

**THE EMOTIONAL LIVES OF OBJECTS:
THE ROLE OF AFFECTIVE ANTHROPOMORPHISM IN HOARDING DISORDER**

by

Brent A. Stewart

B.A., Simon Fraser University, 2008

M.A., Simon Fraser University, 2015

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The following individuals certify that they have read, and recommend to the Faculty of Graduate and Postdoctoral Studies for acceptance, a thesis/dissertation entitled:

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submitted by Brent Stewart in partial fulfillment of the requirements for

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in Psychology

Examining Committee:

Sheila Woody, Clinical Psychology
Supervisor

Ara Norenzayan, Social/Personality Psychology
Supervisory Committee Member

Steve J. Heine, Social/Personality Psychology
Supervisory Committee Member

Additional Examiner

Additional Supervisory Committee Members:

Supervisory Committee Member

Supervisory Committee Member

Abstract

Our lives are interwoven with artefacts of our own creation. While these artefacts are (objectively speaking) inanimate, research on anthropomorphism suggests that we sometimes perceive them to have a mind. For people who hoard this tendency to anthropomorphize their possessions is particularly heightened. Hoarding is characterized by difficulty discarding possessions of little to no apparent value, excessive acquisition of objects, and levels of clutter in the home that cause functional impairment and distress. While it is clear that strong emotional reactions to discarding objects play a role in the development and maintenance of hoarding, it is less clear what the nature of these emotions are. The heightened anthropomorphism associated with hoarding suggests that some of these emotions may be social in nature. People who hoard may find it difficult to part with possessions because they have empathy and concern for their objects. Since much of the research on anthropomorphism has focused on more cognitive aspects of social cognition, I created a scale – the Empathy and Concern for Objects scale (or ECO) – to measure this affective anthropomorphism. Across two studies (N=704), I assessed the psychometric properties of the ECO, its discriminant validity, association with hoarding, and I provide an initial test of models that could explain this association. The ECO demonstrated good psychometric properties, correlated moderately with other measures of anthropomorphism, predicted self-reported hoarding, and mediated the relationship with hoarding and negative affectivity, loneliness, and general empathy.

Lay Summary

Hoarding is a surprisingly common condition that can have dire consequences for the person who hoards and the community at large. Hoarding is characterized by difficulty parting with possessions, acquiring an excessive number of objects, and a substantial amount of clutter that prevents people from using their home in ways they would like. When people who hoard attempt to discard some of their possessions, they tend to experience strong negative emotions. People who hoard also tend to talk about their possessions as if they were alive. This thesis explores the possibility that part of the reason why people who hoard find it so difficult to discard objects is because they have empathy and concern for them. For this purpose, I developed a scale to measure such emotions called the Empathy and Concern for Objects scale (or ECO). The more hoarding behaviours participants reported, the higher they scored on the ECO.

Preface

The work presented in this thesis is the unpublished, original work of Brent Alan Stewart. In collaboration with Dr. Sheila Woody, I was responsible for developing this research program, designing the studies, analyzing the data, interpreting the results, and writing the thesis. The research presented in this thesis was conducted with the permission of the University of British Columbia Office of Research Studies Behavioural Research Ethics Board, certification number H13-01354.

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List of Abbreviations

CFA	Confirmatory Factor Analysis
EFA	Exploratory Factor Analysis
MTurk	Amazon Mechanical Turk
ECO	Empathy and Concern for Objects Scale
RMSEA	Root Mean Square Error of Approximation
TLI	Tucker-Lewis Index
VFI	Variance Inflation Factor

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Chapter 1: Introduction

Artefacts are the children of our cultural success. They clothe our bodies, allow us to create works of art, and transport us from place to place far faster than our hominid ancestors could have imagined. In many ways, these objects of our own creation are the water in which we swim. Given how close we are to them, it would not be surprising if their strange presence in our lives occupied a type of blind spot. The aim of this thesis is to, in a small way, shed some light on this curious relationship we have to our objects. One way to approaching this task is to start where things go wrong. In hoarding disorder, we see our relationship to objects become problematic; for people who hoard, the sheer number of possessions that they own prevents them from using their home in the ways we all enjoy, strains their relationship with close others (Grisham, Steketee, & Frost, 2008), and can – in extreme cases – pose a serious health risk to the community (Frost, Steketee, & Williams, 2000). Seeing the tragic consequences that hoarding behaviour can cause, it is hard not to be incredulous. *Why don't they simply throw it out?* Part of the answer to this question has to do with the strong negative emotions occasioned by the task of discarding possessions (Shaw et al., 2015) (even ones that most people would throw away without a second thought – such as an old shoe box or a bag full of plastic bags). The question then becomes: *What is the nature of these strong negative emotions?* Part of the answer may lie in our tendency to perceive minds in inanimate objects, the weather, and other non-minded things and forces – otherwise known as ‘anthropomorphism’. When we argue with our car that refuses to start on a cold morning, or beg our computer to unfreeze the document we were working on, we are first attributing a mind to these inanimate objects and then entering into a (combative) relationship with them. There is some initial evidence (Timpano & Shaw, 2013;

Neave et al., 2016) that people who hoard tend to attribute mind more broadly than those who do not.

Could the strong emotions in hoarding be a product of perceiving minds in objects? If we take more mundane cases, this certainly seems like a possibility. When we see someone catch their finger in a car door, we feel their pain; when we see a person sobbing in public, we feel concern for them. Perhaps anthropomorphism also involves similar emotional reactions. As opposed to the more cognitive process of perceiving a mind, I call these emotional reactions *affective anthropomorphism*. It is an open question as to how many of our social emotions this may include; to begin I focus on two: Our propensity to feel what we perceive another mind feels (or ‘empathy’; Jordan, Amir, & Bloom, 2016) and our tendency to worry about the welfare of another conscious creature (or ‘concern’; Davis, 1983). Affective anthropomorphism may help to partially explain the strong, negative emotional reactions that maintain hoarding behaviours; people who hoard may feel empathic pain at the thought of an object being thrown in a dumpster and feel concern for the fate of an object they abandon at a thrift store.

1.1 Mind in Nature

If a tree falls in the forest – but no one is around to hear it – does it make a sound? The reason why this old koan-esque question is puzzling is because it forces us to draw a line between what philosophers call ‘primary’ and ‘secondary’ qualities (Nolan, 2012). Primary qualities are the basic, physical properties that compose our universe: charge, spin, mass, and the like; secondary qualities, on the other hand, include subjective properties such as emotion, sensation, and thought. An intuitive way to pose the question of primary and secondary qualities is to ask what properties would disappear if all of the conscious, minded beings in existence were to suddenly vanish. In the case of the lone tree, the question asks us to shuffle the property of

‘sound’ to either side of the primary-secondary quality divide. To answer this, one needs to understand what sound essentially *is*; is it simply the undulation of air molecules? Or perhaps the movement of such particles stimulating the auditory nerves in an ear connected to a brain that responds in a certain way?

This runaway set of questions, occasioned by such a seemingly innocuous puzzle, hints at a gap in our understanding of the mind. The state of the scientific and philosophical landscape supports this point. Many esoteric – possibly redundant – technical terms jostle for position; a short subset includes subjectivity, phenomenology, qualia, phenomenal consciousness, access consciousness, and the *what-it-is-like-ness* of experience. In addition to this multiplication of entities, expert opinion is split dramatically about how far the scientific enterprise is along this path – with some arguing that we’ve already explained what mind is (Dennett, 2007), others cautioning that such an explanation may require a dramatic redraft of our view of the basic physical forces (Chalmers, 1996), to still others claiming that an understanding of the mind is necessarily beyond our grasp (McGinn, 1998). What is certain, however, is that we are faced with a *problem of scope*. That is, we have no clear answer as to how far mind stretches over nature. I have a mind – I experience it directly; however, I have to infer your mind. Researchers can look to homologies, both in behaviour and brain structure, to make a reasonable claim that mind stretches over many other vertebrates such as mammals and birds. As we work our way down the phylogenetic tree, most people will withhold attribution of a mind to creatures without some sort of nervous system such as plants. Still, plants have something homologous to a nervous system (Trewavas, 2016), and display a complex array of adaptive behaviour. Such decisions begin to seem like opinion because we lack a firm understanding of the nature of mind on which to ground such conclusions. In the face of this, one approach is to treat ‘mind’ as a

continuous property and cast it over the whole existence. ‘Panpsychism’ (or literally ‘mind everywhere’ in Greek; Chalmers, 1996) is the claim that all things – from quarks to stars to bacteria – are conscious to some degree. While this saves us from having to draw a firm line, dividing the world into minded and non-minded things, it raises (many) more questions than it answers and, as a result, is not a widely held view in the philosophy of mind, neuroscience, or the behavioural sciences.

1.2 Perceiving Mind in Nature

While the problem of scope remains an enduring scientific problem, humans already possess a set of evolved abilities to sense the presence of a mind in the environment. As humans, one of the most salient aspects of our environment is other people. Social relationships are not only sources of pleasure and meaning – strong relationships are also associated with a decrease in mortality (Holt-Lunstad, Smith, & Layton, 2010) and the ‘need to belong’ to a social group has been theorized to be a fundamental human motivation (Baumeister & Leary, 1995). Key to maintaining such relationships is understanding what is going on in the mind of close others. Given this, it is not so surprising that we are natural born dualists and treat the world as if it were composed of two radically different types of stuff: mind and body (Bloom, 2004). While bodies are publically observable, minds have the ability to hide away their contents (Wegner & Gray, 2017). In the face of the mercurial nature of other minds, it is no wonder that we have evolved a diverse set of abilities that are devoted to understanding their contents; this Swiss army knife of different capacities flies under the broad banner of ‘social cognition’. Social cognition can be split into two neurologically distinct – but functionally interwoven – sets of processes: socio-cognitive and socio-affective (Kanske, 2018; Preckel, Kanske, & Singer, 2018). Socio-cognitive processes include mind perception (the ability to perceive the presence of a mind in the

environment; Epley & Waytz, 2010) and perspective taking (the active engagement in understanding the contents of another mind; Davis, 1983). On the other side of the divide, socio-affective processes include empathy (or sharing in the emotions of other minds; Jordan, Amir, & Bloom, 2016) and concern (or worry for the wellbeing of other minded beings; Davis, 1983).

While this distinction encompasses a large swath of the current research landscape, it is by no means exhaustive. Moreover, in research on social cognition – perhaps more so than other areas in psychology and neuroscience – the semantics of our concepts is a contested issue. For example, some researchers (Baron-Cohen & Wheelwright, 2004) suggest that we use ‘empathy’ as a superordinate category and distinguish between the emotional, prosocial type (‘affective component’) and cold, calculating variety (‘cognitive component’). However, one downside of this taxonomy (Jordan, Amir, Bloom, 2016) is that it confounds our ability to feel the feeling of another mind (‘empathy’ in the former sense) with the feeling of concern that could result in some prosocial action. Used in these ways, empathy and concern need not necessarily entail one another. Knowing that another is in pain – without actually feeling it directly – can cause me to feel compassion towards them; conversely, feeling their pain does not always result in concern but, instead, ‘personal distress’ (Davis, 1983; Singer & Klimecki, 2014) – an aversive emotion that motivates withdrawal from the suffering as opposed to an attempt to alleviate it. For these practical reasons, I stick to the socio-cognitive/ socio-affective taxonomy that divides social cognition in relatively more cognitive processes (such as mind perception or perspective taking) and more affective processes (such as empathy and concern).

Moving from the scientific effort to understand mind’s place in the universe, to investigating these different aspects of social cognition, marks an important epistemic shift: We have moved from addressing the truth of claims about the world (for example, ‘any mind is identical to some

nervous system’) to what we tend to *perceive as minded* given the type of creatures we are and the different cultures we inhabit (for example, people living in small scale societies tend to perceive mind in natural processes such as the weather). Of course, this second claim can be true or false as well. The difference is that the former is a claim about the nature of mind *per se* while the second claim is about the psychology of a group of humans. We then have *two problems of scope*: We could call the first the *metaphysical problem of scope* (that is, what kinds of things in the world – in fact – have a mind) and the second the *psychological problem of scope* (what kinds of things do we *perceive* as minded). This thesis deals squarely with the **psychological problem of scope**.

Note that these two versions of the problem are related: All animals – to a greater or lesser extent – are in the business of sorting out the minded from non-minded entities in their environment. Did a falling pinecone make that rustle in the undergrowth or was it a mountain lion? Is that a bear or a bear-shaped shadow? Answering such questions could not be farther away from idle philosophical speculation. Given that animals have been faced with such questions as long as there have been predators implies that the answers they give should be shaped by selective pressures. After all, the vast majority of our ancestors answered such questions of mind well enough to pass on their genes to the next generation. For this reason, evolution favours promiscuous social cognition that adheres to what evolutionary psychologists call the ‘smoke alarm’ principle (Nesse, 2006). The name invokes our preferred design of a smoke alarm where we would rather err by risking false positives (e.g. enduring some amount of beeping when we are simply cooking pasta) than by risking false negatives (e.g. having it remain silent as our home burns). The plight of the potential prey confronted with a rustle in the bushes is similar to that of someone designing a smoke alarm: A false positive may waste some extra

energy making a hasty and unnecessary escape; however, a false negative could be lethal. Those individuals that tended to restrict their attribute of mind ('Oh it was probably just the wind') were more likely to commit a false negative and, therefore, also more likely to be lunch. Of course, there is an adaptive equilibrium here, and a tendency to spook *too* easily would also be selected against. Still, 'mind' is one property where it pays to be generous in its attribution.

1.3 A Short History of Anthropomorphism

This tendency for promiscuous social cognition is related to what researchers have termed anthropomorphism – or the tendency to attribute human-like attributes to non-human entities. Anthropomorphism is a fairly loaded concept. This is due, in part, to the rhetorical role it has played in discussions of both the metaphysical as well as psychological problems of scope. On the metaphysical side, the history of religion across different cultures and ages is littered with the anthropomorphic representation of gods and supernatural creatures (Morford & Lenardon, 2018) – but also the forces of the natural world. The ancient Greek gods are a good example of this where natural features were personified by a certain human-like god. 'Helios' was a personification of the sun while 'Aeolus' was the god-mind that controlled the wind. In such cultures, it made sense to ask *why* the wind blew as it did – not 'why' in the causal sense (for which meteorology might provide an answer) but the sense of having some purpose (as you might ask of me why I am writing this thesis). There was also less tension between the metaphysical and psychological problems of scope: For the Ancient Greeks, their evolved predisposition towards promiscuous social cognition caused them to perceive a mind behind the wind, and their cultural beliefs supported this tendency by giving that mind a name.

In the development of western civilization, this tendency to personify (or deify) aspects of the natural world became the subject of criticism by a variety of thinkers. The oldest we have

record of is the ancient Greek philosopher Xenophanes (Schoen, 1990) who pointed out the unlikely coincidence that the gods of a given group always bore an uncanny resemblance to their devotees in dress and manner. In the development of modern science, many secular thinkers such as Francis Bacon (Bacon, 1904) criticized Aristotle's attribution of purpose or *telos* to nature. On the other hand, Hebb (1946) argued that the attribution of emotion and intentional mental states to animals provides an indispensable, practical tool in the effort to interpret animal behaviour – even if they are not, upon final analysis, strictly speaking true. While interesting, and no doubt important, the normative status of anthropomorphism is not at issue in the current thesis. What *is* at issue is the causes and consequences of this tendency for anthropomorphic social cognition.

One of the first efforts made to study this bias of promiscuous social cognition was made by Heider and Simmel (1944). Participants were shown animations of simple shapes, such as triangles and squares, moving around from a top-down perspective. After viewing the animation, participants were asked to describe what they saw. Most described the shapes as having specific personalities or being engaged in intentional acts such as chasing or hiding. Since then, research on anthropomorphism has extended to include its role in the evolution of religion (Guthrie, 1995), effect on human-robot interactions (Duffy, 2003), environmentalism (Tam, Lee, & Chao, 2013), and marketing (Fournier, Breazeale, & Avery, 2015).

But what is the relationship between anthropomorphic and regular (i.e., non-anthropomorphic) social cognition? In terms of socio-cognitive processes, (Cullen et al., 2013), gray matter volume in the temporal parietal junction, one area that underwrites theory of mind, predicted anthropomorphism of non-human animals. This suggests the possibility that both anthropomorphic and non-anthropomorphic processes are underwritten by the same neural

networks. This would fit the redundant, conservative nature of evolution where older systems are coopted by new functions – a process called *exaptation* (Gould & Vrba, 1982). Processes that evolved to understand the minds of our conspecifics become applied more broadly.

An important question is what explains individual differences in anthropomorphic tendencies. The most widely accepted model of anthropomorphism – the so-called SEEK model (standing for Sociality, Effectance, and Elicited agent Knowledge) developed by Epley, Waytz, and Cacioppo (2007). At its core, the SEEK model proposes that anthropomorphism is an inferential process guided by knowledge about one's self and humans in general that is applied beyond the human family to non-human entities. This process is egocentric because it takes knowledge about our own experiences as the basis for such inferences about non-human entities. The more human an entity appears (for example, a car with a very face-like grill), the more it will provoke anthropomorphic inferences. As with egocentric reasoning in general, people vary on their ability to suppress this bias, and different cultural contexts support anthropomorphic inferences to a greater or lesser extent. According to the SEEK model, this mechanism of elicited agent knowledge is influenced by two motivational factors. Motivation for effectancy describes our need to predict and make sense out of the environment. Positing the existence of an agent allows us to make sense of the 'blooming buzzing confusion' of complex sense data. For example, attributing intentions to the shapes jumping around on the screen allowed participants in Heider and Simmel's study to make sense of what they were perceiving. Motivation for sociality describes our need to make and maintain connections with other humans. In the absence of such connections, the SEEK model predicts that people will lower their standards, as it were, through greater anthropomorphism, in order to fulfill this need.

Of the two motivational factors, *sociality* has accumulated the largest evidence base. In a line of research that calls to mind Tom Hank's friend/volleyball, Wilson, in the movie *Cast Away*, experimentally inducing loneliness has been shown to cause greater anthropomorphism (Epley et al., 2008). The inverse of this effect has been demonstrated as well: People anthropomorphize less when reminded of close social connections (Bartz, Tchalova, & Fenerci, 2016). An important caveat to this line of research is that the boundary conditions of the effect have not been thoroughly explored. It is possible that aversive experiences (of which loneliness is an example) may generally increase anthropomorphism. If this were true, we might see similar associations between anthropomorphism and experiences such as depression, anxiety, or stress.

While the SEEK model and complementary research programs have advanced our understanding of individual differences in anthropomorphism, this progress has been mostly limited to socio-cognitive processes such as mind perception and perspective taking while socio-affective processes such as empathy and compassion have received far less attention. This bias towards cognitive anthropomorphism can be seen in the two extant scales used to measure individual differences in anthropomorphism; one – the Individual Differences in Anthropomorphism Questionnaire (or IDAQ; Waytz, Cacioppo, & Epley, 2014), is keyed towards mind perception (judgments about what does or does not have some mental faculty) while the other – the Anthropomorphism Questionnaire (or AQ; Neave et al., 2015) – is aimed at perspective taking (actively taking the point of view of another 'agent'). In addition to processes on the cognitive side of the cognitive-affective distinction, we should also expect anthropomorphic social cognition to include both empathy and concern. When Bambi's mother is shot, most of us feel his pain (empathy) and would be moved to help him if given the chance (concern); of course, in this case, our social cognition is aimed at colours of light on a screen that

do not correspond to any minded entity. These emotions, then, are anthropomorphic in the very same way as the thought ‘why does my computer hate me so much’. At present, however, no scales exist to measure individual differences in this *affective anthropomorphism* (i.e., anthropomorphic empathy and concern). This lack of measures prevents researchers from expanding the construct of anthropomorphism to include socio-affective processes. As goes measurement, so does research; as a result of this absence of measures, we lack the tools to investigate the possible role of affective anthropomorphism in both normal and (importantly for this thesis) abnormal human behaviour.

1.4 Affective Anthropomorphism and Hoarding

Considering how vital social cognition is to successfully navigating through life, it is not too surprising that it has been implicated in many forms of psychopathology. A recent review of meta-analyses (Cotter et al., 2018) found that alterations in social cognitive functioning were associated with 24 different clinical conditions. We can see the affective dissociate from the cognitive in cases such as autism spectrum disorder (where there is a deficit in perspective taking but not empathy; Dziobek et al., 2007) and psychopathy (where empathy but not perspective taking is impaired; Lockwood et al., 2013). In addition to such deficits, there is also the scope of who (or what) receives the attention of our social cognition. While a widening of this scope is equivalent to anthropomorphism, a winnowing of this scope results in dehumanization (Haslam, 2006) where we withhold social cognition from other, actually minded beings. From this perspective, anthropomorphism and dehumanization fall on opposite ends of a spectrum. It is easy to see the negative consequences of dehumanization in the prejudicial treatment of outgroup members, but is there any risk in casting the net of social cognition too widely?

Hoarding is one disorder where anthropomorphism could have potentially negative consequences. Hoarding is a debilitating and chronic disorder that is marked with difficulty discarding items of little apparent value and the resulting accumulation of clutter in living spaces that impairs use of the home. It is both surprisingly common, with prevalence estimates up to 5.8% (Timpano et al., 2011), and proving hard to treat (Frost, Tolin, & Maltby, 2010). Currently, hoarding is generally understood from within Frost and Hartl's (1996) theoretical framework - the cognitive behavioral model of hoarding. This model outlines the major components of hoarding: cognitive deficits, maladaptive beliefs, avoidance, and emotional attachment to objects. Central to the phenomenon of hoarding are the strong, negative emotional reactions occasioned by the act – or prospect – of discarding objects. These negative emotional reactions drive avoidance of discarding objects and, as a result, prevent people from reducing the amount of clutter in their homes. Understanding both the etiology of these emotions and the underlying mechanism(s) that give rise to them is crucial to formulating more effective therapeutic interventions.

Why are people who hoard so emotionally distressed by discarding (seemingly) worthless items? Anecdotally, people who hoard often speak about their possessions as if they were alive. Indeed, during a phone screen one participant told me that, though it sounded 'crazy', it was as if all her possessions had souls. Perhaps, then, these negative emotions are social in nature. This clinical impression has been supported by research on cognitive anthropomorphism in hoarding: Self-reported hoarding behaviours have been found to be positively associated with both anthropomorphic mind perception (Timpano & Shaw, 2103) and perspective taking (Neave et al., 2015). Given this association between hoarding and cognitive anthropomorphism, it is plausible that the emotions driving hoarding behaviour may come in part from increased

affective anthropomorphic tendencies. Someone who does not hoard may find it emotionally neutral to crumple a paper bag and throw it in the garbage – but consider doing the same to a hamster. You may not feel concerned for an abandoned chair sitting alone in the rain – but you would probably feel differently if it were a puppy or kitten. The differences in emotional responses between someone who hoards and someone who does not may hang on how much mind is perceived. In the case of an obviously minded entity (which is to say an entity that most people would perceive to have a lot of mind), empathically-mediated emotions and compassionate concern constrain our behaviour to a considerable extent; we would not throw a hamster in the trash and we would feel compelled to rescue an abandoned puppy. A similar phenomenon may be occurring in hoarding where such emotional processes are both driving the acquisition of objects and standing in the way of discarding them. People who hoard objects may be motivated to *save* objects from danger – in the same way you might be motivated to save a dog, cat, or child from danger. Of course, as the dissociation between affective and cognitive components of social cognition in psychopathy and autism attests, the increased levels of cognitive anthropomorphism in hoarding does not guarantee a similar association with affective anthropomorphism. It is also important to note that hoarding is an extremely heterogeneous phenomenon as people hoard objects for many different reasons (Frost et al., 2015).

People who hoard tend to have other mental health problems as well. In a sample of 212 individuals diagnosed with clinical levels of hoarding, Frost, Steketee, and Tolin (2015) found that nearly half of those also met criteria for major depressive disorder and a quarter for generalized anxiety disorder. The authors pose the question of whether this high comorbidity is *the cause of* or is *caused by* hoarding. Of course, it is also possible that the causality runs in a circle or that there is some third variable at play. If such psychopathology were to exacerbate

hoarding, a conceivable mediator would need to be identified. As mentioned in section 1.3, the SEEK model of anthropomorphism proposed by Epley, Waytz, and Cacioppo (2007) suggests feelings of loneliness may shift people's social cognition to become more anthropomorphic. While this is a compellingly intuitive idea, and one that has received some empirical support (Epley et al., 2008), the boundary conditions of the effect have not been thoroughly tested. While extremely speculative, it could be that an increase in anthropomorphic social cognition is a response to stress in general – of which loneliness is but one example. In other words, the evidence supporting the idea that loneliness increases anthropomorphism does not – on its own – rule out the possibility that this effect is unique to loneliness; after all, absence of evidence is not evidence of absence. Hence, it is conceivable that factors such as depression, anxiety, and stress may also widen our social-cognition in a similar fashion as does loneliness. If this were so, and if it were also the case that anthropomorphic empathy and concern contribute causally to hoarding behaviours, then this might help to explain the high comorbidity of mood and anxiety disorders in hoarding.

If affective anthropomorphism were found to be a driver of hoarding behaviours, understanding why such emotional responses are heightened would be an important question to answer. One possibility is that elevated *trait levels* of general empathy or concern may be a risk factor for the development of hoarding. If people who hoard have more empathy or compassion *in general* – for example, for other people – these tendencies may 'spillover' onto other entities such as paper bags, receipts, and the like; we could call this the *Overflow account* of anthropomorphic-driven hoarding. If this were true, we would expect to see a positive association between hoarding measures and non-anthropomorphic measures of empathy and concern. We could call the Overflow account a *trait model* of anthropomorphic driven hoarding

if we assume that people's levels of empathy and compassion are relatively stable over time. Another possible account, suggested by basic research on anthropomorphism, is that feelings of loneliness might cause people who hoard to have higher *state levels* of anthropomorphism. Just like in *Castaway*, people who hoard may have the amount of mind they perceive in inanimate objects upregulated by persistent experience of loneliness; we could call this the *Loneliness account*. If we think of feelings of loneliness as potentially malleable – owing to changes in one's social functioning and life circumstances – then we could call the Loneliness account a *state model* of anthropomorphic hoarding.

It is, of course, possible that both the Overflow and Loneliness accounts operate together. This could suggest a *diathesis-stress model* of anthropomorphic hoarding. Diathesis-stress models have been used in psychology to describe the etiology of various forms of psychopathology from depression (Beck, 1969) to schizophrenia (Meehl, 1962). According to such models, a certain form of psychopathology results from the interplay between an innate disposition (the diathesis) and some environmental influence (the stressor) – together the diathesis and stressor are jointly sufficient to explain the expression of the psychopathology; however, each on their own may not result in the expression of the disorder. In terms of anthropomorphic-driven hoarding, high state levels of *non-anthropomorphic* empathy and compassion would play the role of risk factor or diathesis while experiences of loneliness resulting from social dysfunction would be the stressor. A person with high levels of trait empathy and compassion may never develop anthropomorphic-driven hoarding if they maintain supportive, well-functioning relationships; conversely someone who experiences chronic loneliness due to social dysfunction may also not be at risk for hoarding if they have low trait levels of empathy and compassion.

Chapter 2: The Present Research

Based on the current state of research on anthropomorphism and the potential role that affective anthropomorphism could play in motivating acquiring and saving behaviour in hoarding, I had the following aims in designing the studies in this thesis:

Aim #1 – To construct a self-report measure of empathy and concern for objects (or ECO) and begin to test the psychometric properties of both the scale and construct validity of affective anthropomorphism itself.

Aim # 2 – To test whether the ECO predicts hoarding behaviours and cognitions over and above other extant measures of anthropomorphism.

Aim # 3 – To test whether negative affectivity (e.g., depression, anxiety, stress) could potentially increase anthropomorphism, and, if so, whether affective anthropomorphism accounts for its relationship with hoarding.

Aim # 4 – To test whether there exists any initial correlational evidence for exaggerated non-anthropomorphic empathy and concern in hoarding (i.e., the Overflow account) and, if so, whether affective anthropomorphism accounts for such a relationship.

Aim # 5 – To test whether loneliness is associated with hoarding (i.e., the Loneliness account) and, if so, whether affective anthropomorphism accounts for such a relationship.

Aim # 6 – Lastly, given some evidence for both the Overflow and Loneliness accounts, to test whether a diathesis-stress model of anthropomorphic-driven hoarding finds initial correlational support.

2.1 Study 1

In Study 1, I submitted the initial set of items for the ECO to exploratory factor analysis reducing the number of items to a final set that exhibit an adequate factor structure. Next, I assessed the convergent and divergent validity of the scale using other measures of anthropomorphism and personality (aim #1). To investigate the role of affective anthropomorphism in hoarding, I used regression to test whether the subscales of the ECO predict unique variance in hoarding behaviours and cognitions over and above measures of cognitive anthropomorphism (aim # 2). Lastly, I used mediation as an initial test of the possibility that affective anthropomorphism mediates the relationship between hoarding and general psychopathology (aim # 3).

2.1.1 Item Generation

I wrote items using previously developed non-anthropomorphic measures of both empathy and compassion as models. For the empathy items, I used the empathy subscale of the Empathy Index (EI; Bloom & Jordan, 2016) as a prototype; I used the empathic concern subscale of the Interpersonal Reactivity Index (IRI; Davis, 1983) as a model for items intended to tap anthropomorphic concern. The goal of the item creation phase was to produce items that mirrored the structure and content of the original non-anthropomorphic measures. Compare, for example, the following item of the IRI (*'I often have tender, concerned feelings for people less fortunate than me'*) to its anthropomorphic counterpart (*'I often have tender, concerned feelings for objects that don't have a good home'*). Participants were asked to choose how well the item described them using a 5-point Likert scale from 1 (*'Does not describe me well at all'*) to 5 (*'Describes me very well'*). For the empathy items, the defining criterion was an emotional congruency or isomorphism between the person and the object in a certain situation. That is, if

the object were in a certain situation that would provoke X emotion (in a creature that actually has emotions), then X emotion would also be felt by the person viewing the situation. Take, for example, the following item: *'When I'm in a store and I see there is only one left of a certain product, I feel lonely'*. In this example, the feeling of loneliness experienced by the person mirrors the emotion 'experienced' by the object in that situation. In other words, the loneliness felt by the person mirrors the 'loneliness' 'felt' by the object. For items intended to measure anthropomorphic concern, I wrote items to cover both the positive and negative affective aspects of concern; when someone (or in this case *something*) that we have concern for has some good fortune, we feel happy ("I generally feel quite touched when I see objects that are well taken care of.") – however, we worry when the target of our concern befalls some misfortune ("I usually feel sorry for objects when they are broken"). In addition to these different affective aspects to concern, I also wanted to cover the pro-social side of concern ("When I see an object that has been mistreated, I feel kind of protective towards it"). In total, 24 items (shown in Table 1) were included in Study 1.

2.1.2 Procedure

Following the recommendations of Comfrey and Lee (1992) of adequate samples size for exploratory factor analysis, I recruited 389 participants from Amazon Mechanical Turk (Mturk) to ensure stable estimates of factor loadings. While Mturk is often preferred for its convenience and cost effectiveness, there is also evidence that it offers superior diversity compared to undergraduate student samples both in terms of demographics (Huff & Tingley, 2015) as well as severity of psychopathology (Arditte et al., 2016). To increase data quality, I utilized three attention check questions (where participants were asked to pick a specific response option). In addition to these attention check questions, I asked participants explicitly if they had paid enough

attention during the survey to justify including their data in analyses (with the assurance that their answer would not affect their remuneration). I set as a priori inclusion criteria that participants answer no more than one attention check question incorrectly *and* indicated that their data could be included in analyses. Using these criteria, I excluded 14 participants bringing the total N to 375 ($M_{age} = 37.93$, $SD = 11.97$ ranging from 18-74; 56% female, 1 person identified as non-binary) . Participants received \$0.50 USD in remuneration for completing the study.

2.1.3 Materials

In addition to completing the ECO and demographic questions, participants completed the following measures. The order of all measures was randomized between participants to control for order effects.

2.1.3.1 Individual Differences in Anthropomorphism Questionnaire (IDAQ)

The IDAQ (Waytz, Cacioppo, & Epley, 2014) is a 15-item self-report measure that captures the extent to which respondents perceive various non-human entities (both animate and inanimate) to have human characteristics including mental states (e.g. “*To what extent does a television experience emotion?*”). Respondents rate how much different targets have of various mental processes on a scale from 0 (‘not at all’) to 10 (‘very much’). In the initial validation study, the IDAQ demonstrated good internal consistency (Cronbach’s $\alpha > .85$) and test-retest reliability ($r=.55$) over a 12- to 19-week period. Consistent with the consequences of perceiving human characteristics in non-human entities, the IDAQ also predicted attribution of secondary emotions to non-human animals ($r=.62$) in addition to conceptually-related consequences such as increased environmental concern ($r=.28$) and trust in technological agents ($r=.30$). In the current sample, the IDAQ had a Cronbach’s α of .91.

2.1.3.2 Anthropomorphism Questionnaire – Adult (AQ)

Developed by Neave and colleagues (2015), the AQ is a 20-item self-report questionnaire with two subscales intended to capture current anthropomorphic tendencies as well as retrospective anthropomorphic tendencies as a child. Because I was only interested in current anthropomorphic tendencies, I did not include the 10-item ‘child’ subscale. Participants are asked to respond on a seven-point Likert scale (from 0 ‘Not at all’ to 6 ‘Very much so’) indicating how well a series of statements describes them. Although, as mentioned in the introduction, the authors do not frame it this way, in my estimation, the statements reflect perspective taking with respect to ostensibly non-minded entities (e.g. “*I sometimes wonder if my computer runs more slowly after I have shouted at it.*”) In the initial validation study, the adult subscale of the AQ demonstrated good internal consistency (Cronbach’s alpha = .86), excellent test-retest reliability ($r=.95$) over a 4-6-week period, and was moderately well correlated with the IDAQ ($r=.62$). In the current sample, the AQ had a Cronbach’s alpha of .91.

2.1.3.3 The Saving Inventory-Revised (SIR)

Developed by Frost, Steketee, and Grisham (2004), the SIR is a 23-item self-report measure of hoarding symptoms. The scale consists of 3 subscales that represent the major dimensions of hoarding including difficulty discarding, clutter, and excessive acquisition. (e.g., “*To what extent do you have difficulty throwing things away?*”). Participants are asked to rate their responses to these statements on 5-point Likert scales based on their experiences in the past week from 0 (none/not at all/ never) to 4 (almost all/ extreme/ very often). The scale displayed good test-retest reliability ($r=.86, p<.001$) over a 2-4 week period and high internal consistency (Cronbach’s alpha = .94). In addition, the SIR displayed discriminant validity with scales

measuring OCD, as well as distinguishing between patients with clinical levels of hoarding and those with OCD without hoarding. In the current sample, the SIR had a Cronbach's alpha of .93.

2.1.3.4 Savings Cognitions Inventory (SCI)

The SCI (Steketee, Frost, & Kyrios., 2003) is a 24-item self-report inventory measuring beliefs that are commonly related to hoarding symptoms. The SCI consists of four subscales that correspond to different classes of hoarding-related beliefs including emotional attachment, control, memory, and responsibility for objects (e.g. "*Throwing this away means losing a part of my life*") Participants are asked to rate the extent they had each thought during the past week while they were deciding on whether to throw something away; responses are made on a Likert scale from 1 ('Not at all') to 7 ('Very much'). In the validation study, the SCI displayed high internal consistency (Cronbach's alpha = .96) and discriminated between participants diagnosed with hoarding, with OCD, and healthy controls; however, there has of yet been no assessment of the test-retest reliability of the measure. In the current sample, the SCI had a Cronbach's alpha of .94.

2.1.3.5 The Depression, Anxiety, Stress Scales – 21 (DASS-21)

The DASS-21 (Lovibond & Lovibond, 1995) is a 21-item self-report scale that measures symptoms of depression (e.g. "I couldn't seem to experience any positive feeling at all"), anxiety along with general stress . Participants indicate how much each item has been true of them over the last week from 0 ('did not apply to me at all') to 3 ('applied to me very much or most of the time'). In a more recent validation paper (Henry & Crawford, 2005) using a large non-clinical sample ($N= 1,794$), the DASS-21 showed good internal consistency (Cronbach's alpha = .88), and the subscales showed convergent validity with respect to other measures of depression, anxiety, and stress; however, confirmatory factor analyses suggested that each subscale also

tapped a more general dimension of negative affectivity. No assessment of test-retest reliability has been conducted for the DASS-21. In the current sample, the DASS-21 had a Cronbach's alpha of .95.

2.1.3.6 The Mini-IPIP

The Mini-IPIP (Donnellan et al. 2006) is a short, 20-item version of the long form International Personality Item Pool – Five-Factor Model scale (IPIP-FFM; Goldberg, 2006). The measure contains five subscales corresponding to the personality dimensions of openness, conscientiousness, extraversion, agreeableness, and neuroticism. In the initial validation study, the subscales of the Mini-IPIP were highly correlated with the longer IPIP-FFM scale. In terms of test-retest validity, over a three-week period the subscales of Mini-IPIP correlated $r = .77, .75, .87, .62, .80$ for Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, respectively. Across five studies in the validation paper, Cronbach's alphas for all subscales were well above .60. In the current sample, the MINI-IPIP had Cronbach's alphas greater than .68.

2.1.4 Results

2.1.4.1 Item Reduction

In order to investigate the psychometric properties of the initial set of ECO items, I used iterative maximum-likelihood exploratory factor analyses with a promax rotation. Bartlett's Test of Sphericity was significant ($p < .001$) indicating the items were indeed related and, hence, suitable candidates for factor analysis (Snedecor & Cochran, 1989). The first factor analysis revealed three factors with eigenvalues of at least one (see Appendix A.). The first factor, which explained 51.23% of the variance, was composed of items with a negative valence; that is, they contain situations with a negative outcome for the object. Some of the negatively valenced empathy items loaded on the first factor as well. The second factor, explaining 9.03% of the

variance, was composed of *positively* valenced concern items – where the object had some positive outcome – with, again, some empathy items as well. The third factor, explaining an additional 4.83% of variance, was composed of four empathy items that exhibited high loadings on the main factor (and minimal cross-loadings) as well as two concern items with relatively low loading on the main factor (and higher cross-loadings) on the ‘negative’ concern factor.

In other words, this initial factor analysis resulted in one clear empathy factor (#3) – but split the remaining two factors in terms of valence with items reflecting negative affect loading on the first factor while items reflecting positive affect loaded on the second factor. Since it was intended to produce one ‘concern’ factor with items that were positively and negatively valenced, I took the following approach. As a first step, I retained the four high-loading empathy items of the third factor. Next, I removed all empathy items that loaded onto the first two concern factors. As a final step, I removed items that were tending to split the concern items into positive and negative valence such that the remaining items both formed a single factor *and* contained items that described positive and negative outcomes for the object(s).

The result of this iterative process was a two-factor solution (see Table 1) – one factor of empathy items and the other of items keyed for concern – with four items each with eigenvalues > 1. The empathy factor explained 49.94% of the variance while the concern factor explained another 17.45% of the variance. As intended, the concern factor consisted of two positively and two negatively valenced items. The Kaiser-Meyer-Olkin test of sampling adequacy was .86, considered a ‘meritorious’ level of factorability (Keiser, 1974). The determinant was .035 suggesting acceptable level of multicollinearity in the data (Field, 2004). In this data, the empathy subscale had a Cronbach’s alpha of .83 while the concern subscale had an alpha of .80; the scale as a whole also displayed an adequate Cronbach’s alpha of .85. The two subscales

correlated moderately ($r=.52, p<.001$). While EFA using eigenvalue-greater-than-one approach is standard practice, a different approach, parallel analysis (Horn, 1965), though not as well known, has been shown to perform better in simulation studies (Braeken, Marcel, & Van Assen, 2017). In parallel analysis, a fixed reference point (e.g. an eigenvalue of 1) is not used but rather eigenvalues generated from random data; factors are retained that exceed the 95th percentile of the distribution of eigenvalues generated from this random data. As a check on the factor structure, I performed a parallel analysis using promax rotation. The results (see Appendix A1.) show the same two-factor solution of concern and empathy with similar loadings and cross-loadings.

Table 1. Factor Analysis of the 8-Item Empathy and Concern for Objects Scale (ECO)

ECO Item	Factor	
	1	2
Factor 1 (Empathy)		
I find it painful to tear apart a cardboard box before I put it in the recycle.	.84	-15
When I'm in a store and I see that there's only one left of a certain product I feel lonely.	.80	-.08
When I see a car about to be crushed in a junk yard I feel afraid.	.76	.05
When I see an old rusted car that's been abandoned, I feel sad.	.55	.29
Factor 2 (Concern)		
I am often quite touched when I see objects that are well taken care of.	-.09	.81
I generally feel quite touched when I can find one of my objects a good home.	-.18	.77
I generally feel concern for my possessions that need to be repaired.	.17	.64
When objects are treated badly, I feel sorry for them.	.18	.63

2.1.4.2 Convergent and Divergent Validity of the ECO

To investigate convergent and divergent validity of the empathy and concern subscales of the 8-item ECO, we compare the pattern of correlations with conceptually related measures of cognitive anthropomorphism (the AQ and IDAQ) and the dimensions of the Big-5 (using the IPIP – MINI; see Table 2.). In terms of convergent validity, the empathy subscale of the ECO showed medium positive correlations with the AQ and IDAQ, and the concern subscale of the ECO showed similarly modest positive correlations with the AQ and IDAQ. With respect to divergent validity, the empathy subscale of the 8-item ECO showed small negative correlations with conscientiousness and agreeableness, a small positive correlation with neuroticism, and an association near zero with extraversion; the concern subscale of the ECO showed a small positive with neuroticism.

Table 2. Zero Order Correlations with ECO-Empathy, ECO-Concern, AQ, and IDAQ

	<i>ECO – Empathy</i>	<i>ECO – Concern</i>	<i>AQ – Perspective Taking</i>	<i>IDAQ – Mind Perception</i>
<i>ECO - Empathy</i>				
<i>ECO - Concern</i>	.52			
<i>AQ</i>	.59	.45		
<i>IDAQ</i>	.47	.40	.68	
<i>DASS-21 - Depression</i>	.32	.23	.38	.28
<i>DASS-21 – Anxiety</i>	.44	.30	.50	.43
<i>DASS-21 - Stress</i>	.30	.26	.42	.32
<i>SIR</i>	.52	.43	.60	.43
<i>SCI</i>	.59	.48	.68	.52
<i>IPIP MINI – Openness</i>	-.18	.05	-.19	-.07
<i>IPIP MINI – Conscientiousness</i>	-.21	-.09	-.33	-.17
<i>IPIP MINI – Extraversion</i>	.01	-.09	-.08	.01
<i>IPIP MINI – Agreeableness</i>	-.12	.00	-.18	-.10
<i>IPIP MINI – Neuroticism</i>	.20	.26	.30	.21
<i>Age</i>	-.29	-.15	-.14	-.16
<i>Gender</i>	-.14	.01	-.01	.03

Note. All correlations significant at least $p < .05$, non-significant correlations in grey. Gender (1=male, 0=female). For the correlations with gender, one participant excluded for indicating a gender identity other than male or female.

2.1.4.3 Affective Anthropomorphism in Hoarding

As both the empathy and concern subscales of the ECO were modestly correlated with both hoarding behaviours (as measured by the SIR) and hoarding cognitions (as measured by the SCI), we used simultaneous, single step regression to test whether these measures predicted hoarding over and above the more cognitive measures of anthropomorphism (see Table 3). This serves as a first, initial test of whether the emotions engendered by affective anthropomorphism are associated with hoarding. As age and gender were associated both with the hoarding measures as well as the ECO we entered them as control variables. In predicting SIR scores, both the empathy and concern subscales of the ECO predicted unique variance not captured by the two measures of cognitive anthropomorphism; the overall model predicted 42% of the variance in SIR scores. Similar results held for hoarding cognitions; the concern and empathy subscales of predicted unique variance in SCI scores over and above other measures of anthropomorphism and the total model predicted over half the variance self-reported hoarding cognitions. For both models, all tolerance statistics were acceptably large (>0.2) and VIF statistics suitably small (<4.0) (Hair et al., 2019). For both models, the Durbin-Watson statistic was 2, suggesting that the p -values of the model are not being suppressed by the effects of autocorrelation (Field, 2000).

Table 3. Regression models predicting SIR and SCI

	Saving Inventory - Revised			Saving Cognitions Inventory		
	β	95% CI	p	β	95% CI	p
(Intercept)		-0.09 – 0.06	.75		-0.08 – 0.06	.84
ECO – Empathy	.19	0.08 – 0.29	.001	.21	0.31 – 0.52	<.001
ECO – Concern	.14	0.04 – 0.22	.005	.15	0.07 – 0.23	<.001
AQ	.44	0.33 – 0.56	<.001	.45	0.35 – 0.56	<.001
IDAQ	-.02	-0.12 – 0.09	.78	.05	-0.05 – 0.15	.30
Gender	-.06	-0.14 – 0.02	.16	-.04	-0.11 – 0.03	.26
Age	-.02	-0.10 – 0.06	.68	.01	-0.07 – 0.07	.99
Observations		374			374	
R ² / adj. R ²		.42 / .41			.53 / .53	

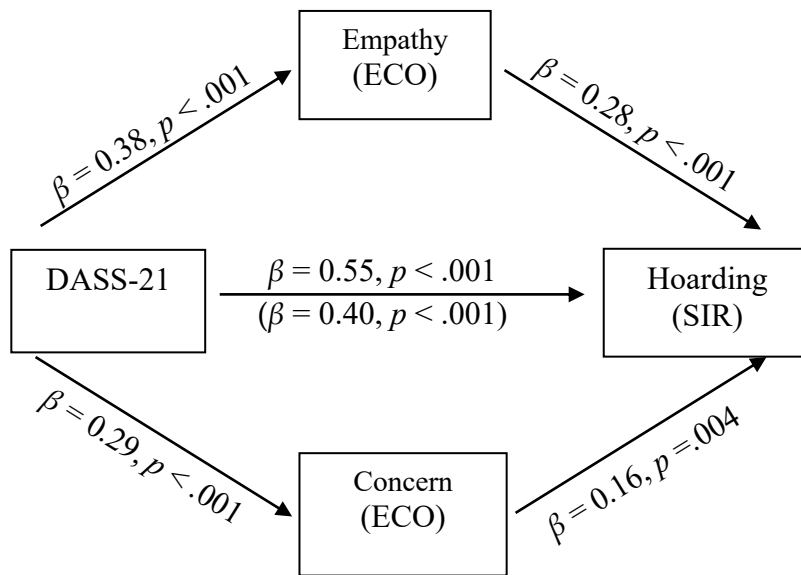
Note. Significant predictors in bold. Gender (1=male, 0=female). One participant excluded for indicating a gender identity other than male or female.

2.1.4.4 Affective Anthropomorphism Mediating Negative Affectivity and Hoarding

To take a first step to testing the possibility that affective anthropomorphism mediates the relationship between general psychopathology and hoarding, we used two separate parallel mediation models using SIR and SCI scores as outcome measures (see Figure 1). Following the recommendation of Shrout and Bolger (2002) for mediation with small to moderate sample sizes, a bias corrected bootstrapping method (with 5,000 resamples) was utilized to test for indirect effects. To run this analysis (and all further mediation analyses in this thesis) the PROCESS macro Version 2 was used (Hayes, 2018). Total DASS-21 scores were entered as the

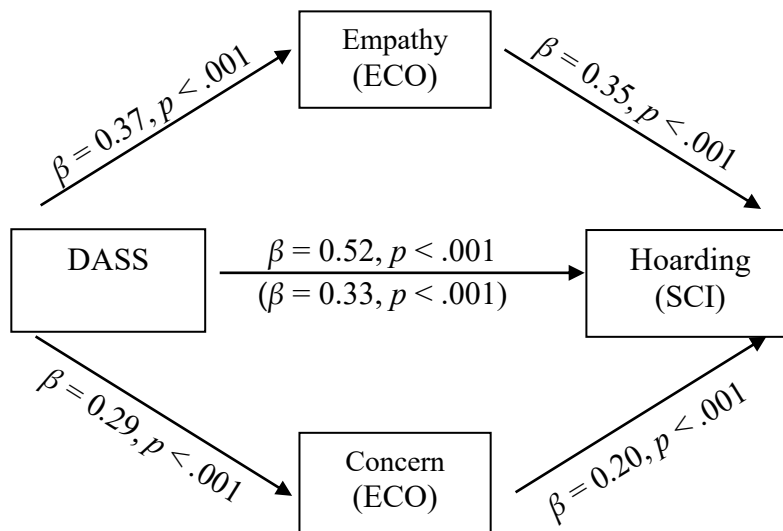
independent variable and the empathy and concern subscale as parallel moderators. In the first model predicting SIR scores (see Figure 1) both the empathy, $\beta = .11$, $SE = .03$, 95% CI = .06, .16, and the concern, $\beta = .05$, $SE = .01$, 95% CI = .02, .08, subscales of the ECO partially mediated the relationship between DASS-21 and SIR scores. Together, both empathy and concern accounted for 27% of the total effect of DASS-21 on SIR scores. As a check on how consistent this model is with a potential causal interpretation, the DASS-21 was switched with the SIR to test for mediation in the opposite direction. In this model, neither the empathy ($\beta = .06$, $SE = .04$, 95% CI = -.003, .14) nor the concern ($\beta = .004$, $SE = .02$, 95% CI = -.04, .05) subscales of the ECO showed significant partial mediation of the relationship between DASS-21 and SIR.

Figure 1. ECO-Empathy and ECO-Concern Mediating DASS-21 and SIR



Next a second parallel mediation model analysis was run predicting SCI scores, with DASS (see Figure 2) total scores entered as the independent variable and empathy and concern subscales of the ECO as mediators. Again, empathy ($\beta = .13$, SE= .03 95% CI = .08, .20) and concern ($\beta = .06$, SE= .02 95% CI = .03, .10) partially mediated the relationship between DASS and SCI scores with these indirect paths accounting for 36% of the variance of the total effect. When DASS and SCI were switched, neither empathy ($\beta = .06$, SE= .04 95% CI = -.01, .15) nor concern ($\beta = -.001$, SE= .03 95% CI = -.05, .05) significantly mediated the relationship between DASS and SCI scores.

Figure 2. ECO-Empathy and ECO-Concern Mediating DASS and SCI



2.2 Study 2

In Study 2, I used confirmatory factor analysis to test the model fit of the two-factor solution for the ECO obtained in Study 1 and EFA to assess the distinction between affective and cognitive anthropomorphism (aim #1). Next, I investigated a more general picture of non-anthropomorphic social cognition to look for evidence consistent with the Overflow account (aim #4) in the form of positive associations with non-anthropomorphic empathy and concern and hoarding behaviours. In addition, I looked for a positive correlation between hoarding and loneliness that would be consistent with the Loneliness account (aim # 5). Lastly, I fit a series of mediation models testing the Overflow, Loneliness, and Diathesis Stress models of anthropomorphism in hoarding (aim #6).

2.2.1 Participants

Following the rule of thumb for confirmatory factor analysis suggested by Yong and Pearce (2013), I aimed to recruit over 300 participants for the study. I used MTurk to recruit participants. To ensure data quality, I excluded participants for failing more than one of the attention check questions or for indicating – when asked at the end of the study – that they felt they had not paid sufficient attention for their data to be analyzed. Of the 353 participants who completed the study, 24 were excluded leaving 329 who were included in all analyses ($M_{age} = 36.89$, $SD = 13.13$ ranging from 18-86; 49% female, 2 participants identified as non-binary). Participants received \$0.50 USD in remuneration for completing the study.

2.2.2 Measures

In addition to the measures of cognitive anthropomorphism (the AQ and IDAQ) and hoarding (the SIR) used in Study 1, I included the following measures in Study 2. All scales were presented in random order between participants.

2.2.2.1 The Interpersonal Reactivity Index (IRI)

The IRI (Davis, 1983) is a 28-item self-report measure of different aspects of social cognition. The scale consists of four subscales including: perspective taking (actively adopting another person's point of view), fantasy (the tendency to become immersed in fictional worlds), empathic concern (worry about the well-being of another), and personal distress (a self-focused, avoidant reaction to the suffering of others). Participants rated the responses on a 5 point Likert scale from 1 ('Does not describe me well') to 5 ('Does describe me well'). In the validation paper, Cronbach's alphas ranged between .70 and .78 for the different subscales. The test-retest reliability after a period of 60-75 days ranged from .61-.81. The perspective taking subscale showed convergent validity with other more cognitive measures of social cognition. On the other hand, the empathic concern and personal distress subscales correlated more highly with affective measures. Originally conceptualized as a measure of cognitive social cognition, the fantasy subscale showed comparatively weaker associations with other cognitive measures. In the current sample, the IRI had Cronbach's alphas greater than .78.

2.2.2.2 The Empathy Index (EI)

The EI (Jordan, Amir, & Bloom, 2016) is a 14-item self-report scale measuring empathy. It consists of two subscales: empathy (or the tendency to experience the same emotions as others) (e.g. "If I see someone who is excited, I will feel excited myself") and behavioural contagion (or the tendency to mirror the behaviours of others). Participants rate the response on a

5 point Likert scale from 1 ('Does not describe me well') to 5 ('Does describe me well'). In the scale validation studies, the subscales demonstrated Cronbach alphas above .70. When entered into a factor analysis with the subscales of the IRI, both the empathy and contagion subscales formed a factor with the personal distress subscale of the IRI. Consistent with the self-focused, avoidant nature of personal distress, the EI *negatively* predicted altruistic behaviour. As of yet, however, there has been no assessment of the test-retest reliability of the measure or of its association with other measures of social cognition. In the current sample, the EI had an Cronbach's alpha of .83.

2.2.2.3 The University of California Los Angeles Loneliness Scale (UCLA-LS)

The UCLA-LS (Russell, 1996) is a 20-item self-report scale measuring the experience of loneliness. Participants use a Likert-scale from 1 (never) to 5 (all of the time) to describe how often they experience different facets of the subjective feeling of loneliness (e.g. "I am no longer close to anyone"). In the validation study, the UCLA-LS showed high internal consistency with Cronbach's alphas between .89 and .94 across demographically distinct samples (college students, teachers, nurses, and elders), and a single factor solution demonstrated good fit across these samples. The UCLA-LS converged with other scales measuring loneliness and also predicted poor self-reported relationship quality. There has been some work on attempting to distinguish loneliness from depression; a longitudinal study by Cacioppo and colleagues (2006) suggested that loneliness and depression have a reciprocal relationship. In the current sample, the UCLA-LS had an Cronbach's alpha of .93.

2.2.3 Results

2.2.3.1 Model Fit and Reliability

In order to test whether the same factor structure replicated in this sample, an EFA using maximum-likelihood exploratory factor analyses with a promax rotation was performed. Results showed the same two structure factors of empathy and concern obtained in the first study. All items loaded on the intended factors; one item from the empathy subscale (“When I see an old rusted car that’s been abandoned, I feel sad”) showed relatively high cross loading with the concern subscale (.41). As in Study 1, I repeated this analysis using parallel analysis replicating the two-factor solution. Using confirmatory factor analysis, I assigned the items of the ECO to the two-factor solution obtained in Study 1 and computed indices of model fit. The Chi-square test was not significant ($\chi^2(13) = 16.29, p < .23$) indicating that the model fit the data. To support the Chi-square test, I also computed the Root Mean Square Error of Approximation (RMSEA) and the Tucker-Lewis Index (TLI). Values below .08 for the RMSEA (Browne & Cudeck, 1992) and above .95 for the TLI (Cangur & Ercan, 2015) are deemed acceptable. I obtained an RMSEA of .03 and TLI of .99 corroborating the results of the Chi-square test and further suggesting good model fit. Next, I computed the reliability for each of the subscales again using Cronbach’s alpha; both demonstrated good internal consistency (empathy= .85 and concern= .81). Similar to Study 1, the two factors were moderately correlated ($r=.52, p<.001$). To assess the broader constructs of affective and cognitive anthropomorphism, I used EFA to test the factor structure of the AQ, IDAQ, ECO-empathy and ECO-concern. Using the eigenvalue > 1 approach (see Appendix A.2), I obtained a 1-factor solution for all four measures. However, using parallel

analysis, I found a two-factor solution (see Appendix A.3) with one factor representing affective anthropomorphism (i.e. the subscales of the ECO) and the other cognitive anthropomorphism.

2.2.3.2 A Broader Picture of Social Cognition in Hoarding

To obtain a broader picture of social cognition in hoarding I correlated the different subscales of the SIR, measuring difficulty discarding, excessive acquisition, and clutter in the home, with both the anthropomorphic (the AQ, IDAQ, and ECO) and non-anthropomorphic (IRI, EI, and UCLA-LS) measures (see Table 4). In addition to this general overview, these correlations allowed me to assess both the Loneliness and Overflow accounts of anthropomorphic hoarding. Positive associations with loneliness and hoarding would be consistent with the Wilson model – while positive associations with the empathic concern, perspective taking, or empathy measures would provide initial evidence for the Overflow account.

Once again, I found all three measures of anthropomorphism to be strongly associated with hoarding; of the four, the empathy subscale of the ECO showed the strongest correlations for difficulty discarding ($r=.65, p<.001$), excessive acquisition ($r=.65, p<.001$), and clutter ($r=.69, p<.001$) subscale of the SIR. In support of the Loneliness account of anthropomorphic hoarding, loneliness was positively correlated with difficulty discarding ($r=.37, p<.001$), excessive acquisition ($r=.34, p<.001$), and clutter ($r=.38, p<.001$). In terms of the Overflow account, there are mixed findings. For empathy, there were modest positive associations with the three subscales of the SIR ($r\approx .34$); however, for both empathic concern and perspective taking I found small *negative* correlations with hoarding behaviour. Another unexpected finding were the modest, positive correlations between the distress subscale of the IRI and the three subscales of the SIR ($r\approx .38$).

2.2.3.3 Testing the Overflow Account of Anthropomorphic-driven Hoarding

Since the Overflow Model found support only for non-anthropomorphic empathy (as non-anthropomorphic concern was a negative predictor of the empathy subscale of the ECO and not a significant predictor of the concern subscale), I ran a parallel mediational model with Empathy Index scores as the independent variable, both subscales of the ECO entered as parallel mediators, and SIR total scores as the outcome variable (see Figure 3). As in Study 1, and following the recommendation of Shrout and Bolger (2002) for mediation with small to moderate samples sizes, a bias corrected bootstrapping method (with 5,000 resamples) was utilized to test for indirect effects using the PROCESS macro Version 2 (Hayes, 2018). Taken together the empathy ($\beta = .27$, $SE = .04$, 95% CI = .20, .35) and the concern ($\beta = .04$, $SE = .02$, 95% CI = .009, .08) subscales of the ECO fully mediated the relationship between the Empathy Index and SIR scores (accounting for 80% of the total effect of the Empathy Index on SIR scores). Comparing the relative contributions of these two indirect effects in this full mediation, the empathy subscales of the ECO predicted significantly more of the variance than the concern subscale ($B = -.23$, $SE = .05$, 95% CI = -.32, -.14). When the position of the SIR and Empathy Index were swapped in the model, the empathy ($\beta = .17$, $SE = .06$, 95% CI = .06, .29) and the concern ($\beta = .10$, $SE = .03$, 95% CI = .04, .16) still fully mediated the relationship between SIR and Empathy Index scores – however, this model performed less well explaining 68% of the total effect. This result is still consistent with the possibility of a causal mediation from EI through ECO to SIR – however, this mediation in the *opposite* direction should temper this causal interpretation in the absence of direct experimental evidence.

Figure 3. ECO-Empathy and ECO-Concern Mediating EI-Empathy and SIR

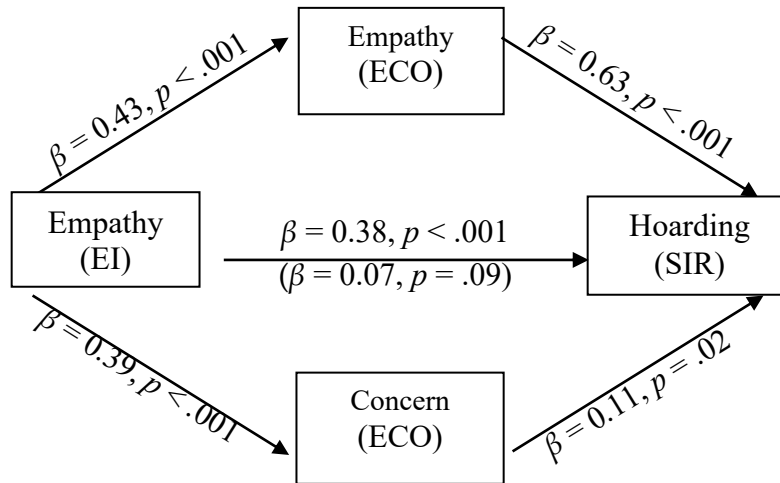


Figure 4. ECO-Empathy Mediating UCLA-LS and SIR

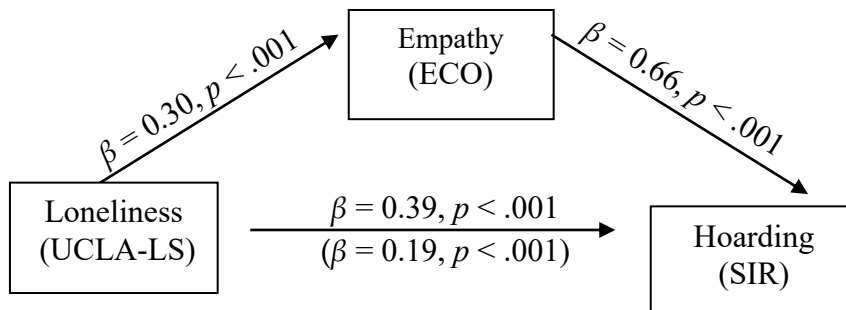


Table 4. Zero Order Correlations of Hoarding, Social Cognition, and Loneliness

	<i>SIR-D</i>	<i>SIR-A</i>	<i>SIR-C</i>	<i>ECO-E</i>	<i>ECO-C</i>	<i>AQ</i>	<i>IDAQ</i>	<i>IRI-C</i>	<i>IRI-PT</i>	<i>IRI-D</i>	<i>IRI-F</i>	<i>EI-E</i>	<i>EI-BC</i>	<i>UCLA-LS</i>
<i>SIR – Discard</i>		.81	.81	.65	.52	.60	.52	-.14	-.15	.43	-.01	.37	.35	.37
<i>SIR – Acquire</i>	.81		.81	.65	.40	.61	.55	-.21	-.22	.39	-.01	.35	.34	.34
<i>SIR- Clutter</i>	.81	.81		.69	.40	.66	.61	-.31	-.23	.33	-.12	.34	.27	.38
<i>ECO - Empathy</i>	.65	.65	.69		.52	.77	.63	-.20	-.21	.43	.02	.47	.33	.30
<i>ECO - Concern</i>	.52	.40	.40	.52		.52	.41	.12	.04	.27	.16	.40	.32	.10
<i>AQ</i>	.60	.61	.66	.77	.52		.78	-.23	-.26	.37	.08	.45	.34	.25
<i>IDAQ</i>	.52	.55	.61	.63	.41	.78		-.24	-.20	.32	.01	.36	.29	.22
<i>IRI – Concern</i>	-.14	-.25	-.31	-.20	.12	-.23	-.24		.52	.07	.35	.23	.26	-.33
<i>IRI– Perspective Taking</i>	-.15	-.22	-.23	-.21	.04	-.26	-.20	.52		-.10	.28	.09	.09	-.30
<i>IRI – Distress</i>	.43	.39	.33	.43	.27	.37	.32	.07	-.10		.24	.54	.45	.28
<i>IRI – Fantasy</i>	.00	-.01	-.12	.02	.16	.08	.01	.35	.28	.24		.43	.37	-.04
<i>EI - Empathy</i>	.37	.35	.34	.47	.40	.45	.36	.23	.09	.54	.43		.72	.08
<i>EI – B. Contagion</i>	.35	.34	.27	.33	.32	.34	.29	.26	.09	.45	.37	.72		.04
<i>UCLA – LS</i>	.37	.34	.38	.30	.10	.25	.22	-.33	-.30	.28	-.04	.08	.04	

Note. All correlations significant at least $p < .05$; non-significant correlations in grey. Abbreviations: SIR=Saving Inventory – Revised, ECO=Empathy and Concern for Objects Scale, AQ=Anthropomorphism Questionnaire, IDAQ=Individual Differences in Anthropomorphism Questionnaire, IRI=Interpersonal Reactivity Index, EI=Empathy Index, UCLA-LS=UCLA Loneliness Scale

2.2.3.4 Testing the Loneliness Account of Anthropomorphic-driven Hoarding

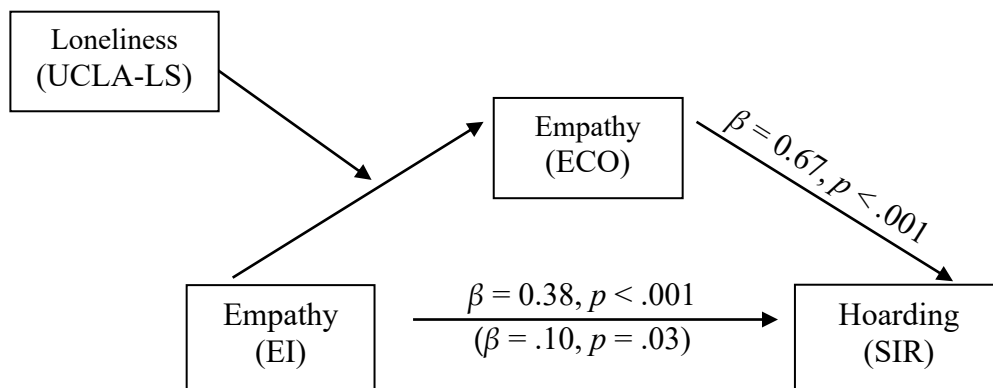
The previous analyses suggested that only the empathy subscale of the ECO could potentially mediate the relation between loneliness and hoarding behaviours. To test this, I ran a mediation model testing whether the indirect path from loneliness through anthropomorphic empathy to hoarding accounted for a significant portion of the relationship of loneliness and hoarding (see Figure 3). Using the same approach as above with bias corrected, bootstrapped confidence intervals, empathy ($\beta = .20$, $SE = .04$, 95% CI = .13, .27) partially mediated the relationship between UCLA-LS and SIR scores. This indirect path through the empathy subscale of the ECO accounted for 51% of the total effect of loneliness on hoarding scores. When the positions of the UCLA-LS and SIR were swapped, empathy no longer significantly mediated the relationship ($\beta = .03$, $SE = .06$, 95% CI = -.08, .16).

2.2.3.5 Testing the Diathesis-Stress Model of Anthropomorphic Hoarding

Combining these two models, I next looked at whether the data supported a diathesis-stress model of anthropomorphic driven hoarding. A moderated-mediation analysis, with bias corrected bootstrapped confidence intervals, was utilized to this end (see Figure 5.). The Empathy index was entered as the independent variable, the SIR as the dependent variable, the empathy subscale of the ECO as the mediator, and finally the UCLA-LS was entered as a moderator of the indirect path. The interaction between the EI and UCLA in predicting scores on the empathy subscale of the ECO was significant ($\beta = .10$, $p = .03$) whereby the relationship between EI and the empathy subscale of the ECO were significantly stronger as UCLA-LS scores increased. The moderated indirect path also partially mediated the association between the Empathy index and SIR scores at one standard deviation *below* the mean on UCLA scores ($\beta = .20$, $SE = .04$, 95% CI

= .14, .29), at the mean ($\beta = .28$, SE= .04, 95% CI = .21, .36), and one standard deviation above ($\beta = .36$, SE= .06, 95% CI = .24, .49). As UCLA scores increased, the effect of the indirect mediated path from EI scores to empathy ECO scores predicting SIR scores also increased. Taken together, this moderated indirect effect partially mediated the effect of Empathy Index on SIR scores ($B = .08$, SE= .03, 95% CI = .02, .15) accounting for 74% of the total effect. When Empathy Index and SIR are swapped in the model, this moderated indirect path is no longer significant ($B = .03$, SE= .03, 95% CI = -.02, .09)

Figure 5. Moderated Mediation Predicting SIR



Chapter 3: Discussion

To structure the general discussion, I refer to the six aims of the thesis laid out in the introduction. For each, I evaluate the degree to which the aim was fulfilled, limitations of the current studies, what more is needed from future research, and note any unexpected findings. After this, I outline future directions.

3.1 Revisiting the Aims

Aim #1 – To construct a self-report measure of empathy and concern for objects (or ECO) and begin to test the psychometric properties of both the scale and construct validity of affective anthropomorphism itself.

Using the Empathy Index (Jordan, Amir, & Bloom, 2017) and the empathic concern subscale Interpersonal Reactivity Index (Davis, 1983) for conceptual templates of the empathy and concern subscales, the original batch of items was reduced to a final eight items (four for each subscale) of the ECO in Study 1. EFA showed adequate factor loadings and the subscales displayed acceptable internal consistency. Study 2 replicated this adequate internal consistency and confirmatory factor analysis was used to test model fit using Chi-squared, RMSEA, and TLI-index as different measures; all three showed acceptable model fit for the two-factor structure. Also in the second study, I used EFA to assess whether the subscales of the ECO, the AQ, and the IDAQ split into distinct factors representing affective and cognitive anthropomorphism. Here the results were mixed: The eigenvalue > 1 approached yielded a single while parallel analysis showed the expected 2-factor solution. In terms of construct validity, convergent and divergent validity were assessed using measures of cognitive anthropomorphism and the Big 5 personality factors. As a very preliminary test of the discriminant validity of the ECO, it correlated modestly

with two other measures of cognitive anthropomorphism but showed weak associations with the Big-5.

There is much work left to be done to properly assess both the psychometric properties of the ECO as well as the construct it purports to measure. An assessment of the ECO's test-retest reliability is perhaps most pressing as the reliability of a measure is an inherent limitation to its validity. To complicate matters, this issue has theoretical considerations woven into it: To what extent is affective anthropomorphism a stable trait over time versus a more state like tendency that remains in flux? If it were driving hoarding behaviour we might expect a more stable trait given the stability of hoarding symptoms over the lifespan. In addition to test-retest reliability, longitudinal research is needed to approach this question empirically. While the CFA showed good model fit, the characteristics of the samples remained constant between Study 1 and Study 2 (i.e., MTurk participants). This leaves open the possibility that the 2-factor solution may fail to fit in other cultural contexts. For example, would participants in cultures with a stronger history of animistic beliefs (such as Japan) interpret the items of the ECO in the same way as the North American MTurk population? While there may be higher mean scores on the ECO in such a culture, the measure may be less reflective of the underlying emotional processes simply because an anthropomorphic manner of speech is more accepted. The same holds true across – not cultural – but clinical divides. For example, would the same factor structure hold in a population of people with clinical levels of hoarding? The clinical utility of the ECO cannot be understood until its psychometric properties can be tested in a *clinical* population. This would be a first step towards the goal of designing interventions that address affective anthropomorphism in hoarding and would allow future research to investigate how changes in both cognitive and affective anthropomorphism relate to treatment outcomes. In addition to the psychometric properties of

the ECO, there is also the underlying construct of affective anthropomorphism it intends to measure. It would be prudent for these initial studies to be the beginning of a multi-method, multi-trait (Campbell & Fiske, 1959) approach to establishing construct validity. For example, social neuroscience has made considerable progress in dissociating the more socio-affective and socio-cognitive processes (Kanske, 2018). If the ECO measures what it intends to, then it should track neurological differences in socio-affective processes to a greater extent than measures of cognitive anthropomorphism.

Aim # 2 – To test whether the ECO predicts hoarding behaviours and cognitions over and above other extant measures of anthropomorphism.

While the ECO showed strong zero-order correlations with both hoarding behaviours and cognitions, such a picture cannot exclude that the link between hoarding and anthropomorphism could be completely explained by measures of *cognitive* anthropomorphism. At the same time, if empathy and concern for objects were driving hoarding behaviour, we should expect that the ECO predicts hoarding over and above measures of cognitive anthropomorphism. Such a result would be consistent with the idea that the affective and cognitive facets of anthropomorphism have dissociable effects – hoarding behaviour being one possible example. Regression analyses in Study 1 showed that the empathy and concern subscales of the ECO did explain unique variance in both hoarding behaviours and cognitions over and above that predicted by the AQ and IDAQ. Taken together the model of ECO, IDAQ, AQ, gender, and age predicted over 40% of the variance for both SIR and SCI.

Given that the studies in this thesis are correlational, we are, of course, extremely limited in our ability to infer what causal role (if any) affective anthropomorphism plays in the maintenance of hoarding disorder. The non-clinical nature of the sample further restricts what

conclusion we can draw. While taxometric analyses (Timpano et al, 2013) suggest that hoarding behaviours are continuous in the general population (as opposed to being a distinct taxonomy) this does not guarantee that associated risk factors or drivers follow this pattern. For example, it could be that the strong associations between hoarding and the ECO observed in these studies are driven by a non-linear relationship where the association between hoarding and affective anthropomorphism decreases as hoarding behaviours reach clinical levels. The current studies cannot rule out such a possibility. However, one way to test this in a preliminary way is to compare the linear and quadratic curves in predicting SIR scores from the ECO. We collapsed across both studies ($N=704$) and compared the R^2 s for the empathy and concern subscales predicting SIR scores. The quadratic model performed slightly better than the linear in both cases (empathy .410 versus .414; concern .203 versus .208). Though slight, the shape of the quadratic curve suggests that the association between ECO and SIR decreases at extremely high and low SIR scores. Given these two limitations of the current research, future research should adopt an experimental approach, in a clinical sample, that attempts to test the causal connection between affective anthropomorphism and acquiring and discarding behaviour. Are people who hoard less likely to discard (or more likely to acquire) an easily anthropomorphized object compared to a less easily anthropomorphized counterpart? Such a study would help to determine whether affective anthropomorphism is driving hoarding behaviour or is simply an ancillary process.

One unexpected finding was that the empathy subscale was considerably more strongly associated with hoarding than the concern subscale of the ECO. Across both studies ($N=704$), empathy correlated $r=.64$ with the SIR while the concern subscale correlated only $r=.45$. Moreover, the 95% CI around each unstandardized estimate (.13-.15 for empathy, and .09-.11 for concern) do not overlap suggesting a statistically meaningful difference between the two effect

sizes in the population (at least, the population of MTurk workers). It is an interesting difference but one that is difficult to interpret with the data at hand. One possibility is that empathy is implicated in *two* distinct processes that contribute to hoarding behaviours while concern is only involved in one of these. In hoarding objects accumulate in the home both through actively saving or acquiring objects (for example, deciding actively not to discard a box or bringing one home from the alley) and avoiding making discarding decisions (for example, finding an excuse to avoid sitting down and making decisions about what to throw away) On the one hand, empathically mediated emotional reactions, such as pain at the thought of an object being destroyed in a trash compactor, could engender feelings of concern for the object – and motivations towards *saving* it. On the other hand, such negative emotions could occasion feelings of personal distress causing the person who hoard to *avoid* the process of discarding objects. Empathy then (but not concern) could be implicated in both ‘prosocial’ acts of saving objects but also avoidance behaviour. Another possibility explaining this difference between the empathy and concern subscales in predicting hoarding, is that the stronger association with empathy is partially explained by a stronger association with depression and anxiety (which themselves are highly correlated with hoarding). Looking more closely at the data from Study 1, when DASS depression and anxiety scores are partialled-out the gap between the empathy and concern subscales in predicting hoarding is reduced (.38 versus .33). Experiments that tease apart this approach and avoidance behaviour would be needed to test this possibility (and exclude such a third variable explanation). For example, a quasi-experimental approach could compare people high on concern (but low on empathy) to high on empathy (but low on concern) to test for group differences in avoidance versus approach behaviour with regards to discarding objects. Such

differences could be measured by participants' willingness to engage in a task that could potentially save an object from 'harm' compared to avoiding the situation all together.

Aim # 3 – To test whether negative affectivity (e.g. depression, anxiety, stress) could potentially increase anthropomorphism, and, if so, whether affective anthropomorphism accounts for its relationship with hoarding.

Hoarding is highly comorbid with mood and anxiety disorders. In one study (Frost, Steketee, & Tolin, 2015), nearly half of people diagnosed with clinical levels of hoarding also met criteria for a major depressive disorder and a quarter for generalized anxiety disorder. At this point, it is unknown to what extent such comorbid psychopathology is cause or consequence (or both) of hoarding. At the same time, while loneliness is the most well researched determinant of anthropomorphic tendencies, the boundary conditions of this effect have yet to be thoroughly mapped. This leaves open the possibility that it is not loneliness *per se* that upregulates anthropomorphism – but aversive conditions in general. Combining the high comorbidity of psychopathology in hoarding with the potential for general distress being a driver of anthropomorphism raises an interesting question: Could affective anthropomorphism mediate the relationship between general negative affectivity and hoarding? This is an extremely speculative proposal, and should be treated cautiously accordingly. However, in parallel mediation, both ECO subscales partially mediated the relationship between DASS and SIR scores accounting for 27% of the total effect. This indirect effect was no longer significant when DASS and SIR were swapped in the model.

Correlation is not causation – and mediational analyses alone do not bridge this gap. Here two paths of the model need further experimental investigation. First, as mentioned under aim # 2, the potential of a causal path from affective anthropomorphism to hoarding behaviours needs

to be tested. Second, the causal path from negative affectivity to affective anthropomorphism needs be established. Paradigms developed to study the connection between loneliness and cognitive anthropomorphism could be adapted to this task. The DASS scale, as the name implies, is intended to measure depression, anxiety, and stress. For sake of simplicity, and given the only modest ability of the DASS to discriminate between the constructs, total scores were used in the mediation analyses. There is much to be done to unpack this constellation of symptoms in order to sort out which (if any) are causally related to affective anthropomorphism. In terms of research on anthropomorphism more broadly, the SEEK model (Epley, Waytz, & Cacioppo, 2007) has outlined three factors that regulate anthropomorphism: Sociality, effectancy, and explicit knowledge. The results presented here suggest that the boundary condition of the two motivational factors (sociality and effectancy) may be broader than previously thought. For example, in addition to loneliness, other negative emotions such as depression, anxiety, and stress may increase anthropomorphic tendencies. Given the important role social cognition has played in the evolution of our species in avoiding predation as well as navigating violent exchanges with other humans, it may not be too surprising that anthropomorphic tendencies may increase in response to a wide range of aversive experiences. Following the logic of the ‘fire alarm principle’ it may be advantageous to err on the side of perceiving more minds in the environment in stressful situations such as war or being tracked by a predator.

***Aim # 4** – To test whether there exists any initial correlational evidence for exaggerated non-anthropomorphic empathy and concern in hoarding (i.e. the Overflow account) and, if so, whether affective anthropomorphism accounts for such a relationship.*

For this aim, the Empathy Index and empathic concern subscales of the Interpersonal Reactivity Index were the focal measures. The logic to the Overflow account was that if people

who hoard exhibited more empathy and concern *in general* (that is, for people) than perhaps these tendencies may overflow onto objects as well. Simply looking at the zero-order correlations, scores on the EI were positively associated with both the empathy ($r=.43$) and concern ($r=.39$) subscales of the ECO along with hoarding behaviours as measured by the SIR($r=.38$). These results suggest that people who have more empathy for other people also tend to have empathy and concern for objects; it is possible, then, that this increased empathy for other people is flowing over to other targets that we would not consider as having a mind. The results were much less supportive when it came to the empathic concern subscale of the IRI where there was a negative association with the SIR ($r=-.24$) and the empathy subscale of the ECO ($r=-.20$) but a small positive association with the concern subscale ($r=.12$). Because these correlations support the Overflow account *only* for empathy, no mediational analysis was run for concern. While the empathy and concern subscales fully mediated the direct effect of EI predicting SIR scores, this result held even when the EI and SIR were swapped in the model.

Although it may be difficult to experimentally manipulate trait levels of non-anthropomorphic empathy, it could be possible to test this path through indirect means. For example, if manipulating loneliness were to increase affective anthropomorphism, such a design could test for an interaction by condition and EI in predicting empathy and concern for objects. Specifically, the Overflow account would predict that people above the mean on the EI (compared to below the mean) would show the greatest increase in empathy and concern for objects when made to feel lonely. Such a result would suggest that affective anthropomorphism *depends upon* one's trait levels of general empathy – as suggested by the Overflow account. Another concern that future research could address deals with the manner in which the ECO was developed. As with self-report in general, shared method variance could potentially explain

significant associations – without being indicative of a relationship between the constructs the scales hope to measure. Given that the EI and IRI served as models for the creation subscales of the ECO, this issue of shared methods variance may be even more pronounced. As such, these effect size estimates should be treated with caution as it is unclear how much of this association would remain after this method variance were removed. One way to address this limitation would be to attempt to replicate these associations using other measures of empathy and concern.

If the (empathy) Overflow account were to receive further support, it would expand our understanding of the type of person who is at risk for developing hoarding. People generally high in empathy may find it more distressing to make discarding decisions and thus allow possession to gradually accumulate in the home over their lifespan. Understanding the effect of general empathy on hoarding behaviours could also allow us to identify different subtypes of hoarding. People who hoard cite many different reasons for saving objects (Frost et al., 2015) – many of which have no apparent connection to the perception of a mind in objects such as feeling prepared for the future or retaining important information. The presences or absence of elevated levels of general empathy could serve as a marker for anthropomorphic-driven hoarding and guide treatment decisions. Considering that cognitive behavioural treatment for hoarding is not as effective compared to other anxiety disorders such as OCD, identifying distinct subtypes of hoarding may help guide a personalized approach to treatment improving outcomes.

One surprising result concerns the *negative* association between hoarding and the empathic concern scale of the IRI. While not exceptionally large ($r=-.24$), this result becomes more interesting when placed besides a negative association between SIR scores and perspective taking ($r=-.20$) and a stronger *positive* association between SIR scores and personal distress ($r=.40$). This pattern of correlations paints a troubling picture of the social-cognitive ability in

hoarding. If people who hoard are worse at taking the perspective of other people, show less concern for their wellbeing, and are liable to avoid emotionally charged situations, this could help explain why people who hoard tend to experience interpersonal problems (Grisham, Steketee, & Frost, 2008) – in addition to the strain that hoarding itself puts on relationships. If we consider that hoarding is a chronic disorder, it is possible that living in a hoarded house could prevent a person from improving these social cognitive skills. Another unexpected finding was the modest correlation between the personal distress subscale of the IRI and the empathy subscale of the ECO ($r=.43$). What explains this association is unclear, however, its presence corroborates the possibility, discussed in aim #2, that empathy for objects could engender avoidance behaviour in hoarding – specifically in the context of making discarding decisions. Since people high in personal distress tend to avoid emotionally charged situations and higher levels of empathy make such situations *more* emotionally charged these two constructs may rise and fall together; this idea is supported by the stronger correlation between the EI and personal distress subscale of the IRI suggesting that this relationship holds for empathy *in general*.

Aim # 5 – To test whether loneliness is associated with hoarding (i.e. the Loneliness account) and, if so, whether affective anthropomorphism accounts for such a relationship.

For this aim, the question being investigated is whether experiences of loneliness could potentially upregulate affective anthropomorphism and, in turn, drive hoarding behaviours. Loneliness, as measured by the UCLA Loneliness scale, was positively associated with self-reported hoarding ($r=.39$) as well as the empathy subscale of the ECO ($r=.30$) – but only showed a weak, marginally significant correlation with concern ($r=.09$, $p=.08$). Since the path from loneliness to concern was not significant, a mediation model was run only for empathy. The indirect path from loneliness to hoarding as mediated by the empathy subscale of the ECO

accounted for 51% of the variance of the total effect; when the loneliness and hoarding variables were swapped in the model, testing the opposite direction, the indirect path no longer significantly mediated the relationship.

While this account is supported by the largest evidence base of those considered in this thesis, this evidence is only indirectly related to the loneliness account presented here. For one, the experimental evidence suggesting that loneliness increases anthropomorphism has been conducted using cognitive measures of anthropomorphism and no work has yet explored whether this holds true for affective anthropomorphism as well. Given this, such experimental designs would be a sensible place to start. Does manipulating feelings of loneliness cause people to experience more affective anthropomorphism? The evidence from this study suggests that this may hold true *only* for empathy. If this were the case, it would be an apparent dissociation between anthropomorphic empathy and concern. Opposed to this asymmetrical relationship, another option would be that loneliness causes an increase in concern for objects as a downstream consequence of its effects on empathy. In other words, it is possible that empathy mediates the relationship between loneliness and concern for objects. This is a model that we are unable to test in our current data given the non-significant association between loneliness and concern – but a higher-powered study may be able to find a significant effect if one exists. A more direct test of this idea would be to manipulate loneliness and measure both empathy and concern to see whether the former mediates the relationship between loneliness and the latter.

The connection between loneliness, affective anthropomorphism, and hoarding could shed light on a vicious cycle that may operate over the lifespan worsening hoarding. In retrospective studies (Hartl et al., 2005), the onset of hoarding has been associated with the experiences of interpersonal trauma. If such an event caused an increase in loneliness, an

increase in anthropomorphism may result as well. In such as case, the person may ‘save’ objects as result of empathy and concern for their welfare. An increase in such saving and acquiring behaviours would leave their homes more cluttered with possessions. This increase in clutter (and the saving and acquiring behaviours themselves) may further strain interpersonal relationships. We see this cross-sectionally, as the close others of people who hoard report that the clutter and associated behaviours place a strain on their relationships. Coming full circle, such a strain may increase the sense of loneliness in the person who hoards – further increasing anthropomorphism. Over the course of a life, this viscous cycle could produce the clutter, the social isolation, and the high levels of anthropomorphism we see in hoarding. In addition to this dynamic over time, there may be a learning component as well. If objects come to be perceived to be more minded, they may also become a more tempting solution to quell the feeling of loneliness; a trip to the thrift store may reduce loneliness – replacing coffee with a close friend. One way to test this possibility is to see whether people higher in anthropomorphism experience the act of acquiring an object to relieve feelings of loneliness.

***Aim # 6** – Lastly, given some evidence for both the Overflow and Loneliness accounts, to test whether a diathesis-stress model of anthropomorphic driven hoarding finds initial correlational support.*

The last aim sought to propose and run a tentative, preliminary test of a model that combines the Overflow and Loneliness accounts. Across both the Overflow and Loneliness account, the empathy subscale of the ECO was the only common mediator, so we excluded the concern subscale from the analysis. If we consider general, non-anthropomorphic empathy as a more trait-like construct and experiences of loneliness as more state-like, the two could be combined and modeled using a diathesis-stress approach. Diathesis-stress models explain the occurrence of

psychopathology by an interaction between a diathesis (a trait-like risk factor) and some environmental stressor (a state-like factor). When both diathesis and stressor co-occur, the chance of psychopathology developing is higher than if only the diathesis were alone present. The diathesis alone then is necessary, but not sufficient, for the expression of the psychopathology. To get a sense of what this looks like in diagram form, take a look back at Figure 5. In the present case, it is the interaction of high levels of trait empathy and state loneliness that produces exaggerated anthropomorphic empathy which, in turn, predicts hoarding behaviours. The interaction between the EI and UCLA-LS significantly predicted scores on the empathy subscale of the ECO (where, as loneliness increased, so too did the association between anthropomorphic and non-anthropomorphic empathy). This result leaves open the possibility that this moderated indirect path significantly predicted hoarding behaviours – a case of *moderated* mediation. This is what we found as the moderated indirect path was significantly stronger at one standard deviation above the mean on UCLA-LS scores. In total, this moderated indirect effect accounted for 74% of the total effect. When EI and SIR were swapped in the model this moderated indirect effect was no longer significant.

The purpose of this analysis was more suggestive than demonstrative; many untested causal assumptions, already covered in the aims #2, 4, and 5 are in need of further research. Even as a suggestive proposal, it is important not to take the content of the model as exhaustive. It may be that there are in fact multiple diatheses and multiple stressors that could produce the moderated indirect effect tested here. The case of general psychopathology discussed in aim #3 is an example of a whole set of potential stressors that could potentially increase anthropomorphic tendencies. In terms of other diatheses, the SEEK model of anthropomorphism (Epley, Waytz, & Cacioppo, 2007) suggests that people high in effectancy motivation – that is, being motivated to

control one's environment – exhibit stronger anthropomorphic tendencies. There is some hint of a parallel here with hoarding, as people who hoard show stronger intolerance of uncertainty (Mathes et al, 2017) and perfectionism (Timpano et al., 2011) both of which are related to an increased motivation to control one's environment. Moreover, even in the case of loneliness as a stressor, the matter is not perfectly cut and dry as the construct of loneliness has both state-like and trait-like features – and is, to some extent, heritable (Boomsma et al, 2005). Taken together, using a diathesis-stress approach could be potentially useful to understanding the role of anthropomorphism in hoarding – but it should not be used to exclude other possible explanations and models. However, understanding potential diatheses could help in identifying individuals more at risk to fall in the vicious cycle described in aim #5. Unlike, perhaps depression or OCD, hoarding becomes increasingly difficult to treat as the disorder progresses. Whereas depressive episodes come and go, stuff stays where you leave it. The challenge of decluttering a house after six months of hoarding is nothing compared to 6 years. If we understand the type of person likely to develop hoarding later in life, the person can exercise more vigilance and guard against the accumulation of clutter in the home. This could be especially helpful when experiencing times of social disconnection. While difficulty making discarding decisions (or controlling acquisition) may be stressful, the real damage in hoarding is done by the hoarded home itself.

3.2 Future Directions

With the limitations of the current studies and basic research needed to better support the ideas presented in this thesis in mind, I now turn to some potential applications. I start with some ideas related specifically to the role affective anthropomorphism may play in hoarding and consider how these might guide the development of novel approaches to treatment. Next, I

consider the role that affective anthropomorphism may play in our moral, economic, and political behaviour.

3.2.1 Hoarding, affective anthropomorphism, and treatment

If future research were to support the idea that empathy and concern for objects play a causal role in hoarding behaviours, how could this understanding help us in designing treatment strategies? One straightforward possibility is to teach people who hoard about the role such anthropomorphic emotions may be playing in their hoarding. Such a psychoeducational approach could potentially be helpful in a couple different ways. One of the challenges in treating hoarding is the poor insight that characterizes the disorder (Frost, Tolin, & Maltby, 2010); people who hoard may not see their behaviour as problematic. Part of this trouble with insight could be the strong, negative emotions brought about by considering discarding objects. If people who hoard could better understand the nature of these emotions, this knowledge could act as a lever helping people gain some perspective on their own behaviour. Beyond helping cultivate more insight, knowing about the origins of such strong emotions could, perhaps, also downregulate the anthropomorphic mind perception and mute the down-stream emotional consequences. This could be accomplished by having the patient challenge the implied claim made by the emotion: “I know I shouldn’t feel sorry for the object because it *really* doesn’t have a mind!” The SEEK model (Epley, Wyatz, & Cacioppo, 2007) proposes that such explicit knowledge about what has a mind and what does not can help to suppress anthropomorphic responses. While people who hoard in Western cultures by and large do not believe that their possessions really have minds, this knowledge may not be connected to the origin of the strong negative emotions occasioned by discarding. Helping people connect these dots could, perhaps, help to suppress their anthropomorphic tendencies.

Besides psychoeducational approaches, there could also be use in resetting treatment targets up-stream of anthropomorphism. The thesis considered a few different models of what could potentially be leading to increased anthropomorphism in hoarding. While the research is a long way off from offering guidance for the development of treatment manuals for hoarding, it is possible that targeting some of the potential drivers of anthropomorphism could be a helpful adjunct to addressing hoarding behaviours directly. For example, if loneliness were found to increase empathy and concern for objects, the social functioning of hoarding patients may be a desirable treatment target in its own right. A meta-analysis of interventions to reduce loneliness (Masi et al., 2011) considered four different treatment approaches: improving social skills, enhancing social support, increasing opportunities for social contact, and addressing maladaptive social cognition; of the four different approaches, remediating social cognitive skills showed the largest effects. Given the pattern of correlations with hoarding and (non-anthropomorphic) social cognition seen in Study 2 – less empathic concern and perspective taking, and greater personal distress – people who hoard might be helped by social cognitive training programs (Valk et al., 2017). The role that loneliness may play here also suggests a reason to prefer group (Muroff et al., 2012) over individual therapy – in addition to issues of cost-effectiveness. If other aversive states were also to be found to upregulate anthropomorphic tendencies – such as depression, anxiety, or stress, this would likewise suggest that treatment outcomes for hoarding could be improved through targeting other mental health problems that a patient may present with. Instead of conceptualizing, say, depression as an issue to work on after the person's hoarding is under control, it may be more effective to reverse the order. The other potential driver of affective anthropomorphism considered in this thesis was elevated levels of non-anthropomorphic empathy. While it may be difficult to affect trait levels of this tendency, there could be a

potential temporary pharmacological intervention (and one that is probably sitting currently in your medicine cabinet). Acetaminophen (Mischkowski, Crocker, & Way, 2016) has been shown to reduce not just one's own pain – but the experience of another person's pain as well. The empathy dampening effects of acetaminophen are a cause for concern in the general population; however, for treating hoarding this side-effect could potentially be a feature. Part of the challenge of decluttering a home is making quick, efficient decisions about objects during a set 'discarding session'. Taking a dose of acetaminophen shortly prior to such a session could potentially allow the person who hoards to be slightly more cold-hearted than usual and, thus, find it emotionally easier to discard possessions. At this point, it is unclear whether the empathy-reducing effects of acetaminophen would reach strong enough levels to be of clinical use; however, the possibility is certainly worth being explored.

3.2.2 Affective Anthropomorphism More Broadly

In the introduction, I discussed what I called the *metaphysical problem of scope* (how many things really have a mind) and distinguished it from the *psychological problem of scope* (how many things do we perceive as having a mind). One potential solution to the metaphysical problem of scope is panpsychism – the idea that *everything* has some amount of mind. While this is unlikely to solve the metaphysical problem, research on anthropomorphism suggests that it may be a viable solution to the psychological one. It could be the case that we are, to greater or lesser extents, *intuitive* panpsychists; we intuitively perceive every object to have some amount of mind. If this were true, then all cognition would be (to some extent) social cognition. This view stands in contrast to the inductive view proposed by the SEEK model where the perception of a mind involves an inferential leap from the absence to presence of a mind. The intuitive

panpsychist view proposes that perceived mind is not a dichotomous variable –but actually a continuous one.

Thinking of perceived mind as continuous variable would allow researchers to consider the impact of anthropomorphism on a wider scale. Consider economics. Behavioural economics has mounted a productive critique of classical economics’ conceptualization of humans as rational, self-interested utility maximizers by showing that economic behaviour is heavily influenced by emotionally laden biases (for example, see Kahneman, Knetsch, & Thaler, 2000). If we perceive the products we buy and sell in the market as having minds, then affective anthropomorphism could potentially hold implications for understanding our economic behavior. While this thesis has focused narrowly on the capacity for empathy and concern, there are many other social emotions (Leary, 2000) that may define our relationship to artefacts such as embarrassment, guilt or shame. One phenomenon where such anthropomorphic social emotions may have an influence is the endowment effect (Morewedge & Giblin, 2015) – which describes the tendency for sellers to value an object more than buyers. If ownership were to increase the amount of mind perceived in an object, then the discrepancy between buyers and sellers could be due to a heightened sense of concern or responsibility for the object.

Intuitive panpsychism also suggests that affective anthropomorphism may not be limited to concrete physical entities. For example, we may have affective anthropomorphic responses to quasi concrete, quasi abstract objects such as nations – or even fully abstract objects such as ideas. When uncle Sam points and sternly declares that he wants YOU to join the army, does this cause Americans to perceive their country as more minded? If so, would the average American feel guiltier at refusing service because they disappointed (the mind of) their country? When lady Justice stands blindfolded outside the courthouse, does this personification cause us to feel a

sense of social responsibility towards upholding the law? When we say someone betrays the Truth, is this more than poetic language? It may be that our political and moral behaviour is under the silent influence of affective anthropomorphism.

3.3 Concluding Remarks

Compared to the culture of, say, the Ancient Greeks, our modern, scientific worldview has drastically reduced the scope of mind in the world. Despite the empirical support such a view has received, it remains in tension with our evolved propensity to view mind more widely. At the same time, the modern industrialized world has produced an immense overabundance of *stuff*. From bags, to toasters, to plastic straws, these artefacts spend most of their lives living in the landfill after enjoying but a short stint in our homes. Apart from environmental considerations, the modern, scientific worldview has a hard time seeing the tragedy in this. However, from the point of view of intuitive panpsychism, throwaway culture involves the suffering of billions of quasi-minded artefacts. For people who are higher in affective anthropomorphism, what we call ‘hoarding’ may be a humane response to intuitively perceived suffering. Through the development of the ECO, this thesis has taken the first steps to testing the validity of this idea – though many more steps are left to be taken.

Bibliography

- Arditte, K. A., Çek, D., Shaw, A. M., & Timpano, K. R. (2016). The importance of assessing clinical phenomena in Mechanical Turk research. *Psychological Assessment, 28*(6), 684-691. doi:10.1037/pas0000217
- Bacon, F. (1904). The physical and metaphysical works of Lord Bacon, including The advancement of learning and Nouvum organum / edited by Joseph Devey. doi:10.5962/bhl.title.19126
- Baron-Cohen, S., & Wheelwright, S. (2004). The Empathy Quotient: An Investigation of Adults with Asperger Syndrome or High Functioning Autism, and Normal Sex Differences. *Journal of Autism and Developmental Disorders, 34*(2), 163-175. doi:10.1023/b:jadd.0000022607.19833.00
- Bartz, J. A., Tchalova, K., & Fenerci, C. (2016). Reminders of Social Connection Can Attenuate Anthropomorphism. *Psychological Science, 27*(12), 1644-1650. doi:10.1177/0956797616668510
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497-529. doi:10.1037/0033-2909.117.3.497
- Bloom, P. (2004). *Descartes baby*. London: William Heinemann.
- Beck, A. T. (1969). *Depression*. London: Staples Press.
- Boomsma, D. I., Willemsen, G., Dolan, C. V., Hawkey, L. C., & Cacioppo, J. T. (2005). Genetic and Environmental Contributions to Loneliness in Adults: The Netherlands Twin Register Study. *Behavior Genetics, 35*(6), 745-752. doi:10.1007/s10519-005-6040-8

- Braeken, J., & Marcel A. L. M. Van Assen. (2017). An empirical Kaiser criterion. *Psychological Methods*, 22(3), 450-466. doi:10.1037/met0000074
- Browne, M. W., & Cudeck, R. (1992). Alternative Ways of Assessing Model Fit. *Sociological Methods & Research*, 21(2), 230-258. doi:10.1177/0049124192021002005
- Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, 56(2), 81-105.
doi:10.1037/h0046016
- Cacioppo, J. T., Hughes, M. E., Waite, L. J., Hawkley, L. C., & Thisted, R. A. (2006). Loneliness as a specific risk factor for depressive symptoms: Cross-sectional and longitudinal analyses. *Psychology and Aging*, 21(1), 140-151. doi:10.1037/0882-7974.21.1.140
- Cangur, S., & Ercan, I. (2015). Comparison of Model Fit Indices Used in Structural Equation Modeling Under Multivariate Normality. *Journal of Modern Applied Statistical Methods*, 14(1), 152-167. doi:10.22237/jmasm/1430453580
- Chalmers, D. J. (1996). *The conscious mind: In search of a theory of conscious experience*. New York: Oxford University Press.
- Cotter, J., Granger, K., Backx, R., Hobbs, M., Looi, C. Y., & Barnett, J. H. (2018). Social cognitive dysfunction as a clinical marker: A systematic review of meta-analyses across 30 clinical conditions. *Neuroscience & Biobehavioral Reviews*, 84, 92-99.
doi:10.1016/j.neubiorev.2017.11.014
- Comfrey, A. L., & Lee, H. B. (1992). *A First Course in Factor Analysis*. Hillsdale, NJ: Lawrence Erlbaum Associates.

- Cullen, H., Kanai, R., Bahrami, B., & Rees, G. (2013). Individual differences in anthropomorphic attributions and human brain structure. *Social Cognitive and Affective Neuroscience*, 9(9), 1276-1280. doi:10.1093/scan/nst109
- Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*, 44(1), 113-126. doi:10.1037//0022-3514.44.1.113
- Dennett, D. C. (2007). *Consciousness explained*. New York: Back Bay Books, Little, Brown.
- Donnellan, M. B., Oswald, F. L., Baird, B. M., & Lucas, R. E. (2006). The Mini-IPIP Scales: Tiny-yet-effective measures of the Big Five Factors of Personality. *Psychological Assessment*, 18(2), 192-203. doi:10.1037/1040-3590.18.2.192
- Duffy, B. R. (2003). Anthropomorphism and the social robot. *Robotics and Autonomous Systems*, 42(3-4), 177-190. doi:10.1016/s0921-8890(02)00374-3
- Dziobek, I., Rogers, K., Fleck, S., Bahnemann, M., Heekeren, H. R., Wolf, O. T., & Convit, A. (2007). Dissociation of Cognitive and Emotional Empathy in Adults with Asperger Syndrome Using the Multifaceted Empathy Test (MET). *Journal of Autism and Developmental Disorders*, 38(3), 464-473. doi:10.1007/s10803-007-0486-x
- Epley, N., & Waytz, A. (2010). Mind perception. In S. T. Fiske, D. T. Gilbert, & G. Lindzey (Eds.), *Handbook of social psychology* (pp. 498-541). Hoboken, NJ, US: John Wiley & Sons Inc..
- Epley, N., Waytz, A., & Cacioppo, J. T. (2007). On seeing human: A three-factor theory of anthropomorphism. *Psychological Review*, 114(4), 864-886. doi:10.1037/0033-295x.114.4.864

- Epley, N., Akalis, S., Waytz, A., & Cacioppo, J. T. (2008). Creating Social Connection Through Inferential Reproduction. *Psychological Science, 19*(2), 114-120. doi:10.1111/j.1467-9280.2008.02056.x
- Field, A. (2000). *Discovering Statistics using SPSS for Windows*. London – Thousand Oaks – New Delhi: Sage publications.
- Fournier, S., Breazeale, M., & Avery, J. (2015). *Strong Brands, Strong Relationships*. Florence: Taylor and Francis.
- Frost, R. O., & Hartl, T. L. (1996). A cognitive-behavioral model of compulsive hoarding. *Behaviour Research and Therapy, 34*(4), 341-350. doi:10.1016/0005-7967(95)00071-2
- Frost, R. O., Steketee, G., & Williams, L. (2000). Hoarding: A community health problem. *Health and Social Care in the Community, 8*(4), 229-234. doi:10.1046/j.1365-2524.2000.00245.x
- Frost, R. O., Steketee, G., & Grisham, J. (2004). Saving Inventory-Revised. *PsycTESTS Dataset*. doi:10.1037/t11887-000
- Frost, R. O., Tolin, D. F., & Maltby, N. (2010). Insight-Related Challenges in the Treatment of Hoarding. *Cognitive and Behavioral Practice, 17*(4), 404-413. doi:10.1016/j.cbpra.2009.07.004
- Frost, R. O., Steketee, G., & Tolin, D. F. (2015). Comorbidity in Hoarding Disorder. *Focus, 13*(2), 244-251. doi:10.1176/appi.focus.130218
- Frost, R. O., Steketee, G., Tolin, D. F., Sinopoli, N., & Ruby, D. (2015). Motives for acquiring and saving in hoarding disorder, OCD, and community controls. *Journal of Obsessive-Compulsive and Related Disorders, 4*, 54-59. doi:10.1016/j.jocrd.2014.12.006

- Gould, S. J., & Vrba, E. S. (1982). Exaptation—a Missing Term in the Science of Form. *Paleobiology*, 8(1), 4-15. doi:10.1017/s0094837300004310
- Goldberg, L. R., Johnson, J. A., Eber, H. W., Hogan, R., Ashton, M. C., Cloninger, C. R., & Gough, H. G. (2006). The international personality item pool and the future of public-domain personality measures. *Journal of Research in Personality*, 40(1), 84-96. doi:10.1016/j.jrp.2005.08.007
- Grisham, J. R., Steketee, G., & Frost, R. O. (2008). Interpersonal problems and emotional intelligence in compulsive hoarding. *Depression and Anxiety*, 25, E63-71. doi:10.1002/da.20327
- Guthrie, S. (1995). *Faces in the clouds: A new theory of religion*. New York: Oxford University Press.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis*. Andover, Hampshire, United Kingdom: Cengage.
- Hartl, T. L., Duffany, S. R., Allen, G. J., Steketee, G., & Frost, R. O. (2005). Relationships among compulsive hoarding, trauma, and attention-deficit/hyperactivity disorder. *Behaviour Research and Therapy*, 48(2), 269-276. doi:10.1016/j.brat.2004.02.002
- Haslam, N. (2006). Dehumanization: An Integrative Review. *Personality and Social Psychology Review*, 10(3), 252-264. doi:10.1207/s15327957pspr1003_4
- Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis a regression-based approach*. New York: The Guilford Press.
- Hebb, D. O. (1946). Emotion in man and animal: An analysis of the intuitive processes of recognition. *Psychological Review*, 53(2), 88-106. doi:10.1037/h0063033

- Heider, F., & Simmel, M. (1944). An Experimental Study of Apparent Behavior. *The American Journal of Psychology*, 57(2), 243. doi:10.2307/1416950
- Holt-Lunstad, J., Smith, T., & Layton, J. (2010). Social Relationships and Mortality Risk: A Meta-analytic Review. *SciVee*. doi:10.4016/19865.01
- Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, 30(2), 179-185. doi:10.1007/bf02289447
- Huff, C., & Tingley, D. (2015). "Who are these people?" Evaluating the demographic characteristics and political preferences of MTurk survey respondents. *Research & Politics*, 2(3), 205316801560464. doi:10.1177/2053168015604648
- Jordan, M. R., Amir, D., & Bloom, P. (2016). Are empathy and concern psychologically distinct? *Emotion*, 16(8), 1107-1116. doi:10.1037/emo0000228
- Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, 39(1), 31-36. doi:10.1007/bf02291575
- Kahneman, D., Knetsch, J. L., & Thaler, R. H. (2000). Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias. *Choices, Values, and Frames*, 159-170. doi:10.1017/cbo9780511803475.009
- Kanske, P. (2018). The social mind: Disentangling affective and cognitive routes to understanding others. *Interdisciplinary Science Reviews*, 43(2), 115-124. doi:10.1080/03080188.2018.1453243
- Leary, M. R. (2000). Affect, cognition, and the social emotions. In J. P. Forgas (Ed.), *Studies in emotion and social interaction, second series. Feeling and thinking: The role of affect in social cognition* (pp. 331-356). New York, NY, US: Cambridge University Press.

- Lockwood, P. L., Bird, G., Bridge, M., & Viding, E. (2013). Dissecting empathy: High levels of psychopathic and autistic traits are characterized by difficulties in different social information processing domains. *Frontiers in Human Neuroscience*, 7. doi:10.3389/fnhum.2013.00760
- Lovibond, S. H., & Lovibond, P. F. (1995). Depression Anxiety Stress Scales. *PsycTESTS Dataset*. doi:10.1037/t01004-000
- Masi C.M., Chen H.Y., Hawkey L.C., & Cacioppo J.T. (2011) A meta-analysis of interventions to reduce loneliness. *Personality and Social Psychology Review*. 15:219–266. doi: 10.1177/1088868310377394
- Mathes, B. M., Oglesby, M. E., Short, N. A., Portero, A. K., Raines, A. M., & Schmidt, N. B. (2017). An examination of the role of intolerance of distress and uncertainty in hoarding symptoms. *Comprehensive Psychiatry*, 72, 121-129. doi:10.1016/j.comppsy.2016.10.007
- Meehl, P. E. (1962). Schizotaxia, schizotypy, schizophrenia. *American Psychologist*, 17(12), 827-838. doi:10.1037/h0041029
- McGinn, C. (1998). *Problems in philosophy: The limits of inquiry*. Oxford, UK: Blackwell.
- Mischkowski, D., Crocker, J., & Way, B. M. (2016). From painkiller to empathy killer: Acetaminophen (paracetamol) reduces empathy for pain. *Social Cognitive and Affective Neuroscience*, 11(9), 1345-1353. doi:10.1093/scan/nsw057
- Morewedge, C. K., & Giblin, C. E. (2015). Explanations of the endowment effect: An integrative review. *Trends in Cognitive Sciences*, 19(6), 339-348. doi:10.1016/j.tics.2015.04.004
- Morford, M. P., Lenardon, R. J., & Sham, M. (2018). *Classical mythology*. New York: Oxford University Press.

- Muroff, J., Steketee, G., Bratiotis, C., & Ross, A. (2012). Group Cognitive And Behavioral Therapy And Bibliotherapy For Hoarding: A Pilot Trial. *Depression and Anxiety, 29*(7), 597-604. doi:10.1002/da.21923
- Neave, N., Jackson, R., Saxton, T., & Hönekopp, J. (2015). The influence of anthropomorphic tendencies on human hoarding behaviours. *Personality and Individual Differences, 72*, 214-219. doi:10.1016/j.paid.2014.08.041
- Neave, N., Tyson, H., McInnes, L., & Hamilton, C. (2016). The role of attachment style and anthropomorphism in predicting hoarding behaviours in a non-clinical sample. *Personality and Individual Differences, 99*, 33-37. doi:10.1016/j.paid.2016.04.067
- Nesse, R. M. (2006). The Smoke Detector Principle. *Annals of the New York Academy of Sciences, 935*(1), 75-85. doi:10.1111/j.1749-6632.2001.tb03472.x
- Nolan, L. (2012). *Primary and secondary qualities: The historical and ongoing debate*. Oxford: Oxford University Press.
- Preckel, K., Kanske, P., & Singer, T. (2018). On the interaction of social affect and cognition: Empathy, compassion and theory of mind. *Current Opinion in Behavioral Sciences, 19*, 1-6. doi:10.1016/j.cobeha.2017.07.010
- Russell, D. W. (1996). UCLA Loneliness Scale (Version 3): Reliability, Validity, and Factor Structure. *Journal of Personality Assessment, 66*(1), 20-40. doi:10.1207/s15327752jpa6601_2
- Schoen, E. L. (1990). Anthropomorphic Concepts of God. *Religious Studies, 26*(1), 123-139. doi:10.1017/s0034412500020254
- Singer, T., & Klimecki, O. M. (2014). Empathy and compassion. *Current Biology, 24*(18). doi:10.1016/j.cub.2014.06.054

- Shaw, A., Timpano, K., Steketee, G., Tolin, D., & Frost, R. (2015). Hoarding and emotional reactivity: The link between negative emotional reactions and hoarding symptomatology. *Journal of Psychiatric Research, 63*, 84-90.
doi:10.1016/j.jpsychires.2015.02.009
- Snedecor, G. W., & Cochran, W. G. (1989). *Statistical methods: By George W. Snedecor and William G. Cochran*. Ames, IA: Iowa State University Press.
- Steketee, G., Frost, R. O., & Kyrios, M. (2003). Cognitive aspects of compulsive hoarding. *Cognitive Therapy and Research, 27*(4), 463-479. doi:10.1023/A:1025428631552
- Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods, 7*(4), 422-445.
doi:10.1037/1082-989x.7.4.422
- Tam, K., Lee, S., & Chao, M. M. (2013). Saving Mr. Nature: Anthropomorphism enhances connectedness to and protectiveness toward nature. *Journal of Experimental Social Psychology, 49*(3), 514-521. doi:10.1016/j.jesp.2013.02.001
- Timpano, K. R., Exner, C., Glaesmer, H., Rief, W., Keshaviah, A., Braehler, E., & Wilhelm, S. (2011). The epidemiology of the proposed DSM-5 hoarding disorder: Exploration of the acquisition specifier, associated features, and distress. *Journal of Clinical Psychiatry, 72*(6), 780-786. doi:10.4088/JCP.10m06380
- Timpano, K. R., Broman-Fulks, J. J., Glaesmer, H., Exner, C., Rief, W., Olatunji, B. O., Schmidt, N. B. (2013). A taxometric exploration of the latent structure of hoarding. *Psychological Assessment, 25*(1), 194-203. doi:10.1037/a0029966

- Timpano, K. R., & Shaw, A. M. (2013). Conferring humanness: The role of anthropomorphism in hoarding. *Personality and Individual Differences, 54*(3), 383-388.
doi:10.1016/j.paid.2012.10.007
- Trewavas, T. (2016). Plant Intelligence: An Overview. *BioScience, 66*(7), 542-551.
doi:10.1093/biosci/biw048
- Valk, S. L., Bernhardt, B. C., Trautwein, F., Böckler, A., Kanske, P., Guizard, N., Singer, T. (2017). Structural plasticity of the social brain: Differential change after socio-affective and cognitive mental training. *Science Advances, 3*(10). doi:10.1126/sciadv.1700489
- Waytz, A., Cacioppo, J., & Epley, N. (2010). Who Sees Human? *Perspectives on Psychological Science, 5*(3), 219-232. doi:10.1177/1745691610369336
- Wegner, D. M., & Gray, K. J. (2017). *The mind club: Who thinks, what feels, and why it matters*. New York, NY: Penguin Books.
- Yong, A. G., & Pearce, S. (2013). A Beginner's Guide to Factor Analysis: Focusing on Exploratory Factor Analysis. *Tutorials in Quantitative Methods for Psychology, 9*(2), 79-94.
doi:10.20982/tqmp.09.2.p079

Appendices

Appendix A Initial EFA of ECO items

ECO Item	Factor		
	1	2	3
I feel sorry for my possessions when I have to throw them out.	1.08	0.13	-0.09
I find it painful to throw my stuff in the dumpster.	0.95	-0.03	-0.16
I usually feel sorry for objects when they are broken.	0.79	0.08	0.06
I feel sad when I give away my objects to a second-hand store.	0.76	-0.23	0.03
I feel sorry for my objects when they break.	0.76	0.13	-0.06
When I see an object sitting alone in the rain, I feel sad.	0.58	-0.05	0.36
When I see an object that has been mistreated, I feel kind of protective towards it.	0.57	0.18	0.14
I feel sad seeing forgotten objects sitting in a lost and found.	0.56	0.07	0.24
I generally feel concern for my possessions that need to be repaired.	0.42	0.40	0.4
I find it painful to watch one of my glasses smash.	0.41	0.23	0.02
When objects are treated badly, I feel sorry for them.	0.40	0.34	0.12
It makes me happy to see an old bike that's well looked after.	-0.19	0.84	0.04
I generally feel quite touched when I can find one of my possessions a good home.	-0.19	0.82	0.02

Appendix A Initial EFA of ECO items

When I treat my possessions well, it makes me feel happy.	0.07	0.80	-0.24
I am often quite touched when I see objects that are well taken care of.	-0.02	0.77	0.02
I feel happy when one of my objects I left on the curb finds a new home.	-0.02	0.71	0.04
I find myself often concerned for the well-being of my possessions.	0.11	0.63	-0.02
I would describe myself as a pretty soft-hearted person when it comes to my possessions.	0.41	0.48	-0.05
I find it painful to tear apart a cardboard box before I put it in the recycle bin.	-0.17	-0.06	0.87
When I'm in a store and I see that there's only one left of a certain product, I feel lonely.	0.05	-0.17	0.81
When I see a car about to be crushed in a junk yard, I feel afraid.	-0.06	0.03	0.80
When I see an old rusted car that's been abandoned, I feel sad.	0.11	0.11	0.62
I feel sorry for stuff that is sitting alone on the curb.	0.32	0.06	0.46
I often have tender, concerned feelings for objects that don't have a home.	0.27	0.24	0.40

A.1 Results from a Parallel Analysis of the 8-Item ECO

ECO Item	Factor	
	1	2
Factor 1 (Empathy)		
I find it painful to tear apart a cardboard box before I put it in the recycle.	.83	-.13
When I'm in a store and I see that there's only one left of a certain product I feel lonely.	.83	-.09
When I see a car about to be crushed in a junk yard I feel afraid.	.77	.04
When I see an old rusted car that's been abandoned, I feel sad.	.57	.27
Factor 2 (Concern)		
I am often quite touched when I see objects that are well taken care of.	-.07	.80
I generally feel quite touched when I can find one of my objects a good home.	-.18	.77
I generally feel concern for my possessions that need to be repaired.	.20	.62
When objects are treated badly, I feel sorry for them.	.21	.62

A.2 EFA with ECO-Empathy, ECO-Concern, AQ, and IDAQ

ECO Item	Factor
Factor 1 (Anthropomorphism)	
AQ	.96
IDAQ	.81
ECO-Empathy	.80
ECO-Concern	.55

A.3 Parallel Analysis with ECO-Empathy, ECO-Concern, AQ, and IDAQ

ECO Item	Factor	
	1	2
Factor 1 (Cognitive Anthropomorphism)		
IDAQ	.84	-.002
AQ	.74	.26
Factor 2 (Affective Anthropomorphism)		
ECO-Empathy	.001	.61
ECO-Concern	.21	.77