantly, although not strongly, with the number of no-cost items given some monetary value by participants (see Table 7). Across groups, correlations between the number of no-cost items given some value and levels of hoarding symptoms and hoarding cognitions were all positive. They ranged from $r = .10$ for hoarding symptoms in the hoarding group to $r = .41$ for hoarding cognitions in the healthy control group. Only two of these were statistically significant (for hoarding cognitions in the healthy control group and for hoarding symptoms in the subclinical group), with no apparent pattern across groups.

Results of a regression analysis showed that hoarding symptoms predicted a significant amount of change in the number of no-cost items given a value greater than $0$, $F(1,124) = 4.81$, $p = .03$. Hoarding symptoms predicted 3.7% of the variance in the number of no-cost items given some value. Given this significant result, a hierarchical regression analysis was run with potential confound variables (income, depression, anxiety, and intolerance of uncertainty) entered at step 1 and hoarding symptoms entered at step 2. In this controlled analysis, hoarding symptoms did not predict a significant amount of change in the number of no-cost items given some value. The combined effect of the
control variables in Model 1 and each of the control variables individually in Model 2 were also non-significant (see Table 8).

In order to better understand these results, separate follow-up hierarchical regressions were performed with one control variable entered at step 1 and hoarding symptoms entered at step 2. In these analyses, hoarding symptoms remained a significant predictor of giving value to no-cost items, above and beyond the non-significant effect of income. In contrast, hoarding symptoms were not a significant predictor of giving value to no-cost items above and beyond the non-significant effects of depression, anxiety, and intolerance of uncertainty separately or combined. These results suggest that giving value to no-cost items could be attributable to hoarding symptoms and/or these other clinical problems, but not to income.

Similarly, in an uncontrolled regression analysis, hoarding cognitions predicted 5.8% of the variance in the number of no-cost items given some value, $F(1,126) = 7.71, p < .01$. However, hoarding cognitions were not a significant predictor above and beyond the effects of depression, anxiety, and intolerance of uncertainty in a hierarchical regression. Control variables were not significant predictors, either combined in Model 1 or individually in Model 2 (see Table 8).

Again, a series of follow-up regression analyses were performed. In this case, hoarding cognitions continued to predict value being given to no-cost items above and beyond the non-significant effects of each of the control variables separately, but not combined. These results suggest that hoarding
Table 8

Results of Hierarchical Regression Analyses Predicting Item Valuation Task Outcome Variables

<table>
<thead>
<tr>
<th>DV</th>
<th>IV</th>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>B</td>
<td>SE</td>
</tr>
<tr>
<td>no-cost items</td>
<td>SI-R</td>
<td>constant</td>
<td>4.06*</td>
<td>1.36</td>
</tr>
<tr>
<td></td>
<td></td>
<td>income</td>
<td>-0.32</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>depression</td>
<td>0.00</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>anxiety</td>
<td>0.07</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IUS-S</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SI-R</td>
<td>0.03</td>
<td>0.02</td>
</tr>
<tr>
<td>SCI-R</td>
<td>constant</td>
<td>3.05*</td>
<td>1.03</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>depression</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>anxiety</td>
<td>0.06</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IUS-S</td>
<td>0.03</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SC-R</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>sentimental items</td>
<td>SI-R</td>
<td>constant</td>
<td>2.08*</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>income</td>
<td>0.02</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>depression</td>
<td>0.00</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>anxiety</td>
<td>0.00</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IUS-S</td>
<td>0.02</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SC-R</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>SCI-R</td>
<td>constant</td>
<td>2.18*</td>
<td>0.41</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>depression</td>
<td>0.00</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>anxiety</td>
<td>0.00</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IUS-S</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SC-R</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Note. N = 124 to 128. DV = dependent variable/outcome measure, IV = independent variable of interest, SI-R = Saving Inventory Revised, SCI-R = Saving Cognitions Inventory-Revised, parent educ. = parental level of education. * = p < .05.
cognitions are confounded with other clinical problems in general in predicting value given to no-cost items but not with any other clinical problem in particular.

3.3.3.2 Sentimental items. Hoarding symptoms and cognitions generally correlated significantly, although not strongly, with placing monetary value on sentimental items that belonged to someone else. Across groups, correlations between the number of sentimental items given some value and levels of hoarding symptoms and hoarding cognitions were all positive. They ranged from $r = .11$ for hoarding symptoms in the healthy control group to $r = .44$ for hoarding symptoms in the subclinical group. Only two of these were statistically significant (for hoarding behaviours in the subclinical group and in the hoarding group), with no apparent pattern across groups.

In an uncontrolled regression analysis, hoarding symptoms predicted 6.1% of the variance in the number of sentimental items given some value, $F(1,124) = 8.11, p < .01$. In a hierarchical regression analysis, hoarding symptoms continued to be a significant predictor of the number of sentimental items given a value greater than $0$, above and beyond the non-significant effects of confounding variables. In this case, hoarding symptoms predicted 4.6% of the variance in the number of sentimental items given some value (see Table 8).

Similarly, in an uncontrolled regression analysis, hoarding cognitions predicted 5.7% of the variance in the number of sentimental items given some value, $F(1,126) = 7.59, p < .01$. And, in a hierarchical regression analysis with the non-significant effects of depression, anxiety, and intolerance of uncertainty
controlled at step 1, hoarding cognitions remained a significant predictor of the number of sentimental items given value, predicting 3.9% of the variance (see Table 8).

Hoarding symptoms and hoarding cognitions, therefore, each uniquely predicted the number of sentimental items given some value. For a one standard deviation increase in either of these measures, 1 in 4 more items was given a value greater than $0 (rather than a value of $0 or less).

3.3.3.3 PVI variables. Across all indicators of the PVI, neither hoarding symptoms nor cognitions were significantly correlated with perceived value as a function of market price. Given this result, regression analyses were not performed.

3.4 Diminishing Marginal Value

Raw data from the DMVT were minimum selling prices for one unit of 6 different items at 3 different endowment levels (i.e., when the participant had 1 unit, when the participant had 2, 3, or 4 units, and when the participant had 5 units). Means and standard deviations for these data are presented in Table 9.

Half of the 18 distributions were excessively right skewed (skewness > 1) and had upper outliers. These outliers were Winsorized and the distributions log transformed in order to resolve these issues. Analyses were conducted using both raw and transformed data when necessary, and any differences in results are noted.

Difference scores (price at endowment of 5 units minus price at endowment of 1 unit) were also calculated. Difference scores were used in
various analyses as measures of the extent to which marginal value differed from a high endowment level to a low endowment level for each item. Given diminishing marginal value, these scores were expected to be negative (marginal value given a high endowment is less than marginal value given a low endowment). Means and standard deviations for difference scores are presented in Table 9.

### Table 9

*Means and (Standard Deviations) for Diminishing Marginal Value Task Data*

<table>
<thead>
<tr>
<th>Item</th>
<th>Endowment</th>
<th>Full Sample</th>
<th>Healthy Control</th>
<th>Subclinical</th>
<th>Hoarding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N = 128</td>
<td>N = 36</td>
<td>N = 46</td>
<td>N = 43</td>
</tr>
<tr>
<td>Flashlight</td>
<td>1</td>
<td>3.20 (2.56)</td>
<td>3.32 (3.44)</td>
<td>2.96 (1.98)</td>
<td>3.35 (2.36)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.65 (1.38)</td>
<td>1.55 (1.38)</td>
<td>1.58 (1.31)</td>
<td>1.83 (1.48)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2.22 (2.14)</td>
<td>2.14 (2.43)</td>
<td>2.42 (2.29)</td>
<td>2.00 (1.72)</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td>-0.98 (2.97)</td>
<td>-1.19 (3.93)</td>
<td>-0.54 (2.67)</td>
<td>-1.36 (2.39)</td>
</tr>
<tr>
<td>Socks</td>
<td>1</td>
<td>2.30 (1.58)</td>
<td>2.46 (1.65)</td>
<td>2.21 (1.54)</td>
<td>2.30 (1.61)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1.72 (1.29)</td>
<td>1.92 (1.40)</td>
<td>1.78 (1.32)</td>
<td>1.55 (1.19)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1.13 (1.02)</td>
<td>1.37 (1.41)</td>
<td>1.20 (0.94)</td>
<td>0.86 (0.62)</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td>-1.18 (1.39)</td>
<td>-1.09 (1.41)</td>
<td>-1.01 (1.16)</td>
<td>-1.44 (1.55)</td>
</tr>
<tr>
<td>Mug</td>
<td>1</td>
<td>2.34 (2.50)</td>
<td>2.89 (3.59)</td>
<td>2.36 (2.03)</td>
<td>1.98 (1.79)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1.51 (1.61)</td>
<td>1.57 (1.36)</td>
<td>1.68 (2.01)</td>
<td>1.32 (1.34)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1.22 (1.43)</td>
<td>1.23 (1.30)</td>
<td>1.36 (1.71)</td>
<td>1.10 (1.27)</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td>-1.12 (2.30)</td>
<td>-1.65 (3.61)</td>
<td>-1.00 (1.59)</td>
<td>-0.87 (1.39)</td>
</tr>
<tr>
<td>Key chain</td>
<td>1</td>
<td>0.56 (1.07)</td>
<td>0.50 (0.63)</td>
<td>0.35 (0.43)</td>
<td>0.88 (1.66)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.47 (0.57)</td>
<td>0.48 (0.55)</td>
<td>0.36 (0.36)</td>
<td>0.59 (0.75)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>0.57 (0.62)</td>
<td>0.49 (0.54)</td>
<td>0.57 (0.63)</td>
<td>0.62 (0.67)</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td>0.01 (1.17)</td>
<td>-0.01 (0.71)</td>
<td>0.22 (0.61)</td>
<td>-0.26 (1.75)</td>
</tr>
<tr>
<td>Soap</td>
<td>1</td>
<td>1.57 (1.27)</td>
<td>1.53 (1.29)</td>
<td>1.47 (0.90)</td>
<td>1.70 (1.60)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.31 (1.02)</td>
<td>1.24 (0.97)</td>
<td>1.36 (0.97)</td>
<td>1.30 (1.14)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>0.87 (0.82)</td>
<td>0.94 (0.70)</td>
<td>0.91 (0.90)</td>
<td>0.82 (0.87)</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td>-0.70 (1.12)</td>
<td>-0.59 (1.04)</td>
<td>-0.56 (1.03)</td>
<td>-0.87 (1.27)</td>
</tr>
<tr>
<td>Marker</td>
<td>1</td>
<td>1.33 (1.21)</td>
<td>1.28 (1.49)</td>
<td>1.18 (0.95)</td>
<td>1.53 (1.23)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.70 (0.65)</td>
<td>0.65 (0.69)</td>
<td>0.74 (0.70)</td>
<td>0.68 (0.55)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>0.48 (0.66)</td>
<td>0.50 (0.67)</td>
<td>0.55 (0.82)</td>
<td>0.42 (0.47)</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td>-0.85 (1.18)</td>
<td>-0.78 (1.28)</td>
<td>-0.63 (1.09)</td>
<td>-1.12 (1.18)</td>
</tr>
</tbody>
</table>

*Note.* All results are in Canadian dollars.
Raw difference score data were also excessively skewed (skewness >|1|). Winsorizing resolved this issue and analyses using difference scores were performed on both raw and Winsorized data. Any differences in results are clearly noted where results of those analyses are presented.

The difference between mean selling price at an endowment level of 1 unit and mean selling price at an endowment level of 5 units was negative across all groups for all items other than the key chains. Also, means at intermediate endowment levels were consistent with diminishing marginal value for all items other than the key chains and the flashlights. Because the data for the key chains and the flashlights were not consistent with diminishing marginal value, they were dropped from subsequent analyses.

3.4.1 Between-groups analyses. A mixed model MANOVA was performed on the data from the 4 items that were consistent with diminishing marginal value. Endowment level (5 vs. 1) was the within-participants factor and group (healthy control vs. subclinical vs. hoarding) was the between subjects factor. This is considered a weak test of diminishing marginal value because it ignores marginal value at intermediate endowment levels. The main effect of endowment level was significant, Pillai’s Trace = .52, \( F(4,119) = 32.47, p = < .001, \eta^2_p = .52 \), indicating that, across groups, participants gave higher prices in the selling condition than in the buying condition. Neither the main effect of group nor the interaction between group and endowment level were significant. This

---

2 Only endowment levels of 5 units and 1 unit were included in the MANOVA because data for all intermediate endowment levels (2, 3, and 4 units) were not collected for all items.
indicated that groups did not differ in the values they gave to items, across endowment levels, and that diagnostic group did not moderate the main effect of endowment level.

Given the significant overall main effect of endowment level, a stronger test of diminishing marginal value, including intermediate endowment levels, was performed. A mixed model, 2-way ANOVA was performed on the data from each of the pairs of socks, the mugs, the bars of soap, and the permanent markers. Results of these analyses are presented in Table 10.

Table 10

Results of Mixed-Model ANOVAs: Diminishing Marginal Value Task

<table>
<thead>
<tr>
<th>Item</th>
<th>Effect</th>
<th>$F$</th>
<th>$p$</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socks</td>
<td>Group</td>
<td>0.70</td>
<td>.50</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Endowment</td>
<td>89.20</td>
<td>&lt; .001</td>
<td>.42</td>
</tr>
<tr>
<td></td>
<td>Interaction</td>
<td>0.88</td>
<td>.46</td>
<td>.01</td>
</tr>
<tr>
<td>Mugs</td>
<td>Group</td>
<td>0.77</td>
<td>.46</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Endowment</td>
<td>38.58</td>
<td>&lt; .001</td>
<td>.24</td>
</tr>
<tr>
<td></td>
<td>Interaction</td>
<td>0.33</td>
<td>.83</td>
<td>.01</td>
</tr>
<tr>
<td>Soap</td>
<td>Group</td>
<td>0.03</td>
<td>.97</td>
<td>&lt; .01</td>
</tr>
<tr>
<td></td>
<td>Endowment</td>
<td>34.81</td>
<td>&lt; .001</td>
<td>.22</td>
</tr>
<tr>
<td></td>
<td>Interaction</td>
<td>0.61</td>
<td>.64</td>
<td>.01</td>
</tr>
<tr>
<td>Markers</td>
<td>Group</td>
<td>0.40</td>
<td>.67</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Endowment</td>
<td>82.98</td>
<td>&lt; .001</td>
<td>.41</td>
</tr>
<tr>
<td></td>
<td>Interaction</td>
<td>2.34</td>
<td>.08</td>
<td>.04</td>
</tr>
</tbody>
</table>

Results were generally consistent with those obtained in the MANOVA.

There was a strong main effect of endowment level for each of the items, indicating that different prices were given at different endowment levels. There were no main effects of group, indicating that prices did not differ among the groups across endowment levels. There were also no significant interactions.
between group and endowment level for any of the items, indicating that groups
did not differ in the extent to which they gave different prices at different
endowment levels.

Results of planned comparisons between endowment levels showed that
marginal value at an endowment level of 1 was significantly greater than
marginal value at an intermediate endowment level, which was in turn
significantly greater than marginal value at an endowment level of 5 for the pairs
of socks, the mugs, and the permanent markers, $p < .001$. For the bars of soap,
marginal value at an endowment level of 1 was greater than marginal value at an
endowment level of 5, $p < .001$. Marginal value at an endowment level of 3 fell
between these two values and was significantly different than marginal value at
an endowment level of 5, $p < .001$, but was not significantly different than
marginal value at an endowment level of 1, $p = .12$. These results are, therefore,
generally consistent with a strong test of diminishing marginal value for 3 of the 6
items used in the study.

Another way of thinking about diminishing marginal value is to consider
those instances in which selling price at a low endowment level was higher (by
any amount) than selling price at a high endowment level as indicative of
diminishing marginal value and those instances in which selling price at a low
endowment level was equal to or less than selling price at a high endowment
level as indicative of no diminishing marginal value. In fact, this is how
diminishing marginal value has been defined in at least some previous research
(Horowitz et al., 2007). In order to capture this conceptualization, the data were
re-coded with 0 for no diminishing marginal value and 1 for diminishing marginal value. Frequency data for these new variables is presented in Table 11.

Table 11

*Frequency (N, %) of Participants Exhibiting Diminishing Marginal Value by Item and by Group*

<table>
<thead>
<tr>
<th>Item</th>
<th>Full sample N = 128</th>
<th>Healthy Control N = 36</th>
<th>Subclinical N = 46</th>
<th>Hoarding N = 43</th>
</tr>
</thead>
<tbody>
<tr>
<td>flashlight</td>
<td>77, 60%</td>
<td>22, 61%</td>
<td>25, 54%</td>
<td>29, 67%</td>
</tr>
<tr>
<td>socks</td>
<td>98, 77%</td>
<td>29, 81%</td>
<td>35, 76%</td>
<td>32, 74%</td>
</tr>
<tr>
<td>mug</td>
<td>94, 73%</td>
<td>27, 75%</td>
<td>35, 76%</td>
<td>30, 70%</td>
</tr>
<tr>
<td>key chain</td>
<td>32, 25%</td>
<td>10, 28%</td>
<td>7, 15%</td>
<td>15, 35%</td>
</tr>
<tr>
<td>soap</td>
<td>84, 66%</td>
<td>19, 53%</td>
<td>30, 65%</td>
<td>32, 74%</td>
</tr>
<tr>
<td>marker</td>
<td>109, 85%</td>
<td>30, 83%</td>
<td>37, 80%</td>
<td>39, 91%</td>
</tr>
</tbody>
</table>

A chi-square test was conducted on the recoded data for each item to test whether there was a difference among the groups in the frequency of exhibiting an endowment effect. Results of these analyses are presented in Table 12.

Table 12

*Results of Chi Square Analyses Conducted on Dichotomized Diminishing Marginal Value Task Data*

<table>
<thead>
<tr>
<th>Item</th>
<th>$\chi^2$ (2, N = 125)</th>
<th>p</th>
<th>Cramer’s V</th>
</tr>
</thead>
<tbody>
<tr>
<td>flashlight</td>
<td>1.60</td>
<td>.45</td>
<td>.08</td>
</tr>
<tr>
<td>socks</td>
<td>0.44</td>
<td>.81</td>
<td>.04</td>
</tr>
<tr>
<td>mug</td>
<td>0.51</td>
<td>.78</td>
<td>.05</td>
</tr>
<tr>
<td>key chain</td>
<td>4.64</td>
<td>.10</td>
<td>.14</td>
</tr>
<tr>
<td>soap</td>
<td>4.03</td>
<td>.13</td>
<td>.13</td>
</tr>
<tr>
<td>marker</td>
<td>1.90</td>
<td>.39</td>
<td>.09</td>
</tr>
</tbody>
</table>

Consistent with results of the analyses using continuous data, there was no significant difference among the groups for any item.
3.4.2 Correlational and regression analyses. Prior to conducting planned regression analyses, bivariate correlations between the predictor variables (hoarding behaviours, hoarding cognitions, and their subscales) and the outcome variables (difference scores for each item) were examined. These are presented in Table 13. None of these correlations were significantly different than zero, so regression analyses were not performed.

3.5 Endowment Effect

Raw data from the EET were buying and selling prices for each of 6 items. Means and standard deviations for these data are presented in Table 14. Means and standard deviations for difference scores (selling price minus buying price) for each item are also presented because these were used as outcome measures in some analyses. All difference scores, except for the chocolate bar, had numerous outliers and excessive skewness (>|1|). Winsorizing resolved both of these issues and analyses were conducted on both raw and Winsorized variables. Because the soy sauce means were opposite in direction from the pattern expected by hypotheses, this item was not included in subsequent analyses.

3.5.1 Between groups analyses. A mixed model MANOVA was performed on the data from all items except the soy sauce, with condition (buying vs. selling) as the within-participants factor and group (healthy control vs. subclinical vs. hoarding) as the between subjects factor. The main effect of
Table 13

Pearson Correlations (r) Between Diminishing Marginal Value Difference Scores and Measures of Hoarding Symptoms and Hoarding Cognitions

<table>
<thead>
<tr>
<th>Item</th>
<th>SI-R Total</th>
<th>SI-R Clutter</th>
<th>SI-R Difficulty Discarding</th>
<th>SI-R Acquiring</th>
<th>SCI-R Total</th>
<th>SCI-R Emotional Attachment</th>
<th>SCI-R Responsibility</th>
<th>SCI-R Control</th>
<th>SCI-R Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashlight</td>
<td>.10</td>
<td>.08</td>
<td>.10</td>
<td>.08</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.13</td>
</tr>
<tr>
<td>Socks</td>
<td>-.09</td>
<td>-.12</td>
<td>-.13</td>
<td>.02</td>
<td>-.05</td>
<td>-.06</td>
<td>-.06</td>
<td>-.08</td>
<td>.04</td>
</tr>
<tr>
<td>Mug</td>
<td>.09</td>
<td>.11</td>
<td>.03</td>
<td>.11</td>
<td>.02</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.08</td>
</tr>
<tr>
<td>Key chain</td>
<td>.06</td>
<td>-.01</td>
<td>.05</td>
<td>.16</td>
<td>.03</td>
<td>.08</td>
<td>.03</td>
<td>-.04</td>
<td>-.04</td>
</tr>
<tr>
<td>Soap</td>
<td>-.07</td>
<td>-.08</td>
<td>-.07</td>
<td>-.05</td>
<td>-.10</td>
<td>-.10</td>
<td>-.15</td>
<td>.02</td>
<td>-.07</td>
</tr>
<tr>
<td>Marker</td>
<td>-.07</td>
<td>-.11</td>
<td>-.02</td>
<td>-.05</td>
<td>-.03</td>
<td>.00</td>
<td>-.02</td>
<td>.06</td>
<td>-.15</td>
</tr>
</tbody>
</table>

*Note. DMV = Diminishing Marginal Value, SI-R = Saving Inventory-Revised, SCI-R = Saving Cognitions Inventory-Revised, PVI = Perceived Value Index. * = p < .05*
Table 14
Means and (Standard Deviations) for Endowment Effect Task Data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N =128</td>
<td></td>
<td></td>
<td>N = 36</td>
<td></td>
<td></td>
<td>N = 46</td>
<td></td>
<td></td>
<td>N = 43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chocolate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.29</td>
<td>2.22</td>
<td>0.06</td>
<td>2.14</td>
<td>2.08</td>
<td>0.06</td>
<td>2.26</td>
<td>2.09</td>
<td>0.17</td>
<td>2.30</td>
<td>2.40</td>
<td>-0.10</td>
</tr>
<tr>
<td></td>
<td>(1.38)</td>
<td>(1.39)</td>
<td>(1.33)</td>
<td>(1.26)</td>
<td>(1.37)</td>
<td>(1.46)</td>
<td>(1.40)</td>
<td>(1.26)</td>
<td>(1.33)</td>
<td>(1.41)</td>
<td>(1.54)</td>
<td>(1.27)</td>
</tr>
<tr>
<td>Newspaper</td>
<td>0.48</td>
<td>0.36</td>
<td>0.12</td>
<td>0.55</td>
<td>0.40</td>
<td>0.16</td>
<td>0.46</td>
<td>0.35</td>
<td>0.10</td>
<td>0.47</td>
<td>0.34</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>(0.69)</td>
<td>(0.58)</td>
<td>(0.41)</td>
<td>(0.68)</td>
<td>(0.64)</td>
<td>(0.52)</td>
<td>(0.49)</td>
<td>(0.46)</td>
<td>(0.32)</td>
<td>(0.89)</td>
<td>(0.66)</td>
<td>(0.42)</td>
</tr>
<tr>
<td>Pencil</td>
<td>0.71</td>
<td>0.59</td>
<td>0.12</td>
<td>0.75</td>
<td>0.52</td>
<td>0.24</td>
<td>0.59</td>
<td>0.58</td>
<td>0.01</td>
<td>0.82</td>
<td>0.69</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>(0.76)</td>
<td>(0.53)</td>
<td>(0.65)</td>
<td>(0.91)</td>
<td>(0.47)</td>
<td>(0.84)</td>
<td>(0.63)</td>
<td>(0.50)</td>
<td>(0.48)</td>
<td>(0.78)</td>
<td>(0.62)</td>
<td>(0.64)</td>
</tr>
<tr>
<td>Soy sauce</td>
<td>0.06</td>
<td>0.10</td>
<td>-0.04</td>
<td>0.06</td>
<td>0.14</td>
<td>-0.08</td>
<td>0.07</td>
<td>0.10</td>
<td>-0.02</td>
<td>0.06</td>
<td>0.07</td>
<td>-0.01</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.18)</td>
<td>(0.14)</td>
<td>(0.11)</td>
<td>(0.27)</td>
<td>(0.21)</td>
<td>(0.11)</td>
<td>(0.15)</td>
<td>(0.10)</td>
<td>(0.08)</td>
<td>(0.09)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Soap</td>
<td>1.27</td>
<td>1.04</td>
<td>0.23</td>
<td>1.36</td>
<td>1.07</td>
<td>0.29</td>
<td>1.23</td>
<td>1.00</td>
<td>0.23</td>
<td>1.27</td>
<td>1.12</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>(0.93)</td>
<td>(0.78)</td>
<td>(0.67)</td>
<td>(0.89)</td>
<td>(0.90)</td>
<td>(0.64)</td>
<td>(0.75)</td>
<td>(0.73)</td>
<td>(0.71)</td>
<td>(1.14)</td>
<td>(0.80)</td>
<td>(0.68)</td>
</tr>
<tr>
<td>Mug</td>
<td>1.76</td>
<td>1.43</td>
<td>0.33</td>
<td>1.69</td>
<td>1.35</td>
<td>0.34</td>
<td>1.82</td>
<td>1.50</td>
<td>0.31</td>
<td>1.77</td>
<td>1.46</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>(1.68)</td>
<td>(1.23)</td>
<td>(1.27)</td>
<td>(1.35)</td>
<td>(1.14)</td>
<td>(0.94)</td>
<td>(1.72)</td>
<td>(1.19)</td>
<td>(1.66)</td>
<td>(1.91)</td>
<td>(1.38)</td>
<td>(1.05)</td>
</tr>
</tbody>
</table>

Note. Diff. = difference score (selling price – buying price). *All prices are in Canadian dollars.
condition was significant, Pillai’s Trace = .20, $F(5,118) = 5.96$, $p = < .001$, $\eta_p^2 = .20$. Neither the main effect of group nor the interaction between group and condition were significant. Given the significant overall main effect of condition, a series of mixed model, 2-way ANOVAs were performed on the data from each of the chocolate bar, newspaper, mechanical pencil, bar of soap, and mug. These results are presented in Table 15.

### Table 15

**Results of Mixed-Model ANOVAs: Endowment Effect Task**

<table>
<thead>
<tr>
<th>Item</th>
<th>Effect</th>
<th>$F$</th>
<th>$\eta_p^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate</td>
<td>Group</td>
<td>0.43</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Endowment</td>
<td>0.14</td>
<td>&lt; .01</td>
</tr>
<tr>
<td></td>
<td>Interaction</td>
<td>0.80</td>
<td>.01</td>
</tr>
<tr>
<td>Newspaper</td>
<td>Group</td>
<td>0.16</td>
<td>&lt; .01</td>
</tr>
<tr>
<td></td>
<td>Endowment</td>
<td>11.86*</td>
<td>.09</td>
</tr>
<tr>
<td></td>
<td>Interaction</td>
<td>0.15</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>Pencil</td>
<td>Group</td>
<td>0.94</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td>Endowment</td>
<td>4.59*</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>Interaction</td>
<td>1.23</td>
<td>.02</td>
</tr>
<tr>
<td>Soap</td>
<td>Group</td>
<td>0.17</td>
<td>&lt; .01</td>
</tr>
<tr>
<td></td>
<td>Endowment</td>
<td>13.45*</td>
<td>.10</td>
</tr>
<tr>
<td></td>
<td>Interaction</td>
<td>0.41</td>
<td>.01</td>
</tr>
<tr>
<td>Mug</td>
<td>Group</td>
<td>0.11</td>
<td>&lt; .01</td>
</tr>
<tr>
<td></td>
<td>Endowment</td>
<td>7.57*</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Interaction</td>
<td>0.01</td>
<td>&lt; .01</td>
</tr>
</tbody>
</table>

*Note. * = $p < .05$

The main effect of condition was significant for all items except the chocolate bar, indicating that selling prices were significantly higher than buying prices for all items other than the chocolate bar. The amount of variance in price explained by these endowment effects ranged from 4% (mechanical pencil) to 11% (bar of soap).
As with the DMVT data, another way of conceptualizing the endowment effect is to consider those instances in which selling price was higher (by any amount) than buying price as indicative of an endowment effect and those instances in which selling price was equal to or less than buying price as indicative of no endowment effect. In order to capture this conceptualization, the data were recoded with 0 for no endowment effect and 1 for an endowment effect. Frequency data for these new variables is presented in Table 16.

Table 16

*Frequency (N, %) of Participants Exhibiting an Endowment Effect by Item and by Group*

<table>
<thead>
<tr>
<th>Item</th>
<th>Full sample N = 128</th>
<th>Healthy Control Group N = 36</th>
<th>Subclinical Group N = 46</th>
<th>Hoarding Group N = 43</th>
</tr>
</thead>
<tbody>
<tr>
<td>chocolate bar</td>
<td>50, 39%</td>
<td>13, 36%</td>
<td>19, 41%</td>
<td>15, 35%</td>
</tr>
<tr>
<td>newspaper</td>
<td>43, 34%</td>
<td>11, 31%</td>
<td>16, 35%</td>
<td>15, 35%</td>
</tr>
<tr>
<td>pencil</td>
<td>51, 40%</td>
<td>17, 47%</td>
<td>16, 35%</td>
<td>15, 35%</td>
</tr>
<tr>
<td>soy sauce</td>
<td>27, 21%</td>
<td>4, 11%</td>
<td>12, 26%</td>
<td>11, 26%</td>
</tr>
<tr>
<td>soap</td>
<td>62, 48%</td>
<td>20, 56%</td>
<td>20, 44%</td>
<td>20, 47%</td>
</tr>
<tr>
<td>mug</td>
<td>61, 48%</td>
<td>20, 56%</td>
<td>19, 41%</td>
<td>19, 44%</td>
</tr>
</tbody>
</table>

A chi-square test was conducted on the recoded data for each item to test whether there was a difference among the groups in the frequency of exhibiting an endowment effect. No significant group differences were observed, $\chi^2 (2, N = 125) < 1.78, p > .41, V < .12$, indicating that groups did not differ in the frequency with which they demonstrated an endowment effect for any item.

Finally, some research has demonstrated that endowment effects are moderated by positive (Lin et al., 2006) or negative (Lerner et al., 2004; Lin et al., 2006).
Two ANOVAs were performed for each item: one to examine moderation by positive affect and another to examine moderation by negative affect. The dependent variable in all of these ANOVAs was the within-participant difference between selling and buying prices for each item. There were no main effects of group, $F(2, 118) < 1.25, p > .29, \eta_p^2 < .02$, and there were no significant interactions between group and state affect, $F(2, 118) < 2.36, p > .10, \eta_p^2 < .04$. There was one significant main effect of affect, which was of negative affect on the difference between selling and buying prices for the mechanical pencil, $F(1, 118) = 4.73, p = .03, \eta_p^2 = .04$, with participants in the high negative affect group generally having a larger difference between selling and buying prices ($M = 0.24, SD = 0.89$) than participants in the low negative affect group ($M = -0.01, SD = 0.97$). There were no other significant main effects of affect, $F(1, 118) < 1.28, p > .26, \eta_p^2 < .01$. The lack of pattern in these results suggests that positive and negative affect were not significant moderators of the endowment effect in the current sample.

3.5.2 Correlational analyses. Prior to conducting planned regression analyses, bivariate correlations between the predictor variables (hoarding symptoms, hoarding cognitions, and their subscales) and the outcome variables
(difference scores for each item) were examined. These are presented in Table 17. All of these correlations were very weak and not significantly different from zero. Given these results, no regression analyses were performed.
Table 17

*Pearson Correlations (r) Between Endowment Effect Difference Scores and Measures of Hoarding Symptoms and Hoarding Cognitions*

<table>
<thead>
<tr>
<th>Item</th>
<th>SI-R</th>
<th>SCI-R</th>
<th>SCI-R</th>
<th>SCI-R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Clutter</td>
<td>Difficulty</td>
<td>Discarding</td>
</tr>
<tr>
<td>Chocolate bar</td>
<td>-0.02</td>
<td>-0.01</td>
<td>-0.08</td>
<td>0.05</td>
</tr>
<tr>
<td>Newspaper</td>
<td>0.02</td>
<td>-0.06</td>
<td>-0.07</td>
<td>-0.09</td>
</tr>
<tr>
<td>Pencil</td>
<td>-0.05</td>
<td>-0.08</td>
<td>-0.01</td>
<td>-0.04</td>
</tr>
<tr>
<td>Soap</td>
<td>0.02</td>
<td>0.05</td>
<td>0.04</td>
<td>-0.06</td>
</tr>
<tr>
<td>Mug</td>
<td>0.02</td>
<td>0.11</td>
<td>-0.02</td>
<td>-0.09</td>
</tr>
</tbody>
</table>

*Note.* SI-R = Saving Inventory-Revised, SCI-R = Saving Cognitions Inventory-Revised, PVI = Perceived Value Index. * = p < .05.
Chapter 4: Discussion

In this chapter I first present a review of the study goals, hypotheses, and results. Next, I discuss the implications of the study in relation to the theory of value and behavioural economics, item ownership, and the study sample. Then, I suggest directions for future research and close with a conclusion.

4.1 Review of Study Goals, Hypotheses, and Results

Hoarding disorder is characterized by excessive accumulation of items and extreme difficulty parting with possessions. These features occur to such an extent that they cause marked distress or impairment and are associated with significant costs to the affected individual, his or her family and friends, and society as a whole. Although hoarding disorder affects 2% to 6% of the population, it has only recently been recognized as a distinct form of psychopathology. As such, theoretical models and treatment strategies are nascent and there is ample room for novel perspectives.

Valuing of items is notably abnormal in hoarding disorder and has hitherto been largely ignored in theoretical models and empirical investigations. Individuals with hoarding disorder acquire and keep larger quantities of items than are apparently needed – at the expense of space and convenience. Moreover, the items found in hoarded homes are often objectively worthless. These features of hoarding imply that individuals with hoarding disorder value items more highly than they value other commodities and that they value items that others do not value.
Further, individuals with hoarding disorder keep multiples of the same item when a much smaller number would suffice. Clinical observation suggests that hoarding may be associated with a tendency to perceive each item (or unit of an item) as unique (Frost & Hartl, 1996; Steketee & Frost, 2003). This implies difficulty valuing items in the context of what is owned or needed, and reduced substitutability. If one item (e.g., black pen) cannot substitute for another (e.g., blue pen), the value of each item increases and a larger number of units of the item (e.g., pens) are kept.

Moreover, individuals with hoarding disorder value their possessions to such an extent that parting with them – even things most people would discard without a thought – is extremely distressing. This implies that, consistent with the observation that individuals with hoarding disorder may have a higher threshold for decisions to discard possessions (Frost & Hartl, 1996; Grisham & Barlow, 2005), a wider range of items is defined as valuable enough to acquire and keep and that possessions are more highly valued by individuals with hoarding disorder than by individuals without the diagnosis.

Although the features of hoarding disorder clearly imply abnormal valuing, insufficient research has been done to specify this aspect of the psychopathology or to articulate a clear theoretical model that can serve as the basis for empirical investigation. The purpose of the current study was, therefore, to develop a theory of abnormal valuing in hoarding disorder and to conduct a set of initial studies to test predictions from the theory.
The theory of value from economics (Debreu, 1959) provides a suitable framework for this endeavour. The theory of value suggests that individuals’ choices about which goods to acquire and keep reflect the idiosyncratic value they attribute to those goods. The theory also suggests that the value attributed to a choice is revealed when the cost of the choice is observed in terms of a reference good (e.g., money, time, effort, space; Samuelson, 1953). Finally, the theory of value suggests that, within the restrictions of budget constraints, individuals acquire and keep items when idiosyncratic value is greater than perceived costs. These postulates permit development of hypotheses related to excessive accumulation of items and difficulty discarding in compulsive hoarding.

Several aspects of the phenomenon of hoarding are directly relevant to principles from the theory of value. First, hoarding is defined by the acquisition and retention of a large number of items, many of which are considered by others to be worthless. According to the theory of value, the choice to acquire or keep an item reflects an individual’s preference for that item in relation to something else. For experimental purposes, money is a suitable comparison good because its value is well understood and it is readily divisible, facilitating the measurement of fine gradations of value. The first hypothesis of the current research was, therefore, that hoarding is associated with overvaluing, in monetary terms, of everyday household items (i.e., the types of items that are typically hoarded).

Hoarding also typically involves keeping multiple units of the same item – usually many more exemplars of items than most people would keep. Diminishing marginal value is an empirically supported principle from economics,
which describes a phenomenon in which people generally demonstrate a
decrement of how much they value additional units of the same good. As more
units of the same good are acquired, people tend to value them less and less.
Eventually, the value of an additional unit becomes less than the perceived cost
of acquiring or keeping the additional unit.

For example, someone might have seven pairs of work socks. This is
more than enough pairs to get through the work week if laundry is done on
weekends, and there are a couple of backup pairs available in case laundry is
done late or one pair gets a hole. In this case, the individual might value the first
5 pairs equally, particularly if they are identical, and value each of the 6th and 7th
pairs a bit less. There might be some additional value to acquiring an 8th pair
because it could serve as an additional backup in case a pair was lost (in
addition to a pair having a hole and the laundry being done late). This is,
however, a fairly unlikely scenario so the 8th pair would probably be valued less
than the 6th and the 7th pairs. There are also costs associated with acquiring and
keeping an 8th pair of socks. There is the time, energy, and money required to
acquire an additional pair of socks. Also, perhaps this individual only has room in
his drawer for 7 pairs of work socks. So, there would be a space-related cost for
an 8th pair of work socks that had not been incurred for the 6th and 7th pairs.
Perhaps these costs are greater than the (small) additional value that would be
obtained from having an additional pair of socks. At this point, the additional unit
(i.e., pair of socks) is not acquired or is discarded (i.e., If the individual is given a
new pair of socks for Christmas, he might discard an old pair because the
additional value of a new pair of socks is greater than the additional value of an old pair of socks, and because the cost of having a pair of socks, even a new pair, that doesn’t fit into a drawer is greater than the benefit of having the extra pair of socks). These behaviours reveal the individual’s preference regarding the tradeoff between perceived costs and perceived value.

When this function is strong (i.e., a steep negative slope), people will generally not acquire or keep many units of an item. For example, most households do not choose to have more than one cell phone per person because the costs of acquiring and keeping an additional cell phone are relatively high and the value of additional cell phones drops off fairly quickly. Conversely, when the diminishing marginal value function is weak (i.e., shallow negative slope), people will generally acquire and keep multiple units of an item. For example, most households have many spoons, as the cost of acquiring and storing them is low and the utility of extra spoons is high. Hoarded homes often contain more multiples of items (such as sewing machines or office supplies) than one would see in typical homes. The second hypothesis of the current research was, therefore, that hoarding is associated with attenuated diminishing marginal value.

Third, individuals with hoarding problems have extreme difficulty parting with excess possessions. The theory of value would suggest that difficulty parting with possessions reflects higher perceived value of possessions. Actually, most people value their possessions more highly than they value identical items that are not possessions – a phenomenon economists call the endowment effect. The stronger the endowment effect, the more highly possessions are valued and the
more difficult it is to part with them. The third hypothesis of the current research was, therefore, that hoarding is associated with an increased endowment effect, such that the bias of valuing possessions over non-possessions would be stronger for hoarders than for others.

Analyses showed no diagnostic group effects on any of the three valuing processes that were examined. However, hoarding symptoms and hoarding cognitions predicted valuing of used objects of a sentimental nature that had belonged to someone else, as well as worthless items that most other people would readily discard. Implications of these results, and the research project as a whole, are presented below.

4.2 Study Implications

In this section, I first discuss the implications of the significant results for sentimental and no-cost items. Then, I discuss the overall results from various perspectives. I consider aspects of the theory and the methodology in relation to the results. In the subsequent section, I draw on these observations to present directions for future research.

4.2.1 Sentimental and no-cost items. As noted previously, higher levels of hoarding symptoms and hoarding cognitions were positively associated with attributing some value (greater than $0) to items of a sentimental nature that belonged to someone else and to worthless items that most people would readily discard. These findings partially support my theory of abnormal valuing in hoarding disorder and have implications for how abnormal valuing in hoarding disorder is conceptualized. Whereas I hypothesized that hoarding would be
associated with attributing greater value to a range of everyday household items that I operationalized as low- to no-cost items from typically hoarded categories, my results suggest that hoarding more specifically predicts attributing value to items of a sentimental nature and items that others would consider to be worthless.

These results are consistent with Frost and Hartl’s (1996) hypothesis of “hypersentimentality” in hoarding. Frost and Hartl defined hypersentimentality as increased saving for sentimental reasons and greater emotional attachment to possessions. My results extend this definition to include overvaluing items that are of a sentimental nature. My results suggest that hypersentimentality in hoarding extends beyond valuing of one’s own items to attaching sentimental value to a wider range of items, such as those that have sentimental connotations but with which the individual has had no personal experience (i.e., sentimental items belonging to a stranger).

Importantly, the effect of hoarding on ascribing value to a larger number of sentimental items was observed above and beyond the possible confounding effects of income, depression, anxiety, and intolerance of uncertainty. This lends support to the idea that overvaluing items of a sentimental nature is unique to hoarding and should be incorporated into models of excessive acquisition and difficulty discarding in hoarding disorder. Avenues for future research that follow from this result are discussed below.

Although continuous measures of hoarding symptoms and cognitions were significantly associated with valuing sentimental items, no significant
differences were found in a between-subjects analysis of diagnostic groups. This unexpected finding may have been due to a small effect size and the reduced variance associated with a categorical measure of hoarding. Possible reasons for the small effect size are discussed below in the context of sentimental attachment to items and the psychology of ownership.

The other significant results, that higher levels of hoarding symptoms and hoarding cognitions were positive predictors of the number of no-cost items given some value, also have implications for our understanding of the excessive accumulation of items that is characteristic of hoarding disorder. Clinical observation suggests that many items in hoarded homes are those that others would consider to be worthless – a dried up old pen, a broken shoe. Given that individuals who ascribe some value to an item are more likely to acquire and keep it, attributing value to worthless items may be one way that abnormal valuing processes contribute to hoarding.

This result is not as definitive as the result obtained for items of a sentimental nature because neither hoarding symptoms nor hoarding cognitions was a unique predictor of attributing value to worthless items. In these analyses, hoarding was confounded with the combined effects of depression, anxiety, and intolerance of uncertainty, indicating that it is not yet clear which, if any, of these clinical issues is key to overvaluation of no-cost items. There are good reasons to think that attributing value to worthless items is an aspect of abnormal valuing associated with the central features of hoarding. However, until this effect is differentiated from other clinical features, its implications for hoarding specifically
are unclear. These results suggest directions for future research, which are discussed below.

### 4.2.2 Theory of value and behavioural economics in relation to hoarding

My research makes a unique contribution to the literature on compulsive hoarding because it is the first to propose hypotheses based on several principles from the theory of value and to examine them using methods from behavioural economics. This is a unique contribution because there has been almost no previous research on the topic of valuing in hoarding disorder. Further, the few studies that have examined valuing have either not been informed by a coherent theory of valuing (e.g., Frost et al., 1998) or have failed to use established methods for assessing value (e.g., Preston et al., 2009; for a notable exception, see Boffi, Preston, Rick, & Stansfield, 2012). Although the theory of value and behavioural economics are in some ways particularly well suited to answering questions about excessive accumulation of items, my approach also has certain limitations. Below, I consider some of these advantages and limitations.

First, the theory of value argues that value is meaningful only with respect to an individual’s preferences. These preferences are unobservable unless they are revealed via comparison with another good. Thus, it is meaningless to ask someone whether they value an item “a lot”, “a little”, or “not at all” because definition of these labels is subjective to each individual. Previous research on item valuation in compulsive hoarding has failed to examine value in a relative sense, resulting in comparisons between participants that cannot be interpreted
(Frost et al., 1998). The current research addressed this problem by taking direction from the theory of revealed preference (Samuelson, 1953) and examining item valuation in monetary terms.

As useful as money is for experimental (and other!) purposes, monetary valuing may not completely capture value as it applies to the way people make everyday decisions in their lives. For example, other decision-making processes, like heuristics, could bias valuing decisions. Kahneman and Frederick (2002) propose that heuristics operate out of our awareness to simplify complicated decisions. So, someone faced with the complex task of translating all the forms of value that an item holds for them (e.g., instrumental, sentimental, intrinsic) into monetary terms could, unintentionally, resort to answering the simpler question, “How much does this item typically cost on the market?”. The strong, positive correlation between market prices and participants’ selling prices in the IVT could be interpreted as an indicator of this phenomenon.

The difficulty transforming all forms of value into monetary terms could be particularly challenging for individuals, like those with hoarding disorder, who experience deficits in aspects of decision-making (Woody et al., 2014). These individuals might, therefore, be more likely to resort to a heuristic. In the current research, a higher tendency to resort to a market cost heuristic could obscure any real overvaluation of items in the hoarding group. Money may, therefore, not be the most appropriate comparison good to use with this population. Below, I present some implications of this observation for future research.
The Becker-DeGroot-Marschak (BDM) mechanism is a validated procedure that was designed, and used in the current research, to try to mitigate some of the “shortcut” decision-making processes described above. It provides incentives for participants to report true values: If they report higher or lower values they could end up with undesired outcomes, and outcomes are meaningful because some are enacted at the end of the study. Providing incentives for participants to report true values is also particularly important in research like the current study because participants were asked to value a large number of items. This is presumably taxing and, without an incentive to continue providing true values, participants could tire and start reporting random values.

One limitation of this approach in the context of the current study is that the cost to participants of not reporting true values was small. If the true value of a bar of soap to a particular participant was $1.50 but he or she instead reported the value as $1.00, the greatest loss that the participant could have incurred was $0.50. Because all items were of low to very low objective value, the potential cost of misreporting values was quite low. With items of larger objective value, the potential cost of misreporting values to the same extent would be much higher and is, therefore, less likely to occur. In the current research, therefore, participants may not have had large enough incentives to report true values such that there may have been error in the values reported.

In contrast, although it might seem that the incentives were too low to obtain true values, in fact inter-task reliability was quite good. Participants provided selling prices for two different items (a mug and a bar of soap) across
the three tasks, responding to different instructions in each task. These results suggest that participants reported consistent, rather than random, values across the tasks. Further, although these ratings were obtained for only two of the many items used in the study, one of these items was an item that is commonly used in the economics literature (the mug) and the other was an item that was considered to be representative of the types of items that are typically hoarded (the bar of soap). That inter-task reliability was established for one of each of these two categories of items lends credibility to the choice made in the current research to use items from both of these categories in each task.

Moreover, a number of participants in the hoarding group reported that they were purposefully undervaluing items because they were aware of their hoarding problems and did not want to acquire more items. This level of insight could have masked any possible overvaluing of items that might have been observed among a less insightful group of hoarding participants.

Next, I discuss some adaptations that were made in the current research to the procedures that have previously been used in behavioural economics research. The reasons for making the adaptations and some potential limitations are presented below.

First, the endowment effect is typically assessed using a between-subjects design (e.g., Biel, Johansson-Stenman, & Nilsson, 2011; Lerner et al., 2004; Lin et al., 2006; Morewedge, Shu, Gilbert, & Wilson, 2009; Zhang & Fishbach, 2005), although a within-subjects design is not unique to the current research (see Kachelmeier & Shehata, 1992; Weaver & Frederick, 2012). Furthermore, both
the endowment effect and diminishing marginal value paradigms are typically studied with a smaller number of trials per participant than were used in the current research. Participants in such studies also tend to be relatively easy to recruit (e.g., undergraduate students, healthy adults). Because the current research involved comparisons among groups and because participants for the hoarding group are typically difficult to recruit, in order to maximize the power of analyses, a within-subjects design was used in the current research.

One possible consequence of using a within-subjects design and including a larger number of trials per participant in the current research is that there may have been a tendency for participants to start giving consistent values for particular items. In a between-participants design, valuing biases may be displayed without participant awareness, whereas, in a within-participants design, participants may observe their tendency to give biased responses and make instantaneous “corrections”, perhaps motivated by social desirability.

For example, in the DMVT, after a participant had said that a pair of socks was worth $2.00, she may have continued to state $2.00 as the value for the pair of socks, regardless of whether she had a single pair of socks or whether she was stating her value for a 5th pair of the same socks. This differs from real-life decisions, in which a person typically considers buying or keeping a pair of socks without having explicitly valued the same pair of socks a few minutes earlier. Likewise, in the EET, after a participant said he would be willing to pay $0.25 for a community newspaper, he might have been more likely to ask for $0.25 to sell
the same item, whereas he may have asked a different selling price if he had not first considered his buying price.

If participants in fact used their own responses as benchmarks for future responses, the diminishing marginal value and the endowment effect would both be reduced. This could help to explain why these effects were not found for some items in each of the tasks and why differences were not found among the groups.

Another adaptation that was made to the endowment effect task was that I gave participants money for each buying trial, whereas, in previous research, participants have used their own money. This adaptation was made in an attempt to standardize the budget constraint across participants (i.e., all participants had the same resources with which to buy an item). Thus, any bias that may have been due to the amount of money participants had available for the purchase of items was removed, at least within the context of the study).

An unintended consequence of this adaptation may, however, have been to reduce participants’ incentives to report true values. The loss aversion hypothesis states that there is a strong preference for people to prefer avoiding losses to acquiring gains (Kahneman & Tversky, 1984). So, the perceived loss of unexpectedly being asked to spend some of one’s own money would be greater than the perceived benefit of unexpectedly receiving some money from an experimenter that can be used to buy items. Thus, the perceived worth of one’s own money is greater than the perceived worth of gifted money, and the perceived cost of overspending with one’s own money would be greater than the perceived cost of spending money that has only recently been gained (i.e., given
to the participant by the experimenter). In fact, Thaler and Johnson (1990) observed such a “house money effect” whereby a windfall gain is spent more casually than other forms of money. Thereby, the incentive for participants to report true values for items may have been reduced because, in the current research, they were using recently gifted money to do so rather than considering the potential loss of money they brought to the study themselves.

Finally, the failure to find an endowment effect for the chocolate bar is somewhat surprising because it is an item for which an endowment effect has been found in previous research (e.g., Kahneman et al., 1990; Knetsch, 1989; List, 2003; Weaver & Frederick, 2012). However, three of these studies used reluctance to trade paradigms, which tend to yield large endowment effects (Kahneman et al., 1990; Knetsch, 1989; List, 2003). In fact, in the current research, I made the choice to not use a reluctance to trade paradigm in order to avoid a potential ceiling effect that could have interfered with observing differences among the groups. Weaver and Frederick (2012) also observed an endowment effect for a chocolate bar. They examined the size of endowment effect using the ratio of selling to buying prices. Although the difference between selling and buying prices for the chocolate bar in their study appear significantly different, they do not report results of such an analysis. So, although the research supports the use of a chocolate bar as an item for which an endowment effect has been observed in previous research, the more stringent test of a significant different between buying and selling prices that was used in the current research, as compared to the tests that have been used in previous
research, may help to explain the lack of significant endowment effect for the chocolate bar in the current research.

There has been much less empirical investigation of diminishing marginal value than of the endowment effect. Diminishing marginal value is conventionally defined as a higher marginal value at a low endowment level (e.g., 1 unit) than at a higher endowment level (e.g., 5 units; Horowitz et al., 2007). A more stringent definition that was used in the current research is that these values are significantly different than each other. In previous research, the less stringent test has universally been met, whereas, the more stringent test is met in only some cases (Horowitz et al., 2007). In the current research, I observed that, for all but one item (the key chains) participants valued one unit of the item significantly more highly if it was the only one they had than if they had four others. This can be considered a weak test of diminishing marginal value because intermediate endowment levels were not considered. In a stronger test of diminishing marginal value, taking intermediate endowment levels into account, the data from two items (the flashlights and the key chains) did not conform to diminishing marginal value. For these items, the values for one unit at intermediate endowment levels were smaller than values given for the 5th units. The other four items exhibited diminishing marginal value as expected.

Again, it is difficult to explain why some items exhibited diminishing marginal value whereas others did not. Items that did exhibit diminishing marginal value had (e.g., mugs) and had not (e.g., socks) been tested in previous research. Likewise, items that did not exhibit diminishing marginal value also had
(i.e., flashlights) and had not (i.e., key chains) shown diminishing marginal value in previous research. Further, the items were all of similar market value and appeared to be equally useful and desirable household goods. Further consideration is given below to the types of items used in the current research.

Before turning to a consideration of the types of items used in the current research, however, there is one final issue from the perspective of the theory of value and behavioural economics that deserves consideration. Figure 2 shows two components to the model of accumulation: the diminishing marginal value curve and the perceived cost line. Together, these two components predict the number of items that will be accumulated. The current research focused on abnormal valuing, although abnormal perceived cost may also contribute to excessive accumulation of items in hoarding disorder.

Imagine that, instead of the marginal value curve shifting upward due to overvaluation of items, as was represented in Figure 2, the perceived cost line shifted downwards due to underestimation of perceived cost (see Figure 5). Such a shift in perceived cost would result in similar excess accumulation of items as would a shift in item valuation. Therefore, another possible explanation for the failure to find overvaluing of low- to moderate-cost everyday household items among individuals with hoarding problems is that the tendency to accumulate large quantities of items may be due to a different valuing process – underestimation of the costs (e.g., space, time or money) of acquiring and keeping the items rather than overestimation of their value to the individual. An interesting avenue for future research would be to simultaneously consider the
roles of perceived value and perceived cost in predicting the accumulation of items and whether the interaction of these two components of the model differs among diagnostic groups.

**Figure 5. Consumption of Items by Non-Hoarders and by Hoarders with Underestimation of Cost**

![Diagram showing consumption of items by non-hoarders and hoarders with underestimation of cost.]

4.2.2 **Psychology of ownership.** One perspective that can be taken on hoarding is that it is a problem of item ownership. Individuals with hoarding disorder often engage in excessive acquisition such that they increase the number of items they own. And, difficulty discarding, which is commonly more severe for personal possessions than for other people’s items, is extreme in hoarding disorder. So, one question that could be asked about the current
research is whether the operationalization of ownership adequately represented the aspects of ownership that are problematic in hoarding disorder. First, I consider implications of the way that ownership was operationalized in the current research. Then, I discuss features of the items that seem relevant to item ownership as it is experienced in hoarding disorder.

Certainly in “mere ownership” (Beggan, 1992) and behavioural economics paradigms, giving items to participants and allowing them to examine them for as long as desired combined with a statement of ownership, as was done in the current research, has been more than sufficient to induce observable ownership effects. These methodologies have, however, not been previously studied among individuals with hoarding disorder. So, the possibility remains that they may not induce the type of ownership that is problematic in hoarding disorder. I discuss this further below.

Mere ownership methodologies have, for example, been sufficient to increase recognition of self-owned items as compared to other-owned items (Cunningham, Turk, Macdonald, & Macrae, 2008; Cunningham, van den Bos, & Turk, 2011; van den Bos, Cunningham, Conway, & Turk, 2010). They have also resulted in higher implicit preference (Huang, Wang, & Shi, 2009), and higher activation of brain areas related to attention and reward, for self-owned versus other-owned items (Turk, van Bussel, Brebner, et al., 2011; Turk, van Bussel, Waiter, & Macrae, 2011). These studies have, however, not specifically examined the effects of ownership on perceived value as I have conceptualized it in my model of abnormal valuing in hoarding disorder.
Those studies that have examine the effects of ownership on item valuation specifically have found stronger ownership effects on item valuation for longer duration of ownership (Strahilevitz & Loewenstein, 1998) and for physical possession of the item rather than simply being told that the item is owned (Reb & Connolly, 2007). Perhaps the ownership procedures used in the current research (i.e., relatively short duration of ownership before valuing, uncertain ownership, removal of items at the end of each trial) were too similar to mere ownership procedures and did not adequately represent the type of ownership that increases item valuation in hoarding disorder.

In addition to what has already been mentioned, choice of and sentimental attachment to items are interconnected aspects of ownership that may be particularly important to ownership in hoarding disorder. Individuals who engage in excessive acquisition, which contributes to hoarding disorder in most cases, report great pleasure in acquiring “the perfect find”. They do not bring home just any items but rather those that are particularly valuable to them for some reason. Sometime these items fit with a particular area of interest (e.g., restoring old furniture), sometimes they are considered to be particularly useful (e.g., parts for old electronic equipment), and sometimes they are considered to be very beautiful (e.g., glass beads for making jewellery). In all of these examples, the items have particular qualities that make them more valuable to the person acquiring them rather than being ordinary exemplars of everyday household items as were the items used in the current research.
An attempt was made in the current research to capture idiosyncratic areas of interest with the maximum perceived value index. This variable indicated the highest ratio of perceived value to market price for a single item for each participant. Thus, the maximum perceived value index variable measured the extent to which the most idiosyncratically appealing item was overvalued. This variable was, however, created from selling prices for items that were selected by the experimenter. Because participants did not freely choose which items to rate, it could be that none of the items were ones that they would particularly overvalue. It is unlikely that everyday household items chosen by an unknown experimenter could capture the deeply personal ways that items are given exaggerated value as sources of comfort and avenues for identity formation in hoarding disorder. This is an under-researched topic in the literature on hoarding disorder that certainly deserves further attention.

As discussed above, results of the current research show that hoarding symptoms and hoarding cognitions predict an increased tendency to attribute value to items of a sentimental nature that belonged to someone else. This finding can be interpreted as “hypersentimentality” in action. Most people would not attribute value to items of a sentimental nature that belonged to someone else but individuals with increased levels of hoarding symptoms and hoarding cognitions were particularly sensitive to these stimuli. They attributed value to these items that have a mere hint of sentimentality, whereas most people would consider these items to have increased value only for those individuals who were related to the items in some way. This valuing of items of a sentimental nature is
another aspect of ownership that warrants further consideration in future research.

To summarize, the methodology used in the current study operationalized some aspects of ownership as ownership has previously been operationalized in basic ownership research and behavioural economics. Ownership is, however, a complex phenomenon and paradigms do not yet exist for studying ownership in relation to hoarding disorder. Sentimental attachment to items, as well as the ways in which items are used as a source of comfort and in identity formation, may be aspects of ownership that are particularly important to ownership as it contributes to problematic overvaluing of items in hoarding disorder. Because no one is yet studying the psychology of ownership in relation to hoarding, the current research makes a contribution by beginning to examine this phenomenon. Other avenues for examining effects of ownership in hoarding disorder are indicated and are discussed below.

4.2.3 Sample characteristics. An important contribution of the current research was examination of the research questions in a community-based sample of individuals with hoarding disorder. One potential concern about the current research could be that no significant differences were found among the groups because the individuals in the hoarding group did not adequately represent individuals with hoarding disorder.

In fact, individuals in the hoarding group met key diagnostic criteria for hoarding disorder on the basis of a clinical interview. In contrast, in previous research, compulsive hoarding has often been assessed using self-report
questionnaires, some of which were designed to measure compulsive hoarding (e.g., SI-R; Bulli et al., 2014) and some of which were designed to measure OCD (e.g., Yale-Brown Obsessive Compulsive Scale; Frost et al., 2000). Some research has selected participants based on self-identification as someone who has problems with excessive accumulation of items (e.g., Frost & Gross, 1993). The current research is, therefore, a marked improvement over many previous studies.

In addition, hoarding was measured using a multi-method design. A clinical interview, two self-report questionnaires, and a pictorial rating scale were all used to measure the same (or a very closely related) construct. Scores in the hoarding group on each of these measures were similar to scores obtained in previous research. Moreover, participants in the hoarding group scored higher than participants in the subclinical group, who in turn scored higher than participants in the healthy control group. In addition, all of these measures demonstrated good to excellent internal consistency and convergent validity. Discriminant validity of these measures was also established in relation to symptoms of depression and anxiety. The gender and age compositions of the hoarding group were also comparable to those in other studies (e.g., Frost et al., 2004; Tolin & Villavicencio, 2011). These results suggest, therefore, that null findings cannot be attributed to lack of severity in, or imprecise definition of, the hoarding group.

A “subclinical” group was included in the current research so that differences among groups could be used to differentiate vulnerability factors for
hoarding disorder from clinical features or sequelae. That is, if differences had been found between the healthy control and hoarding groups, and the subclinical group had performed like the hoarding group, it would have suggested that abnormal valuing is a vulnerability factor for hoarding disorder. In contrast, if the subclinical group had performed more like the healthy control group, it would have suggested that abnormal valuing is a feature or consequence of hoarding disorder.

Although these reflections were not possible in the current research because of the lack of significant differences among the groups, it is still recommended that subclinical groups be included in future research. Reasons for this position are provided below.

4.3 Directions for Future Research

Several of the directions for future research that are mentioned or implied in the implications section above are reprised and elaborated upon below.

4.3.1 Economic principles. An important challenge in conducting the current research was that there has been limited empirical investigation of some of the economic principles used in my theory of item valuation in hoarding disorder. For example, there appear to be only two empirical papers on diminishing marginal value, although diminishing marginal utility is a fundamental principle in economics. Moreover, the current research is the first known attempt to investigate these principles among individuals with hoarding disorder. One result of this state of the literature is that there were few methodologies to choose
from when considering how to operationalize these principles in the current clinical sample.

Also, statistical tests of diminishing marginal value and the endowment effect in the economics literature are, in many cases, less stringent than the tests that would be standard in psychology research. For example, both diminishing marginal value and the endowment effect have been tested in the economics literature on the basis of any difference between two prices. A more stringent test that might be expected in the psychology literature is that these differences are statistically significant. These more stringent tests were operationalized in the current research, which revealed that, at least in some cases, these effects (diminishing marginal value and the endowment effect) are not as robust as they might appear to be on the basis of research in the field of economics.

These observations point to a need for further empirical investigation of the endowment effect and, particularly, diminishing marginal value in the economics literature. Although there is a solid foundation of theoretical work concerning these basic principles, empirical validation is limited. Economic research in this area could then support application of these fundamental principles to investigations of phenomena in other fields.

4.3.2 Eliciting “true” values. One important issue when conducting examinations of item valuation is how best to elicit “true” values from participants. This is an area where economics has made a significant contribution with the BDM procedure, which has been applied across disciplines. As discussed above,
however, the current research suggests several directions for future research with regard to eliciting true values from participants, which are discussed below.

First, a couple of adaptations that were made to valuing tasks in the current research (i.e., within-subjects design and giving participants money for buying trials in the EET) may have contributed to bias in the reporting of item values. Returning to a between-subjects design and asking participants to spend their own money to buy items might alleviate this problem. Rather than the researcher providing participants with money for buying trials in order to standardize the budget constraint across participants, participants could receive their study honorarium at the outset of the study. This would remove the "unexpected windfall" nature of the money they would be using to buy items. Alternatively, the endowment effect could be examined with a willingness to trade paradigm, which would remove the exchange of money from the task.

Also, procedures that would make the valuing tasks less complex could reduce reliance on heuristics and contribute to less bias in the reporting of item values. This could be achieved by asking participants to value fewer items and to engage in only one type of valuing task, rather than three. Given that participants with hoarding disorder were not as difficult as expected to recruit, multiple studies with fewer items each could be considered. Participants might also find it less complicated to engage in goods-goods trades. In this paradigm, participants would be asked how many units of one item they would be willing to trade for a certain number of units of another item. This could serve to reduce the extent to which participants might refer to a heuristic like the market price of the item.
Another direction for future research that might increase participants’ incentives to report true values would be to use higher cost items. With higher priced items the incentive to report true values would be higher because the potential cost of reporting untrue values would be greater (i.e., the cost of not getting the iPod that one wants is greater than the cost of not getting the box of cereal that one wants).

Further, the use of personal items might enhance elicitation of true values from participants. If participants were being asked how much they would ask to sell a personal item to the experimenter, there is more incentive to report a true value than if the participant is being asked how much they would ask to sell an item they have just been given. Directions for future research concerning the types of items used are discussed further below.

4.3.3 Items. A key result in the current research was that hoarding symptoms and hoarding cognitions both independently predicted the number of items of a sentimental nature and worthless items that were attributed with some value. This is a result that warrants further investigation.

In the current research participants were provided with a set of experimenter-owned items to value in order to standardize items across participants. This was a suitable first step in a preliminary examination of a novel theory. However, the discussion above suggests that items chosen by participants, or that are of sentimental value to them, might better represent the types of items that are typically problematic in hoarding disorder.
There are several ways that this could be operationalized in future research. Participants could choose “favourite” items from a set provided by the experimenter and provide values for those, the experimenter could ask participants to bring personal items into the lab, or the experimenter could conduct research with participants' items in participants' homes. The current research used a methodology that was quite tightly controlled, whereas, future research might like to use a more ecologically valid methodology.

Further, using higher cost items might also be more likely to capture attenuated diminishing marginal value. For example, the difference in value of a second pair of socks vs. a fifth pair of socks may not be very great. For such low cost and useful items, individuals might not exhibit significant diminishing marginal value until they have 15 or 20 pairs. In contrast, most people would exhibit fairly steep diminishing marginal value for a second sewing machine as compared to a first, whereas, an individual with hoarding disorder might exhibit very little diminishing marginal value for sewing machines between one unit and two. They might not exhibit diminishing marginal value for sewing machines until the fourth or fifth unit is reached.

The difference between pairs of socks and sewing machines can be conceptualized as the difference between high and low cost items or it can be conceptualized as the difference between the types of items that people typically only have one of and the types of items that people typically have quite a few of. None of the items used in the current research were the types of items that people usually only have one of.
These observations suggest that a useful next step would be to establish the diminishing marginal value functions of various household items. These items should include: exemplars of those that are typically hoarded, some that are typically owned in single units and others that are typically owned in multiples, and a range of market prices. It might also be helpful to differentiate diminishing marginal value curves for items provided by the experimenter from those for participants’ personal items. This would help to establish items for which there are strong diminishing marginal value functions and those for which the functions are weak. Items for which the diminishing marginal value functions are typically strong could then be used in future research to examine moderation of diminishing marginal value by diagnostic group.

4.3.4 Ownership. As noted above, hoarding can be conceptualized as a disorder of item ownership. Therefore, the operationalization of ownership in research on item valuation in hoarding is an important feature of the research.

One direction for future research that would be a concrete operationalization of ownership and, as previously discussed, would have other benefits in the context of research on hoarding, would be to use participants’ own items. Another concrete operationalization of ownership would be to use a procedure like the one used by Preston and colleagues (2009) whereby participants chose which items to put into a shopping cart and a shopping bag. Given the research suggesting that touch increases one’s sense of ownership and perceived value of items (Peck & Shu, 2009) and given that touching objects appears to be an important aspect of the phenomenon of hoarding and of
everyday decisions to discard or not, I would adapt the procedure by using real items.

Research also suggests that duration and certainty of ownership both increase the value attributed to items. So these would be important aspects of methodology to incorporate into future studies. For example, Strahilevitz and Loewenstein (1998) manipulated duration of ownership by asking participants to provide item ratings immediately upon receiving the item and various durations of time thereafter. Certainty of ownership is not precluded under the BDM procedure and could be operationalized by guaranteeing that participants would take home items they chose during the study.

Finally, basic research on ownership – factors that contribute to and mitigate it – is another area of basic research that deserves further attention. Like further basic empirical validation of the economic principles used in the current research, basic ownership research could then inform investigations of how sense of ownership may be different among individuals with hoarding disorder.

4.3.5 The sample. There are two aspects of the sample used in the current research that indicate directions for future research.

First, the clinical interview used to diagnose hoarding disorder in the current sample is a novel instrument that was developed before the final criteria for hoarding disorder were published. The current research supports its validity as a diagnostic instrument. It is not, however, the only diagnostic interview available (for example, see Nordsletten et al., 2013). It would, therefore, be
useful in future research to give careful consideration to which diagnostic
instrument is used, particularly now that formal diagnostic criteria are available.

Future research should also continue to consider the features and
definition of subclinical hoarding. This will help to specify clinically significant
hoarding disorder and could contribute to a better understanding of vulnerability
factors. In the current research, the subclinical group was quite clearly
differentiated from both the healthy control group and the hoarding group,
suggesting that it is a valid category in the distribution of hoarding
psychopathology. Also, hoarding seems to be progressive in that many
individuals report experiencing subclinical levels of some symptoms quite early in
life that worsen over time but don’t reach clinical levels until many years later.
Being able to identify vulnerability factors for hoarding disorder and differentiating
them from sequelae of the disorder would be an important contribution to current
theories of hoarding, which do not tend to specify this distinction. Finally,
increased specificity in the definition of subclinical hoarding and differentiation of
it from clinically significant hoarding would contribute to refining the boundaries of
the disorder. This would be a worthwhile endeavour given that it is a new
diagnosis and, as such, the diagnostic boundaries are still relatively under
formulated.

4.4 Conclusion

In the current research I proposed a novel model of abnormal valuing in
hoarding disorder. Drawing on the theory of value from economics, this model
proposed that excessive accumulation and difficulty discarding items could be
explained by overvaluing of everyday household items, attenuated diminishing marginal value, and an enhanced endowment effect. These hypotheses were tested using methods from behavioural economics among individuals with hoarding disorder, individuals with subclinical levels of compulsive hoarding, and healthy controls. There were no significant differences among the groups, but hoarding was associated with attributing value to a larger number of sentimental and no-cost items.

This result points to the salience of certain types of items in hoarding. Individuals with hoarding disorder do not simply acquire and keep excessive quantities of any and all items. They seem to be particularly adept at finding value in items that others would consider to be worthless. My results suggest that sentimental attachment to items or “hypersentimentality” contributes to perceiving value in items when others would not. That hoarding was associated with valuing a larger number of items of a sentimental nature (towards which most people would not feel sentimental unless the item were their own) suggests that individuals with hoarding disorder are particularly sensitive to stimuli with even a hint of sentimentality. This finding could have implications for treatment strategies by suggesting the utility of a focus on helping individuals with hoarding disorder to define the healthy boundaries of sentimental attachment to things.

That hoarding was associated with attributing value to a larger number of items that others would consider to be worthless suggests that individuals with hoarding disorder may be particularly adept at finding any small amount of value that remains in an item. This could be a case of ex-consequentia reasoning
whereby individuals infer importance from their emotional reactions (Arntz, Rauner, & van den Hout, 1995). Indeed, hoarding is characterized by extreme emotional difficulty parting with possessions, and it has been argued that difficulty parting with possessions is central to the accumulation of possessions (Frost & Hartl, 1996). It could be that this emotional attachment to items makes them seem more valuable than they otherwise would. This would be an interesting question to pursue in future research.

Beyond what these results may say about the psychopathology of hoarding, application of the theory of value and methods from behavioural economics to the issue of hoarding permitted several observations about the theory and methods themselves, and about how they relate to the psychopathology of hoarding. First, the theory of revealed preferences suggests that any substitute good, including money, can be used as a relative measure of value. Although results of the current research did not fully support my hypotheses, I have argued that cash value may be inadequate to reveal all the aspects of preference that occur in hoarding disorder and that heuristics may interfere with the accurate translation of value into dollar terms.

Heuristics and aspects of the psychopathology of hoarding may also interfere with the universal validity of the BDM mechanism. Despite the incentives offered by this mechanism, individuals may have other reasons for reporting untrue values for items. For example, participants in the current study reported that they were reporting lower than true values for items because they were aware of their hoarding problems and did not want to take more items home.
with them, although they really liked the items and felt urges to acquire them. Participants might also have undervalued items in response to perceived social desirability. That is, having acknowledged that their clutter or difficulty discarding was problematic in order to participate in the study, they might have experienced shame or embarrassment over their intense desire to acquire additional items and adjusted their valuing in order to meet perceived experimenter expectations. These are aspects of the psychopathology of hoarding that the BDM mechanism might not be able to regulate.

Finally, the standard methods used in behavioural economics may not be sufficient to operationalize ownership as it contributes to valuing in hoarding disorder. Even though mere ownership exerts measurable psychological effects, my research intimates that something more that mere ownership is disrupted in hoarding disorder, particularly with respect to item valuation. Aspects of ownership such as the power of objects to evoke sentimental feelings, convey a sense of security, and solidify self-identity may be more fruitful avenues for future research into abnormal valuing in hoarding disorder. Taken together, these observations from the current research suggest concrete next steps in future research on the topics of behavioural economics and ownership as they relate to hoarding disorder.

Overall, this research establishes a foundation for a line of inquiry into abnormal valuing in compulsive hoarding. Valuing processes are intimately connected to excessive accumulation of items and difficulty parting with possessions, which are the distinctive features of hoarding disorder. A better
understanding of how valuing contributes to compulsive hoarding would serve to refine existing models of the disorder and potentially define new avenues for treatment. For a disorder that is so poorly understood, affects a considerable number of people, and has significant costs and impacts, further research on this topic would be a worthwhile endeavour.
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Appendix A

Demographics Questionnaire

For each item, please put a mark in the box next to the response that applies to you or fill in the blank with the appropriate number. Please indicate only one answer for each question. If you have any questions, please ask the experimenter for assistance.

1. What is your sex?
   □ Male
   □ Female
   □ Other

2. How old are you?
   _____ years old.

4. What is the highest level of education that you have completed?
   □ Elementary or middle school
   □ High school or equivalent (e.g., GED)
   □ College diploma
   □ Bachelor's degree
   □ Graduate or professional degree

5. What is the highest level of education that your mother completed?
   □ Elementary or middle school
   □ High school or equivalent (e.g., GED)
   □ College diploma
   □ Bachelor's degree
   □ Graduate or professional degree

6. What is the highest level of education that your father completed?
   □ Elementary or middle school
   □ High school or equivalent (e.g., GED)
   □ College diploma
   □ Bachelor's degree
   □ Graduate or professional degree

7. When you were growing up, what was your family’s socioeconomic status?
   □ well-off
   □ about average
   □ poor

8. When you were 10 years old, how many people lived in your household? _____

9. When you were 10 years old, how many bedrooms were there in your home? _____
10. What is your current annual income?*

- [ ] Less than $10,000
- [ ] $10,000 to $19,999
- [ ] $20,000 to $49,999
- [ ] $50,000 to $99,999
- [ ] $100,000 +

* If you are the only adult in your household, please indicate your individual annual income. If you live in a household with two or more adults who share their incomes, please indicate your share of the total (e.g., You live in a household with one other adult. Together, your incomes total $100,000 and they are shared equally between the two of you. Your annual income is $50,000). If you are a dependent, please indicate the amount of money you live on annually. Please include income from all sources.
## Appendix B

### Item Valuation Task Items

<table>
<thead>
<tr>
<th>Item Category</th>
<th>Moderate Cost ($7-$12)</th>
<th>Low Cost ($3-$6)</th>
<th>Very Low Cost ($1-$2)</th>
<th>No Cost (worthless)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office supplies</td>
<td>stapler</td>
<td>spiral bound notebook</td>
<td>roll of packing tape</td>
<td>dried up old pen</td>
</tr>
<tr>
<td>Clothing/accessories</td>
<td>toque</td>
<td>rain poncho</td>
<td>bandana</td>
<td>sock with a hole</td>
</tr>
<tr>
<td>Reading material</td>
<td>paperback novel <em>(Catcher in the Rye)</em></td>
<td>current magazine <em>(Maclean’s)</em></td>
<td>current newspaper <em>(Vancouver Sun)</em></td>
<td>tourist pamphlet</td>
</tr>
<tr>
<td>Toiletries</td>
<td>tube of body lotion</td>
<td>travel toothbrush and toothpaste set</td>
<td>bar of soap</td>
<td>used toothbrush</td>
</tr>
<tr>
<td>Food</td>
<td>bottle of olive oil</td>
<td>box of cereal</td>
<td>can of soup</td>
<td>used tea bag</td>
</tr>
<tr>
<td>Tools/hardware</td>
<td>tape measure</td>
<td>dust pan and brush</td>
<td>BBQ lighter</td>
<td>rusty hardware</td>
</tr>
<tr>
<td>Containers</td>
<td>food storage jar with lid</td>
<td>mug</td>
<td>spice jar</td>
<td>used take out container</td>
</tr>
<tr>
<td>Multiples</td>
<td>package of batteries</td>
<td>bag of tea lights</td>
<td>box of paperclips</td>
<td>bag of used twist ties</td>
</tr>
<tr>
<td>Sentimental items</td>
<td>picture frame withhold photo</td>
<td>small cuddly toy</td>
<td>first place ribbon</td>
<td>birthday card with greeting</td>
</tr>
</tbody>
</table>