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The Effectiveness of Response Inhibition Training on Compulsive Acquiring

Supervisor: Dr Helena Drury

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Abstract

Objective: Impairment in inhibitory control has been suggested to be associated with major disorders such as overeating, substance use and gambling. Albeit response inhibition training (training to inhibit one's responses) has been found to be effective for these disorders, no any previous research has attempt to explore the role of inhibitory control and apply such training for compulsive buying. As compulsive buying has been also found to be underpinned by a deficit in inhibition, this study aims to explore the effectiveness of response inhibition training on compulsive acquisition as a first attempt to support novel treatment approaches.

Method: Sixty-nine individuals with a relatively high compulsive acquisition were selected from a non-clinical student population and were allocated to a randomised, double blind design to receive four 10-min sessions of go/no-go training in either active or inactive condition. In training, participants were told to withhold their responses to either chosen items (active condition) or to faces and landscapes (inactive condition). Participants were told to complete the training pre- and post-intervention and provided self-report measures of compulsive acquisition at pre, post and follow up.

Results: Using parametric analysis, participants in the active condition showed a significant reduction in the likeability of both chosen and corresponding items compared to participants in the inactive condition in which a slight reduction was observed only at follow-up. No any association between intervention and shopping tasks, three main self-report measures was found. There was also no observed effect of intervention on the number of bought items and total spending.

Conclusion: This is the first study to investigate the effectiveness of response inhibition training on compulsive acquisition. The results show that future studies are warranted to look at the role of inhibitory control and evaluate the training effect.

Contents

1. Introduction

1.1 Background for Compulsive Buying Disorder

Compulsive buying disorder (CBD) is characterized by repeated and frequent buying episodes that generates psychological distress and impacts social and occupation functioning and increases risk of suicide attempts and criminal behaviour (Müller, Mitchell, & de Zwaan, 2015). Specifically, CBD can result in financial problems, such as financial distress and even indebtedness (Achtziger, Hubert, Kenning, Raab, & Reisch, 2015). CBD typically occurs in young adulthood; its prevalence rate has been suggested to range from 2- 10%, with a higher proportion of affected women (Lee & Mysyk, 2004; Maraz, Griffiths, & Demetrovics, 2016). Compulsive buying is also seen in hoarding disorder which is characterised by having difficulty with discarding belongings and goods regardless of the actual value (DSM-5; American Psychiatric Association, 2013; Steketee, & Frost, 2003). Although not all compulsive buyers also suffer from compulsive hoarding, most individuals who engage in extreme hoarding behaviour seem to also suffer from compulsive acquisition (Frost, Steketee, & Williams, 2002). Nevertheless, both conditions differentiate themselves from non-pathological consumer behaviour in its focus on the buying process rather than the purchased item itself (O'Guinn & Faber, 1989).

Historically, CBD was categorised as an 'impulse control disorder (ICD) not elsewhere specified' in the Diagnostic and Statistical Manual of Mental Disorders (DSM) III-R. Currently, there are controversial opinions around the classification of CBD as to whether it belongs to an addictive disorder, an obsessive-compulsive disorder or a mood disorders spectrum (Tavares, Lobo, Fuentes, & Black, 2008). The DSM-IV and the International Classification of Diseases (ICD) 11 abstained from including CBD as a form of addiction due to lack of data and clarity of the relationship of CBD to other disorders (Lee & Mysyk, 2004; Piquet-Pessôa, Ferreira, Melca, & Fontenelle, 2014). In the old descriptions of the DSM, in order for a condition to be diagnosed as an addictive disorder, it was necessary for it to be related to alcohol and substance use. However, in the DSM-5, the meaning of these diagnostic criteria of addiction have changed; for example, gambling disorder is currently classified as "Substance-related and addictive disorders", which supports the fact that both substance use and gambling share similar clinical profiles such as early age onset, high prevalence rates in adolescents, activation of the brain's reward system, comorbidity with similar disorders (e.g. mood disorders, bipolar disorders) and high levels of discomfort when ceasing the pathological

behaviours (Müller et al., 2015; Piquet-Pessôa et al., 2014). The fact that gambling shares important clinical features with substance use disorder supports the idea and decision of including gambling disorder under the classification of addictive disorders. Compulsive buying, on the other hand, shares less similarities with addictive disorders such as different neurocircuitry pathways and less extreme frequency and severity of pathological behaviours (Piquet-Pessôa et al., 2014).

Whilst CBD and its classification still remains unclear, the common opinion prevails that compulsive buying belongs to a form of impulse control disorder (Müller et al., 2015), supporting the key characteristics of CBD which are high impulsivity and lack of control over buying behaviour. Interestingly, several common psychiatric disorders, including CBD, are subject to general criticism. It has been suggested that some might be based on medicalising social and personal issues stemming from mainly political factors, inequality and secularization, resulting in regarding the phenomenon and the underlying issue from a medical point of view rather than from a social perspective (Lee & Mysyk, 2004). CBD has received considerable attention and its prevalence is expected to rise within the next decades (Dittmar, 2005; Maraz et al., 2016). The rise of the consumer culture (including e-commerce and marketing tactics) and the shift of focus on endorsement of materialistic values have been suggested as key predictors for CBD which have led to this increased presence of the disorder (Horváth, Adigüzel, & Herk, 2013). Access to easy credit, money attitudes such as money obsession and money as a gateway to power, but also trust issues and anxiety seem to be among the main causes of overspending (Lo & Harvey, 2011; Roberts & Jones, 2001).

1.2 The role of inhibitory control in CBD

Inhibitory control, which is one of the most important components of executive function, refers to a capability of inhibiting unwanted and unsuitable behaviours (Allom, Mullan, & Hagger, 2016). The concept of inhibitory control is based on the dual process model, which indicates that there are two different cognitive mechanisms that influence behaviour (Smith & DeCoster, 2000; f, Labrecque, Lin, & Rünger, 2014). The first one is an impulsive system based on fast, unconscious and uncontrolled processes that leads people to engage in automatic reactions (involving impulsivity). The second one is a reactive system which is linked with slower, deliberative, conscious and more controlled processes that enable better decision making. Individuals with stronger inhibitory control are able to resist their impulses more by selectively focusing on stimuli that match their goals and ignoring their attention to

those that do not (Smith & DeCoster, 2000). Linked to inhibitory control is the concept of delayed gratification (studied as part of the well-known "marshmallow experiment"), a process that depicts the individual's ability to resist temptations of immediate short-term rewards for later long-term rewards (Mischel et al., 2010). Delayed gratification is one of the neuropsychological tests assessing inhibitory control. Inability to delay gratification present in childhood has been related to mental, physical and behavioural aspects in adulthood, including financial problems (Dawd, 2017). In fact, Dawd (2017) suggests individuals with an inability to delay gratification to be primary victims of CBD; however, this notion is suggestive and not conclusive as it does not rely on any quantitative data.

1.3 The role of inhibitory control in other disorders

Whilst it remains unclear to what extent inhibitory control plays a role in CBD, it has been greatly studied in relation to other disorders. There is a body of evidence that has linked inhibitory control to eating disorders (Claes, Nederkoorn, Vandereycken, Guerrieri, & Vertommen, 2006), physical and mental health outcomes (Oldehinkel, Hartman, Ferdinand, Verhulst, & Ormel, 2007; Riggs, Spruijt-Metz, Sakuma, Chou, & Pentz, 2010), substance use, pathological gambling and other addictions (Moffitt et al., 2011). However, a 30-year longitudinal study has suggested that these associations might to some extent be moderated by socioeconomic factors and intelligence during childhood (Fergusson, Boden, & Horwood, 2013). This suggests that these factors can have protective effects on these poor regulatory capacities and are indeed dynamic and shaped during early life exposure up to young adulthood. These studies based on other disorders aid understanding of CBD, but also demonstrate that exploring the role of inhibitory control might be complex due to the interplay of moderating and dynamic factors. Yet, lack of inhibitory control seems to underlie impulse-related phenomena, such as overeating in obesity, and behaviours leading to addiction; it can hence be considered an important predictive factor for individuals with CBD as the key feature include an inability to control impulses over buying.

1.4 Neuroscientific evidence of inhibitory control

Inhibitory control involves the ability to suppress inappropriate and irrelevant cognitions and behaviours including planned movements (Diamond, 2013). A review by Nigg (2000) provides a framework of inhibition models and proposes several different kinds of inhibitory control including 'interference inhibition' (the ability to supress distractors that compete with the desired response) and 'intentional motor inhibition'. The main inhibitory control type that is relevant to the present study and cognitive task is 'intentional motor inhibition'. It involves the ability to deliberately control a main motor response in accordance with relevant contextual cues (infrequent stimulus) which thus produces inhibition of the desired/ dominant response. This inhibition control has long been studied experimentally with the use of cognitive psychology computerised paradigms (Nigg, 2000). The go/no-go task is such a computerised paradigm to assess sustained attention and inhibitory control based on the idea that individuals should respond quickly (manually pressing a key) to certain stimuli ('go' stimuli) and withhold their responses when presented with other stimuli ('no-go' stimuli). Successfully withholding the response to the 'no-go' stimuli demonstrates a stronger capacity for inhibitory control. Neuroscientific evidence has shown the underlying neural basis implicated in cognitive processes involved in inhibitory control (Aron et al., 2007). Specifically, neurons within the primary motor cortex seem to play a vital role in voluntary movement and the selection and maintenance of task-relevant information. Initiation of movements as during a computerised decision-making task, stems from activation in the prefrontal cortex that act via the basal ganglia and travel along the corticospinal pathways via corticospinal and intracortical neurons (Coxon, Stinear, & Byblow, 2006).

1.5 Evidence of inhibitory control in substance use

Although evidence of impaired inhibitory control in CBD has not been explored in detail, information on how inhibition may be impaired in impulse control disorders can be gained from examining other disorders such as addiction and gambling but also over-eating. Dysfunctional inhibitory control characterises various behavioural addictions. For instance, alcohol and substance addiction are disorders known for the involvement of impaired response inhibition (López-Caneda, Rodríguez Holguín, Cadaveira, Corral, & Doallo, 2013). Ahmadi et al. (2013) showed that during go/no-go tasks with neutral stimuli, individuals with high alcohol consumption had increased reaction times and lower accuracy rates to suppress the required response than light drinkers. These behavioural responses correlated with dysfunctional brain

activity in areas related to impulsivity and inhibition, suggesting the involvement of these areas in impaired attention and response inhibition. While this study presented neutral stimuli in the go/no-go tasks, others have investigated the effect of alcohol-related cues on attention and inhibitory control. Alcohol abusers have been shown to have difficulty suppressing their responses to alcohol-related cues, which is thought to indicate unconscious and automatic behaviour towards alcohol cues (Bechara, Noel, & Crone, 2006). In line with the dual-process model, drinking behaviours of alcohol abusers are seen as controlled by the impulsive system driven by positive implicit attitudes to alcohol and resulting in difficulty in managing their urges to drink (Houben & Wiers, 2007).

Some treatments for drug addictions (pharmacological and behavioural treatments, detoxification plans) are promising but there are individual differences in terms of effectiveness. In fact, reduced inhibitory skills in drug abusers have been shown to predict lower treatment responsiveness, poorer outcomes and abstinence (Sofuoglu, DeVito, Waters, & Carroll, 2013) and also increased risk of relapse (Morein-Zamir & Robbins, 2015). This indicates that behavioural interventions focusing on cognitive processes could be used as complementary treatment approaches. Training alcohol-dependant individuals to have better motor inhibitory ability has potential to improve drinking behaviour. The computer-based go/no-go task can be used as a way to train inhibition (by learning how to sustain attention and withhold responses to stimuli in question) and this training could be stimuli specific or non-stimuli specific (Jones & Field, 2013). Specific inhibition training involves exposing individuals to pictures of alcohol cues and non-stimuli specific inhibition training involves showing individuals non-alcohol related pictures. Field, Kiernan, Eastwood and Child (2008) suggest that a non-specific response inhibition training could indeed be helpful for heavy drinkers due to reduced exposure to the addictive cue. However, Jones and Field (2013) compared inhibitory control training with alcohol-related cues to neutral cues and a control group not receiving any training and showed that the presence of alcohol-related stimuli were responsible for improvements in inhibition and reductions in alcohol consumption. A meta-analysis showed an increased effectiveness of response inhibition training on behavioural measures such as reaction time and accuracy rates (related to neuroscientific activations in inhibitory control centres) and health behaviours when the training was based on specific rather than non-specific stimuli (Allom et al., 2016). Nevertheless, inconsistencies in the literature exists and might be explained by the fact that studies do not consider training duration and intensity and methodological aspects in the administration of these trainings such as speed of

stimulus presentation (Bartsch, Kothe, Allom, Mullan, & Houben, 2016; Simpson & Riggs, 2006).

1.6 Response inhibition training for alcohol abuse

Since evidence exploring inhibition in addictions has been well researched, the impact of response inhibition training on addictive behaviours will now be explored in detail. It remains unclear what exactly causes behaviour change as a result of response inhibition training. Houben, Havermans, Nederkoorn and Jansen (2012) carried out a stimuli-specific inhibition training with a go/no-go task to analyse the underlying mechanisms of the training effect on alcohol consumption. In their study, they compared implicit attitudes, alcohol consumption and inhibitory control between two conditions, a beer/no-go condition, in which individuals needed to withhold their response from alcohol-related stimuli and a beer/go condition, in which participants needed to react to alcohol-related stimuli. While there was no difference between the two groups in inhibitory control after one single training session (considering the importance of training duration and intensity as a limiting factor), individuals that were asked to withhold their responses showed a reduction in implicit attitudes towards alcohol and less alcohol consumption. This suggests that devaluation of alcohol-related stimuli seems to play a more important role than increased (trained) inhibitory control over alcohol-related cues. Implicit attitudes towards alcohol-related pictures might become less positive which leads to a reduction in the hedonic value by repetitively withholding responses towards the cues. This is thought to eventually help individuals with excessive alcohol use to control their automatic reactions which have been found to be regulated by the impulsive system. In this regard, the response inhibition training seems to work in the same way as extinction learning. This training does not lead people to forget the already learned association between alcohol and the approaching behaviour but generates a novel association between the stimuli and the stopping response (Bouton, 1994; Havermans, & Jansen, 2003).

1.7 Response inhibition training for people who are overeating

Moving to the role of inhibition in other disorders, people who overeat have been found to have an impulsive and uncontrolled motor response towards high energy foods (Jasinska et al., 2012). Similar to substance abusers, individuals with unhealthy relationships to food and therefore resulting unhealthy eating habits seem to have the same underlying neurological pathways that suggest an inadequate inhibitory control and tendency for impulsive behaviours (Dawe & Loxton, 2004). Meta-analytical studies demonstrate that overweight individuals

especially those suffering from binge eating have hypoactivity in the pre-frontal cortex when presented with food cues, suggesting that this lack of impulse-control-related activity is linked with unhelpful dietary choices (e.g. Balodis et al., 2013; Lavagnino, Arnone, Cao, Soares, & Selvaraj, 2016). The increasing number of people suffering from excessive weight or obesity has attracted interest in new treatment options focusing on behaviour interventions that strengthen inhibitory control and ability to resist one's urges over eating behaviour (Cavill & Ells, 2010). If inhibitory control can be weakened through behaviours and neurocognitive processes, it is plausible that it is also possible to improve response inhibition with the use of neurocognitive training (Diamond, 2013). The go/no-go task is a method that can assess and simultaneously train inhibitory control and one study that has addressed the training effect of this task in overeaters is a study conducted by Lawrence et al. (2015). This study will now be explored in detail, since the design of the current study was based on Lawrence et al. (2015). Specifically, Lawrence et al. (2015) studied the effectiveness of a 2-week food-related response inhibition training of 10-min sessions on weight loss and energy intake in overweight/obese people. Participants' weight, snacking frequency, energy intake and likability of food images was measured prior to the training, immediately after the intervention and at two follow-up points (one month and six months). Participants selected high energy foods (no-go) that they consumed regularly as chosen items and rated their likability for their taste for these and for items from the same category (corresponding items) and for other high-energy food category items. These additional items to the chosen items were used to explore whether the inhibition training could be generalised to other items that fall into the same or different categories, respectively. Participants received either an active or control go/no-go training. In the active training group, healthy food was always matched with 'go signals' for which participants needed to press the left or right key according to the location of the stimuli, whereas high-energy food was always matched with 'no-go signals' (indicated with a bold frame) in which participants were told to withhold their responses without pressing any key). In the control training group, participants were given the same tasks with non-food stimuli such as household and clothes pictures. The findings of the study showed that after the training, the active group had lower weight, less daily energy intake and lower likeability and attractiveness ratings for palatable food images with the reduced weight being maintained at 6-months follow-up. Persistently not responding to high calorie food items in the training could have potentially suppressed motor responses towards these respective foods and therefore impacted health behaviours in real life. This study was based on a double-blind, randomised experimental design and while it demonstrates the effectiveness of the response inhibition training on self-

rated behavioural outcomes and a physiological tangible marker (i.e. weight), it is indeed possible that other factors such as exercise (including type, intensity and frequency) might have played a role in contributing to the observed weight loss; factors that were not assessed and controlled for. Interestingly, self-reported snacking frequency did no differ between the two experimental groups. This might suggest either, that individuals, that received the food-related training had healthier snacking choices that did not change in frequency, or that participating in a food-related study in itself might enhance awareness and sensitivity towards food and health behaviours in general. However, as energy intake and weight was lower in the active group, the former seems more plausible.

1.8 Response inhibition training for pathological gamblers

Inhibitory control is also considered a core element of problem gambling and the use of neuropsychological tasks and the go/no-go paradigm similarly reveal ability of inhibitory control and action monitoring in this population group (Devos, Clark, Maurage, Kazimierczuk, & Billieux, 2015). When exposed to laboratory slot machine gambling, individuals (that are non-gamblers) with lower inhibitory control have been found to display greater persistence and stronger subjective need to continue gambling (Devos et al., 2015). In experimental cognitive tasks, pathological gamblers show worse target detection performance than matched controls, suggesting lower attention spans in pathological gamblers (Kertzman et al., 2008). Response inhibition training has been shown to be effective for pathological gamblers by strengthening executive control and decrease the impulsivity underlying the gambling behaviour. A study by Stevens et al. (2015) analysed the decision making process of gamblers under varying instructions and uncertainty that manipulated chances of winning or losing. Participants were supposed to give bets on certain gambling tasks with different winning opportunities that differed in instructions on either withholding their response or providing responses as quick as possible. It was found that when participants were exposed to inhibitory signals (requiring them to withhold their response) they gave lower bets than when they were required to respond quickly even if the chances of winning were high. This suggests that stopping gamblers' responses occasionally made them become more thoughtful and cautious about their choice responses by reducing approach tendencies and by changing the underlying mechanism of the motivation towards gambling (Stevens et al., 2015; Verbruggen, Adams, & Chambers, 2012).

1.9 Other intervention approaches for CBD

The cognitive elements underlying CBD stem from self-regulation deficits that could be targeted with psychological interventions to generate cognitive and behavioural change. Excessive acquisition in hoarding is an analogous behaviour to CBD, which may inform our understanding of potential treatments for CBD (Mueller, 2008). Both hoarding and compulsive buying are conditions that are thought to be resistant to treatment (Steketee, & Frost, 2003). Over the past decade, these two areas have attracted more scientific attention in relation to psychological interventions. While Cognitive Behavioural Therapy (CBT) has been shown to be helpful for some people with hoarding problems (e.g. Steketee, Frost, Tolin, Rasmussen, & Brown, 2010), it seems that patients suffering from CBD show stronger deficits of inhibitory control which makes this condition more resistant to treatment (Claes et al., 2012). Treatment refusal and low adherence rates seem to reduce the applicability and usability of this therapy approach (Vermeire, Hearnshaw, Van Royen, & Denekens, 2001). Although CBT is thought to be based on a brief therapy session outline, Steketee et al. (2010) report CBT duration of relatively long sessions. While high attrition rates might be driven by low motivation to engage in treatment, also commitment to lengthy treatment might play a role. Further, factors that seem to relate to stronger durability of gains (symptom improvements) are homework assignment and more introspective work, which patients might not be willing to engage in. For people with hoarding problems, specific CBT components need to target motivational, acquiring and organisational aspects (Tolin, Frost, & Steketee, 2007). As inhibitory control seems to be implicated in the aetiology of CBD, multicomponent CBT-based approaches seem to be more effective such as the inclusion of financial counselling, together with cognitive restructuring and behavioural experiments targeting hoarding (Tolin et al., 2007).

Lawrence et al. (2015) found response inhibition training using go/no-go trials to be effective for individuals who were overweight in reducing energy intake and weight. Food-related response inhibition training has been one of the most important areas that has been researched so far. However disordered eating is currently seen as distinct from impulse control disorders according to the DSM-5. Response inhibition training has been found to reduce maladaptive and addictive behaviours related to specific disorders for instance gambling and substance use, supporting the notion that these disorders underlie impairment in inhibitory control (Lawrence et al., 2009). Treatment approaches for CBD have not been well studied;

given that the key features of CBD include lack of inhibitory control, response inhibition may be an effective approach for this disorder. While response inhibition training has shown effectiveness for compulsive overeating, there is no study that has explored the impact of such training on compulsive buying or hoarding disorder with compulsive acquiring – an area that has been neglected and is worth investigating.

Aims and hypothesis of the current study

The aim of the present study was to explore whether response inhibition training impacts compulsive buying and acquisition in a non-clinical sample to support novel intervention approaches for compulsive buying disorder. Several outcome measures assessed acquisition and hoarding behaviour but the main outcome assessed was the likability ratings of items.

The hypotheses were as follows:

1. Compared to participants receiving the inactive training, participants receiving the active training will have lower likability ratings of chosen items post-training, and this effect may be generalise to corresponding items.

2. Compared to participants receiving the inactive training, participants receiving the active training will select fewer items on the shopping tasks post-training.

3. Compared to participants receiving the inactive training, participants receiving the active training will report buying less items and spending less on the acquisition diary.

4. Compared to participants receiving the inactive training, participants receiving the active training will have a bigger reduction in their tendency on the Compulsive Acquisition Scale, Savings Cognition Inventory, Savings Inventory Revised at post-intervention levels.

2. Method

2.1 Design

The study was based on a longitudinal, mixed model design. The study used a prospective randomized design over a two-week period. The main dependent variables were the likability scores of items by Visual Analogue Scale (VAS) (VAS scores as hedonic value score), and the number of items selected in the shopping task (based on three criteria: freely, fitting into shopping trolley fitting into a plastic bag). The independent variables were intervention type with two levels (active or non-active) and also the scores on Compulsive Acquisition Scale, Savings Cognition Inventory, Savings Inventory Revised to explore potential moderating effects.

2.2. Participants

Seventy-five individuals representing a non-clinical population at King's College London and Exeter University (aged 18-55) were recruited via the university participant recruitment websites (N = 57 females; N = 18 males). While sixty-nine baseline measure scores were collected from the participants, 6 participants dropped-out due to time commitments which resulted in excluding their data before analysis. The remaining 63 participants (N = 52 females; N = 17 males) completed pre-, post- and follow-up measures, acquisition diary and at least two days of training.

Table 1. Characteristics by intervention

Characteristics	**Intervention**		
	Active (N = 33)	**Inactive (N = 36)**	**p value**
	M (SD)/ N (%)	**M (SD)/ N (%)**	
Age	24.47 (7.85)	23.09 (3.63)	.358
Ethnicity			.226
White British	10 (30.3)	16 (44.4)	
Other	23 (69.7)	20 (55.6)	
Personal income			.767
£0-400	11 (39.3)	11 (33.3)	
£450-800	7 (25.0)	11 (33.3)	
£1000-8000	10 (35.7)	11 (33.3)	
Household income			.182
£0-1200	10 (43.5)	6 (23.1)	
£1280-4500	7 (30.4)	7 (26.9)	
£5000-60000	6 (26.1)	13 (50.0)	

2.3 Self-report measures

Compulsive Acquisition Scale (CAS)

The Compulsive Acquisition Scale (CAS; Frost et al., 2002) has been previously used to assess urges over both buying and acquiring free items. It includes 18 questions, based on a seven-point Likert scale ('not at all/rarely' to 'very much/very often'). The CAS has two separate subscales. The CAS-buy (12 items) measures what extent participants feel excessive urge over buying and include question like 'Do you buy things you never use?'. The CAS-free (6 items) measures the tendency to acquire free items and questions included 'Do you regret not taking things you could have gotten for free.' Possible CAS scores ranged from 18 to 126 and sum scores were computed with higher numbers indicating higher levels of compulsive acquisition. It has been suggested that a cut-off score of 48 represents a clinically severe group (Frost, Tolin, Steketee, Fitch, & Selbo-Bruns, 2009). The scale was shown to have adequate reliability

(α's > 0.7; Frost et al., 2002) and also in the present study it showed high internal consistency (α = 0.918).

Savings Cognition Inventory (SCI)

The Savings Cognition Inventory (SCI; Steketee, Frost, & Kyrios, 2003) is a 24-item, self-report measure that has been used to assess individuals' thoughts linked to discarding an item and how they felt in response to throwing away any item over the past 2 weeks to detect the severity of hoarding behaviours (example item: 'Throwing some things away would feel like part of me dying'). This construct was assessed as part of compulsive acquisition to explore whether the training effects might extent onto hoarding cognitions. The scale is based on a 7-point Likert scale where ('not at all' to 'very much'). The SCI is made up of 4 subscales (Emotional attachment, Control, Responsibility, and Memory) and the total score of all items range from 24 to 168. Sum scores were computed with higher numbers indicating higher levels of negative thoughts when discarding an item. 42 has been determined as a cut-off score indicating that scores above this represents clinically severe group for hoarding (Steketee, Frost, & Kyrios, 2003). The scale was shown to have adequate reliability (α's > 0.8; Fontenelle et al., 2010; Steketee et al., 2003) and also in the present study it showed high internal consistency (α = 0.904).

Savings Inventory Revised (SI-R)

The Savings Inventory Revised (SI-R; Frost, Steketee, & Grisham, 2004) is a 23-item self-reported scale which assesses the severity of hoarding behaviour. Participants were asked to rate the similarity of their experiences over the past week based on a 5 point scale Likert scale (not at all - mild - moderate - considerable/severe - extreme) and items included 'How much control do you have over your urges to acquire possessions'? Using a factor analysis, Frost et al. (2004) found three major subscales indicating different subtypes of SI-R: Clutter (9 items), Difficulty Discarding (7 items), and Excessive Acquisition (7 items). Total scores range from 0–92; sum scores were computed with higher numbers indicating higher hoarding behaviours. 41 has been determined as a cut-off score indicating that scores above this represents clinically severe group for hoarding (Frost et al., 2004; Tolin, Meunier, Frost, & Steketee, 2011). The SI-R was found to have high test retest reliability and convergent and discriminant validity, internal consistency in discriminating people with or without hoarding problems (α's 0 < 0.87; Frost et al., 2004) and in the present study this scale also had a high internal consistency (α = 0.933).

Likability ratings of items (VAS; Hedonic value score)

Likability ratings of items were assessed with a VAS measure/ hedonic value measure. Participants were asked to rate how much they liked and valued a given object, landscape and the image of a person (responses were based on a 9-point hedonic scale: 'not at all' to 'very much'). This task consisted of 32 images that were personalised according to the images that participants chose as representing items they typically acquire most often at the beginning of the study. These 32 images were made up of eight chosen items, eight corresponding items that are different but still resemble the chosen items, eight other items in the same or similar category. The remaining 8 images included 4 images and 4 landscapes that were also used when personalising participants' training task.

Shopping tasks

The shopping task is a behavioural measure that was adapted from Preston, Muroff and Wengrovitz (2009) designed to assess acquisition behaviours. Participants were asked to select items from a range of images that they would chose to take home, based on three criteria: a) freely available, b) fitting into a shopping trolley and c) fitting into a medium-sized plastic bag. For all three criteria, sum scores were computed on selected items and higher numbers indicate a higher number of items selected.

Acquisition-diary

This is a diary that participants were asked to keep for a week after the completion of the training, which involves answering three questions per day about acquisition that explore different issues including exact items brought, cost and necessity. In the last day of the diary, participants were asked to answer further questions about the items they have acquired.

Demographics

At the end of the baseline measure, participants were asked to indicate some personal information such as age, gender, ethnicity and their economic status (total personal monthly income and household monthly income).

2.4 Intervention

The response inhibition training was adapted from the food-related training task employed by Lawrence et al. (2015). In their study, Lawrence et al. (2015), the authors used images of high energy density foods compared to low energy density foods to assess response inhibition. In the present study, the desirable images (high energy density foods) have been replaced by objects rated as highly desirable (acquirable) by participants, and images of (low energy density foods) have been replaced by the images of faces, landscapes and patterns. Images of faces were taken from the Nim-Stim database (Tottenham et al., 2009) and consisted of an equal amount of smiling men and women coming from different ethnicities. Landscape images were taken from the International Affective Picture System (IAPS), which is a well-validated data base, commonly used in psychology and consists of image sets triggering emotional cues (Yanulevskaya et al., 2008). These images were selected as they represent items that cannot be acquired. In addition, these images were selected specifically to increase motivation, positivity and engagement of participants during the task as research has found these images to be more rewarding compared to neutral images and expressions (Vrugt & Vet, 2009; Yanulevskaya et al., 2008).

Before conducting the study, a database of 146 images was developed, based on studies of items that were commonly acquired and bought impulsively (Dittmar, Beattie, & Friese, 1996; Mogan, et al., 2012; Scherhorn, Reisch, & Raab, 1990). Two images of each type of item were selected (i.e. two images of sweaters, two images of high-heel shoes etc., Figure 1) in order to create matched image sets: A and B which were used to develop the chosen and corresponding items for VAS ratings.

Figure 1. Example of matched image sets A and B.

These items that have been found to be commonly acquired and bought impulsively (as identified in previous literature mentioned above) were classified into 10 as follows: (1) Clothing and Accessories, (2) Grooming and Self Care, (3) Tools and Useful Equipment, (4)

Leisure and Hobbies, (5) Hi-tech/Electronics, (6) Household Items, (7) Souvenirs and Momentos, (8) Stationary, (9) Decorative Items/Knick Knacks, and (10) Written Information. In the pilot study, it was found that participants rated the images according to the specific categories and there were no differences in the hedonic value and the attractiveness of images in Set A and Set B, indicating that they are broadly equivalent and thus able to be used to assess the generalizability of training effect at follow-up.

In the go/no-go task, participants were asked to respond to images that appeared on the screen (for 1500 ms followed by a 500 ms inter-stimulus interval) by either pressing a left or right arrow key according to the location of image inside the rectangular (left side - left arrow key, right side - right arrow key). Participants were also asked to respond to these images as quickly and accurately as possible. However, on some trials the black border around the image became bold which was a sign for participants that they have to withhold their responses and not to press any key (Figure 2).

Participants would press right arrow key on the keyboard **Participants would withhold their response**

Figure 2. Example of a screen that requires pressing a key (left image) and withholding the response (right image).

During the task, there was a total of 3 blocks to be completed and the training started with a practice session in which participants were given feedback on their performance. For example, if they pressed a button instead of withholding their responses when the rectangle was bold, then they were shown a signal stating that “Do not press when the border is bold” or to increase the speed and accuracy of their responses, the signal was shown as “Too slow! Press a key faster”. Participants were also given a summary of their performances at the end of each block including their response time and error rate to increase their motivation. They could then continue with the task by pressing any key on the keyboard.

During the online task, participants in both the active and inactive groups were shown 32 images which involved 8 landscapes, 8 faces, 8 abstract and 8 chosen images (that they chose at the beginning of the study). In both groups, particular images were used to differentiate experimental conditions, where there was consistent mapping of image type and required response (e.g. 'go' or 'no-go') and control conditions with less consistent mapping, which were included to obscure the main task manipulation and were not used for analysis (as can be seen in Table 1).

Active training

During the active training in the experimental condition, participants were trained to withhold their responses to the chosen items which were always (100%) paired with a 'no-go' response to be able to train inhibitory control. Images of faces and landscapes were always paired with a 'go' response (100% of the time). During the active training in the control condition, participants were presented with faces or landscapes (whichever are not used as experimental stimuli) and abstract images that were all paired with a 'no-go' or a 'go' response 50% of the time (Table 1).

Table 2. Images by experimental and control conditions (Active training).

Active Phase

Experimental		Control	
Chosen (acquirable) images	Landscapes OR faces	Landscapes OR faces	Abstract images
100% no-go	100% go	50% no-go AND 50% go	50% no-go AND 50% go

Inactive training

During the inactive training in the experimental condition, participants were shown landscapes and faces. Half of the participants were exposed to faces paired with a 'go' response 100% of the time while landscapes were paired with a 'no-go' response 100% of the time. And the other half of the participants were exposed to the opposite patterns of this trial. During the inactive training in the control condition, chosen images and abstract images were used with 'go' and 'no-go' responses 50% of the time. Since participants in the inactive training were not trained

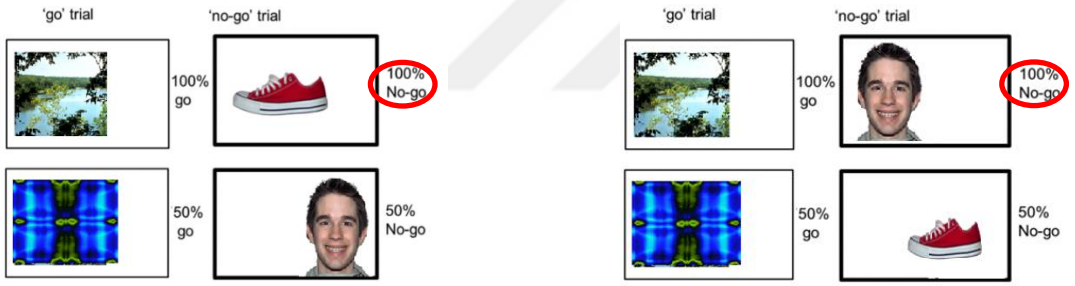
to withhold their responses to 'no-go' stimuli (chosen images) 100% of the time, no impact of training on inhibition was expected for these items.

Table 3. Images by experimental and control conditions (Inactive training).

Inactive Phase

Experimental		Control	
Faces	Landscapes	Abstract images	Chosen (acquirable) images
100% go OR 100% no-go	100% no-go OR 100% go	50% no-go AND 50% go	50% no-go AND 50% go

The main difference between the active and inactive training and the expected responses ıs depicted in Figure 3. While participants in the active training were always trained to withhold their responses to chosen items 100% of the time, participants in the inactive training were asked to do the same only 50% of the time as they were trained to withhold their responses to faces or landscapes 100% of the time.



Active training **Inactive training**

Figure 3. Difference between the active and inactive training indicating the percentage of training to the chosen items.

2.5. Procedure

Participants were recruited via King's College London Research Volunteer Recruitment Circular. After participants indicated their willingness to take part in this study, they were asked to fill out an informed consent form in which they were also asked to indicate their preferences for reminders for both training and diary recordings. Furthermore, participants were sent a link in which they were asked to select eight different items that they acquire most; the number of items should not be selected from more than 5 categories. After participants completed the

informed consent and selected items, they were again contacted for their personalized tasks (baseline measure and training) which were constructed based on their chosen items. Prior to the training task, participants were asked to rate the hedonic value of 8 chosen images including matched images (image set A and image set B as shown in figure 1) to see if the training effect can be generalised to corresponding items (the items that were of similar type to the chosen images). For instance, the sweater (2a) shown in Figure 1 was replaced with another type of sweater (2b) to investigate if learning can be generalised to all types of sweaters or only this kind of specific sweater. With randomization, half of the participants needed to select their chosen images from set A and the other half from set B. After participants completed the baseline measures, they were asked to complete four sessions of training with reminders sent (according to their preferences). When participants had completed four days of training sessions, they were sent post-training measures to be completed again with an acquisition diary to complete for that week. Afterwards, follow-up measures were sent to participants with three additional questions (asking if all the items they chose represent items that they typically acquire, are any items that were not included that they typically acquire and if they noticed any particular rule to training). These additional questions were used as a manipulation check and a way of test the validity of the training. They were then asked to send the diary back to the researcher. Participants reimbursed with a £5 amazon voucher and entered in a draw to win a £25 gift card at the end of the study (all study materials found in the appendix). The overview of the study procedure can be seen in the figure below (Figure 4).

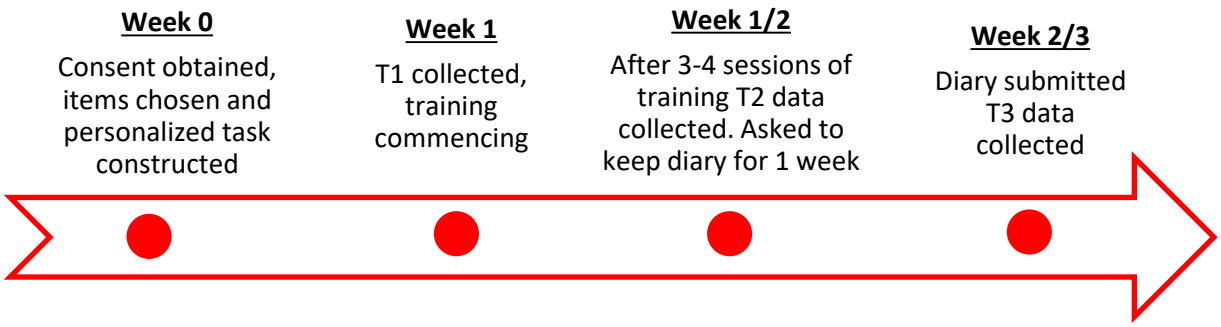


Figure 4. Overview of study procedure.

2.6 Statistical Analysis

All analyses were conducted on SPSS version 24. Inferential statistics were used as appropriate (independent sample t-tests or Chi^2 tests) to compare participants in the active and inactive conditions on demographic information. Where parametric analysis was appropriate, mixed-effects ANOVAs and independent-samples t-test were used to explore changes and group differences in the dependent variables. Prior to analyses, normality of the data was assessed. The values for likeability of chosen and corresponding items were normally distributed with skewness and kurtosis values being within the acceptable range (> -1 and < 1) and Kolmogorov-Smirnov not being significant (p's > 0.200). All shopping task items (the raw values including the difference scores) and the bought items from the acquisition diary were not normally distributed (skewness and kurtosis far above 1 and Kolmogorov-Smirnov tests were significant; p's < 0.014). Log-transformation (using the ln method) of these items did not improve normality and therefore non-parametric tests were conducted on these. Spending from the acquisition diary and the CAS, the SCI and the SI was not normally distributed (skewness and kurtosis < -1 and Kolmogorov-Smirnov tests p's < 0.047) but normalised after log-transformation (for descriptive purposes, the raw rather than the log-transformed values will be presented). Personal and household income (assessed as continuous variables) was divided by tertiary split into low, medium and high income groups.

3. Results

3.1 Participant characteristics

There were 69 participants (N=52 females) aged 18-55. There was a gender difference in ethnicity, $\chi2(1) = 4.284$, $p = 0.038$. There were significantly more females from other ethnicities than males. There was no gender difference in age, personal and household income. There were 33 participants assigned to the active (26 females and 7 males) and 36 in the inactive intervention (26 females and 10 males) and no gender difference in intervention presence, $\chi2(1) = 0.400$, $p = 0.527$.

3.2 Data cleaning

Participants that have initiated the study (N = 6) but did not finish at time point 2 were eliminated from the dataset prior to analyses.

3.3 Summary of the main data

Table 1 depicts the demographic characteristics by intervention. There were no differences in age, ethnicity, personal and household income between the two intervention groups.

Table 4 shows the correlation between the study variables at pre-intervention level for the whole sample. Likability ratings of chosen items correlated highly with likability ratings of corresponding items, which serves as a manipulation check (with the aim to extend the training effect onto corresponding items). Likability ratings of corresponding items correlated positively with SCI and SI levels. Likability ratings of chosen and corresponding items correlated positively with number of selected of trolley- and bag-filled items. Number of selected free shopping items correlated positively with numbers of trolley- and bag-filled items. The measures CAS, SCI and SI correlated positively with each other (which is in line with previous literature).

Table 4. Correlation matrix (pre-intervention level)

Variables	1.	2.	3.	4.	5.	6.	7.	8.
1.Likability rating (chosen item)	1	.891***	.192	.393**	.439***	.096	.251	.322
2.Likability rating (corresponding item)		1	.228	.366**	.445***	.234	.386*	.427*
3. Shopping items (free)			1	.539***	.479***	.541**	.352	.418*
4. Shopping items (shopping trolley)				1	.699***	.244	.190	.211
5. Shopping items (shopping bag)					1	.337	.341	.335
6. CAS						1	.762***	.780***
7. SCI							1	.743***
8. SI								1

**p < 0.05 **p < 0.01 *** p< 0.001*

3.4 Time and interventions effects on main outcomes

T-tests (and Mann-Whitney tests) were conducted to evaluate baseline differences between the interventions. There were no significant differences in any of the measures, except for the CAS, $t(67) = 2.198$, $p = 0.031$ with higher CAS reporting in the active ($M = 64.48$, $SD = 17.49$)

compared to the inactive intervention (M = 55.33, SD = 19.43); mean chosen and corresponding items were just off significance level (p = 0.053 and p = 0.060, respectively).

3.4.1 Chosen items

Table 5 provides the mean values for all outcome measures per time point and per intervention. Mixed-effects ANOVA with the three time points as within-subject factor and intervention as the between-subject factor were conducted on chosen and corresponding items. Mixed-effects ANOVA on chosen items revealed an interaction effect, $F(2,122) = 4.025$, $p = 0.020$, suggesting that being trained in the active or inactive intervention made a difference in the hedonic value of the chosen items. Repeated-measures ANOVA split by intervention group revealed time effects in both groups. Post-hoc tests with Bonferroni correction showed that participants in the active group rated the chosen items as less likable over time (Time 2: M = 5.30, SD = 1.86, Time 3: M = 4.81, SD = 1.87, all p's < 0.001) compared to baseline (Time 1: M = 6.41, SD = 1.57), with no difference between time point 2 and time point 3 (p = 0.091). However, participants in the inactive group rated the chosen items as less likable only at time point 3 (M = 4.76, SD = 1.66) compared to baseline (Time 1: M = 5.46, SD = 1.53, p = 0.022), but there was no difference between baseline and time point 2 (M = 4.92, SD = 1.66, p = 0.091). There was a main effect of time, $F(2,122) = 27.283$, $p < 0.001$. Post-hoc tests with Bonferroni correction showed that individuals rated items after the first and the second intervention as less likeable (Time 2: M = 5.10, SD = 1.76 Time 3: M = 4.80, SD = 1.75) than before the intervention M = 5.93, SD = 1.61; both p's < 0.001). Likeability ratings were not different between time point 2 and time point 3 (p = 0.067). There was no main effect of intervention, $F(1, 61) = 1.423$, $p = 0.237$.

3.4.2 Corresponding items

Mixed-effects ANOVA on corresponding items revealed also an interaction effect, $F(1.67, 101,92) = 3.751$, $p = 0.034$. Repeated-measures ANOVA split by intervention group revealed time effects in both groups. Post-hoc tests with Bonferroni correction showed that participants in the active group rated the corresponding items as less likable over time (Time 2: M = 5.35, SD = 1.58, Time 3: M = 4.74, SD = 1.74, p's < 0.001) compared to baseline (Time 1: M = 6.16, SD= 1.47), with no difference between time point 2 and time point 3 (p = 0.316). However, participants in the inactive group rated the corresponding items as less likable only at time point

3 (M = 4.54, SD = 1.67) compared to baseline (Time 1: M = 5.26, SD = 1.55, p = 0.001), but there was no difference between baseline and time point 2 (Time 2: M = 4.83, SD = 1.73, p= 0.038). There was a main effect of time, F(1.67, 101,92) = 29.353, p < 0.001 (Greenhouse-Geisser correction due to violation of Mauchly's test of Sphericity, p = 0.001). Post-hoc tests with Bonferroni correction showed that individuals rated corresponding items over time (after the intervention and at follow-up) as less likeable (Time 1: M = 5.70, SD = 1.56; Time 2: M = 4.94, SD = 1.65; Time 3: M = 4.64, SD = 1.70; p's < 0.020). There was no main effect of intervention, F(1, 61) = 1.377, p = 0.245. Figure 5 shows the mean change from time point 1 to time point 2 and time point 1 to time point 3 by intervention type for both the chosen and corresponding items, respectively. Independent-sample t-tests indicated that there was a significant difference in the strength of the reduction between the interventions in the time point 1 to time point 3 interval of chosen items (p = 0.016) and in the time point 1 to time point 2 interval (p = 0.031) and time point 1 to time point 3 interval of corresponding items (p = 0.032). The active intervention showed stronger likeability rating reductions in both chosen and corresponding items.

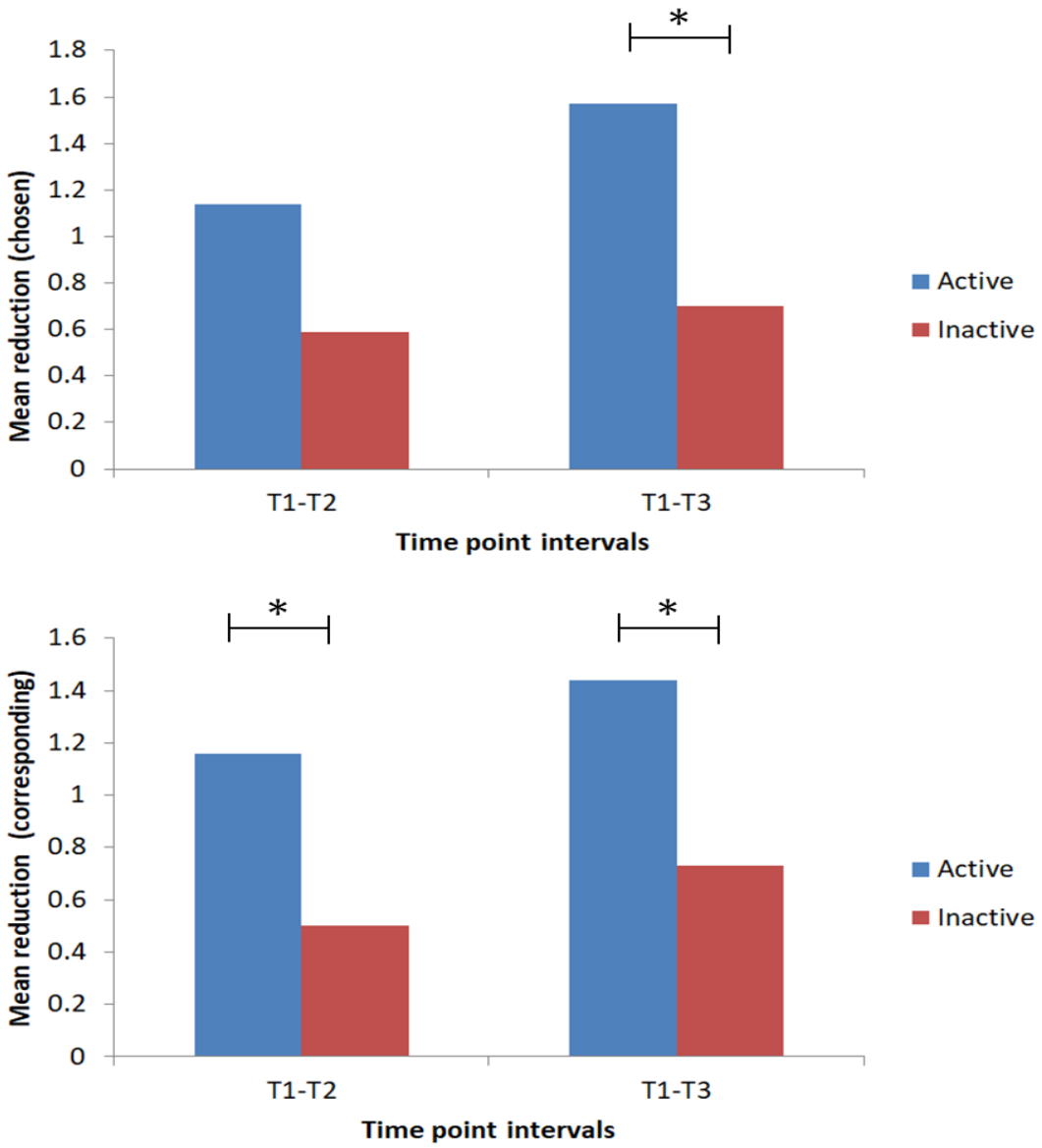


Figure 5. Mean change by intervention type for chosen (upper graph) and corresponding items (lower graph).

Table 5. Mean levels for the main outcome variables by intervention type and per time point.

Variables	**Time point**					
	Pre-intervention (time 1)		**Post-intervention (time 2)**		**Follow-up (time 3)**	
	Active	**Inactive**	**Active**	**Inactive**	**Active**	**Inactive**
	M (SD)	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**
Likability rating (item)						
Chosen	6.41 (1.57)	5.46 (1.53)	5.30 (1.86)	4.92 (1.66)	4.81 (1.87)	4.76 (1.66)
Corresponding	6.15 (1.47)	5.26 (1.55)	5.05 (1.82)	4.83 (1.73)	4.74 (1.74)	4.54 (1.67)
Shopping items						
Free	31.64 (21.94)	37.00 (24.96)	23.34 (14.31)	25.89 (18.30)	21.55 (17.60)	22.38 (13.20)
Shopping trolley	15.39 (9.50)	17.33 (15.70)	17.41 (17.73)	12.97 (9.16)	13.68 (14.40)	11.44 (8.44)
Shopping bag	10.70 (12.72)	10.83 (13.06)	9.91 (13.10)	7.11 (5.01)	9.58 (13.00)	7.38 (5.08)
CAS	64.48 (17.49)	55.33 (19.43)	56.56 (20.19)	52.22 (20.86)	51.63 (18.73)	45.22 (19.39)
SCI	78.18 (28.89)	67.78 (28.68)	66.31 (30.37)	60.28 (29.28)	62.09 (28.39)	57.09 (28.36)
SI	35.06 (16.29)	32.42 (17.21)	31.06 (15.58)	29.97 (17.07)	28.94 (14.49)	26.16 (15.14)
Acquisition diary					7.72 (3.82)	6.42 (4.52)
Bought items					175.71 (328.41)	47.2658.65)
Amount spent						

3.4.3 Shopping task items

Friedman test showed that there was a statistically significant difference in the number of selected free items over time in both interventions, $\chi2(2) = 14.000$, $p = 0.001$ for the active training and $\chi2(2) = 7.821$, $p = 0.020$ for the inactive intervention. Post-hoc analyses with Wilcoxon signed-rank tests were conducted with applied Bonferroni correction (generating a new significance level at $p < 0.017$ as 0.05/3 for all following post-hoc analyses). In the active training, median (IQR) selected free items from time 3 were significantly lower at 16.0 (10.0 to 29.0) than at time 1 at 27.0 (18.0 to 42.5, $p = 0.008$). In the inactive training, median (IQR) selected free items from time 2 and time 3 were significantly lower at 21.5 (12.0 to 38.5) and at 18.0 (11.0 to 32.25), respectively, than at time 1 at 29.5 (21.25 to 56.5, p's < 0.013). Friedman test showed that there was a statistically significant difference in the number of selected trolley-related items in the inactive intervention, $\chi2(2) = 6.462$, $p = 0.040$ but not in the active training, $\chi2(2) = 3.365$, $p = 0.186$. For the inactive intervention, post hoc analysis with Wilcoxon signed-rank tests showed that there was a tendency for median (IQR) selected trolley-related items from time 3 to be significantly lower at 8.50 (7.0 to 15.75) than at time 1 at 12.0 (7.0 to 22.75) that, however, did not reach the new significant value ($p = 0.035$ as the new adjusted p value was set at $p < 0.017$). Friedman test showed that there was no statistically significant difference in the number of selected bag-related items in either intervention, $\chi2(2) = 1.407$, $p = 0.495$ for the active training and $\chi2(2) = 2.837$, $p = 0.242$ for the inactive intervention. To be able to evaluate the differential effect of training on the shopping tasks, the analyses were repeated on the difference scores (time point 1 - time point 2 interval and time point 1 - time point 3 interval) and no other findings were revealed.

3.4.4 CAS

Mixed-effects ANOVA on the CAS revealed no interaction effect, $F(1.67, 101.928) = 0.529$, $p = 0.559$. There was a main effect of time, $F(1.67, 101.928) = 32.957$, $p < 0.001$ (Greenhouse-Geisser correction due to violation of Mauchly's test of Sphericity, $p = 0.001$). Post-hoc tests with Bonferroni correction showed that individuals reported feeling less compelled to acquire possessions over time (Time 1: $M = 1.16$, $SD = 0.35$; Time 2: $M = 1.06$, $SD = 0.38$; Time 3: $M = 0.92$, $SD = 0.40$; all p's < 0.001; all values are presented as ln as the data was log-transformed to ensure normality). There was no main effect of intervention, $F(1, 61) = 2.732$, $p = 0.104$.

3.4.5 SCI

Mixed-effects ANOVA on the SCI revealed no interaction effect, $F(1.78,108.830) = 0.417$, $p = 0.637$. There was a main effect of time, $F(1.78,108.830) = 19.367$, $p < 0.001$. (Greenhouse-Geisser correction due to violation of Mauchly's test of Sphericity, $p = 0.021$). Post-hoc tests with Bonferroni correction showed that participants' scores on hoarding thoughts reduced over time Time 1: M = 1.04 SD = 0.41 ; Time 2: M = 0.89, SD = 0.45; Time 3: M = 0.80, SD = 0.45; all p's < 0.044; all values ln). There was no main effect of intervention, $F(1, 61) = 1.371$, $p = 0.246$.

3.4.6 SI

Mixed-effects ANOVA on the SI revealed no interaction effect, $F(2,120) = 0.806$, $p = 0.449$. There was a main effect of time, $F(2,120) = 9.824$, $p < 0.001$. Post-hoc tests with Bonferroni correction showed that participants' scores on hoarding behaviour reduced from time point 1 to time point 3 (Time 1: M = 0.25, SD = 0.63; Time 3: M = 0.03, SD = 0.64; p's < 0.001; all values ln), with no significant difference from than before the intervention (Time 1: M = 3.12, SD = 0.742; p's < 0.034), with no difference between time point 2 and time point 3 ($p = 0.098$) and time point 1 and time point 2 ($p = 0.051$). There was no main effect of intervention, $F(1, 61) = 0.341$, $p = 0.562$.

There were positive correlations between the time points within each measure, CAS (r's ranged from 0.73 to 0.87, p's < 0.001), SCI (ranged from 0.66 to 0.82, p's < 0.001 and SI (ranged from 0.78 to 0.86, p's < 0.001). This indicates consistency of reporting of compulsive buying and hording from test to retest.

3.4.7 Acquisition-diary

Mann-Whitney U showed that there was no difference in number of purchased items between the intervention groups, $U(N = 51) = 238.0$, $p = 0.099$. An independent-sample t-test revealed that there was a difference in amount spent between the active and the inactive intervention, $t(51) = 2.229$, $p = 0.030$. Individuals in the active intervention reported spending more (M = 4.15, SD = 1.55; all values ln) than individuals in the inactive intervention (M = 3.33, SD = 1.13).

4. Discussion

4.1 Summary of results

The present study examined the effectiveness of a computer-based response inhibition training on compulsive acquiring in a student analogue sample, who may have relatively high acquisition compared to other groups. To our knowledge, this is the first study that investigates response inhibition training for compulsive acquisition inspired by previous studies that have found the training to be effective for other impulse control-related disorders such as overeating (Lawrence et al., 2015), substance use (Houben et al., 2012) and gambling (Stevens et al., 2015). The findings suggest that both the active and the inactive intervention resulted in reductions in likeability ratings of chosen and corresponding items. However, the active intervention group showed a significantly stronger reduction in the likeability ratings than the inactive intervention group and also more consistently, with pre- to post-intervention and pre- to follow-up reduction, whereas the inactive group showed only pre- to follow-up reduction. This supports the first hypothesis. Findings indicate that in both interventions the number of items individuals selected in the free shopping tasks was reduced. Interestingly, the reduction in the number of trolley-related items was observed only in the inactive condition. No reductions were observed for the medium-sized shopping bag-related items. These findings do not support the second hypothesis as it was expected that the active intervention would lead to a reduction in the number of items individuals selected. The subjective ratings for compulsive acquisition, hoarding thoughts and behaviours reduced over the course of the study, regardless of intervention. This provides no evidence for the third hypothesis; the active intervention did not reduce buying and hoarding thoughts and behaviours more than the inactive intervention. There was no difference in the number of purchased items from the acquisition diary, suggesting that the active intervention did not reduce acquisitions and people in the active group spent more money on their acquisitions compared to people in the inactive group. This does not support the fourth hypothesis.

4.2 The effectiveness of response inhibition training

The inhibitory control intervention reduced likeability ratings of chosen and corresponding items considerably stronger than the control intervention. While this shows the effectiveness of the training to some extent, the other outcome measures (acquisition behaviour and cognitions) were not improved as expected. This is slightly at odds with previous studies that have found inhibitory control training to be effective in other contexts. Response inhibition training with a go/no-go task has been found to be effective for overeating, as the training led to a reduction in participants' weight, energy intake and in the likability ratings of the food stimulus (Lawrence et al., 2015). The intervention effect in this study was strong as these reductions were only observed in the active and not in the inactive intervention. Stimuli-specific inhibition training (go/no-go task) has also been found to reduce alcohol consumption in alcoholics together with their implicit attitudes towards alcohol (Houben et al., 2012; Jones & Field, 2013). Further, response inhibition training has been shown to be effective for pathological gamblers with inhibitory control training leading to reductions in impulsivity and risk-taking by changing approach tendencies and motivation towards gambling (Stevens et al., 2015; Verbruggen et al., 2012).

Interestingly, likeability ratings decreased in both groups over time which is different to the findings by Lawrence et al. (2015) for individuals with compulsive eating. Studies based on alcohol addiction (and also gambling) did not assess for explicit attitudes towards their respective objects or behaviour. Houben et al. (2012) assessed implicit attitudes towards alcohol which are unconscious and involuntarily formed attitudes. It would be interesting to evaluate favourable and unfavourable attitudes in other disorders to investigate consistency across population groups. This inevitably gives rise to the question as to whether the context of acquisition is different and whether novelty and appeal of objects that individuals acquire are crucial elements that diminish over time. Lawrence et al., (2015) focused on a clinical sample that displays high levels of overeating; it is indeed possible that likeability ratings might be different if the sample included individuals who actually suffered from CBD. However, in the present study, a student analogue sample showed reductions in attitudes towards initially desired objects over time. This might be explained by theories that tap into the temporal effects of exposure and presence of stimuli on attitudes. The well-known Mere Exposure Effect proposes that familiarity with novel stimuli (such as objects or individuals) engenders positive attitudes and likeability for the respective stimuli (Zajonc, 2001). However, the opposite

function has also been researched. A concept called incremental threat effect has been observed with an inverse association between exposure and liking following awareness of identity threat (Crisp, Hutter, & Young, 2009). When social identity threat was high or present then mere exposure led to less liking over time. Making individuals aware of their buying behaviours could potentially present such a social identity threats by making them realise that they belong to a category of people that has been evaluated negatively. Having raised this self-awareness together with continuous presentation of relevant objects might have generated reductions in likeability ratings. This awareness change might not occur in food-related behaviours; obesity (including fat-shaming) public awareness constantly reminds individuals about this negative evaluation, whereas excessive buying is not actively shamed for by society. Further, attitude change might be easier in the context of objects due to the increase variability of the available objects. While awareness might generate attitude change to some extent, these interpretations might apply only to individuals with buying behaviours within the normal range and not to individuals with CBD. The reduction in likeability ratings was stronger in the active intervention group. If the training accelerates this process of awareness and attitude change, then this would potentially show clinical significance.

The active intervention did not show stronger effects in some of the other outcomes compared to the inactive intervention. A possible explanation for the lack of effectiveness of the active intervention could be due to the nature of the cognitive task, employing the go/no-go task. Other tasks such as stop/signal have also been shown to be effective to explore and train response inhibition (Verbruggen, & Logan, 2008). More importantly, it has been debated to what extent the go/no-go and stop/signal paradigms work on the identical or different inhibitory control pathways and cognitive mechanisms. The main difference between the two tasks is the temporal aspect of presentation of the inhibitory signal. Within the go/no-go task, the inhibitory signal (indicating to withhold the response) is presented *simultaneously* with the 'go' stimulus (Simmonds, Pekar, & Mostofsky, 2008), whereas in the stop-signal task the inhibitory signal is always shown to the participant immediately *after* the 'go' stimulus during the actual process of response completion (Verbruggen, & Logan, 2008). The difference in the temporal aspect of the inhibitory signal between two tasks might be responsible for different performance outcomes. For instance, a recent study by Littman and Takács (2017) demonstrated that with the use of certain stimuli, cognitive performance and inhibitory functioning was improved when exposed to the stop-signal task, but not when exposed to the go/no-go task. This suggests a differentiation between the bottom-up (automatic, not requiring executive functioning) as

assessed in the go/-no-go task and the top-down inhibitory control (controlled, requiring executive functioning) as assessed in the stop-signal task. Studies need to explore whether the inhibitory control mechanisms underlying compulsive buying and hoarding in specific are due to a bottom-up or top-down inhibitory control to inform for most appropriate use of cognitive task.

4.3 Psychological measures

Individuals reported less self-reported compulsive acquisition, hoarding thoughts and behaviours regardless of intervention. Again, being asked questions around these thoughts and behaviours might increase self-awareness, introspection and reflection and therefore lead to attitude change (Vogel & Wanke, 2016). Participants might become more aware of their conduct and actively try to change this by either changing their attitudes or their behaviour. Cognitive dissonance is a concept that describes that individuals seem to experience psychological discomfort when two contradictory beliefs are held and that stimuli or external cues can trigger this cognitive dissonance state leading people to actively seek ways to reduce this discomfort and therefore either adapt the behaviour or change the attitudes (Festinger, 1962; Harmon-Jones, Harmon-Jones & Levy, 2015). The questionnaire might hence trigger self-perception on buying and hoarding thoughts and therefore creates internal conflicts of not wanting to be considered a compulsive buyer and hoarder, leading to a desire to reduce this conflict. This might be especially the case for individuals without actual compulsive buying disorder. The current study focused on a non-clinical population group with scores on these measures that were relatively low throughout and below the suggested clinical cut-offs. It would be interesting to explore the factors that lead to the change in perception in a sample that display high compulsive buying and hoarding thoughts. Interestingly, it could be argued that these measures would assess trait longstanding tendencies, compulsive acquisition, hoarding thoughts and behaviours and therefore might not change over a relatively short period of time. Trait measures have been defined as stable and long-lasting concepts that are driven by internal processes; state measures, on the other hand, characterise temporary concepts that are mainly influenced and manipulated by external circumstances and situations (Chaplin, John & Goldberg, 1988; Steyer, Mayer, Geiser & Cole, 2015). The present study showed high inter-correlation between the measues (assessing the temporal stability and reliability of an instrument over the three time points) and hence high test-retest reliability (Weir, 2005). However, reductions seem to show sensitivity to change in these inventories following

interventions such as CBT (Steketee et al., 2010) and inhibitory control training within the present study.

4.4 The concept of impulsivity

Albeit CBD seems to be underpinned by impulsivity and lack of control, it seems that there might be other factors that can impact pathological buying. In the past decade, research has mostly focused on exploring the concept of impulsivity and the link it has to certain disorders, including CBD, rather than studying the determinants of pathological buying. There is strong rationale in investigating these determinants to inform novel treatment approaches for CBD. Given that, three main characteristics have been suggested to be linked to impulsive buying; lack of control (impulsivity), stress reaction and absorption (Youn & Faber, 2000). Stress reaction refers to a catastrophic response of an individual when facing stressors. Individuals classified as highly stress reactive tend to cope by engaging in impulsive buying (in the coping literature referred to as distraction and denial strategies and to relieve psychological pain). This notion is also supported by Gardner and Rook (1988) who found that impulsive buyers reported feeling better after engaging in buying behaviour. Stress reaction and individuals' coping mechanisms could be potential moderating variables and warrant further research when evaluating the treatment approaches for CBD. For instance, certain interventions might be less effective for at-risk individuals. On the other hand, absorption has been considered as a construct that could affect impulse buying behaviour for offline and online shopping (Youn & Faber, 2000). Absorption is the tendency that an individual is sensitive to environmental cues. Literature reviews on consumer behaviour outlines that external and interior ambient factors, retail layout/ design factors and human/ social factors can modulate consumer behaviour (Bohl, 2012; Turley & Milliman, 2000). In addition, in the e-commerce world, website quality and attractiveness plays a major role in online purchasing behaviour (Wells, Parboteeah, & Valacich, 2011). Research that assesses buying behaviour should take these factors into consideration and sub-analyses could reveal for which individuals interventions might be most effective. Finally, maybe CBD does not necessarily belong to an impulse control related disorder but might relate more to obsessive-compulsive disorder. If future studies fail to find evidence for the effectiveness of response inhibition training, this could indicate that the pathological underlying mechanism might be different from addiction, gambling and overeating. This might provide support for the classification of CBD as an obsessive-compulsive disorder rather than an impulse control disorder.

4.5 Limitations, future research and implications

Several limitations need to be acknowledged. Methodological aspects in the use of inhibition training tasks have been shown to play a role for effectiveness (Bartsch et al., 2016; Simpson & Riggs, 2006). Training duration, intensity and also speed of stimulus presentation might be factors that could mitigate the intervention's value. Further, the higher the number of consecutive days of training the more effective could be the training (Field et al., 2008). In the fLawrence et al.'s (2015) study, 82% of the participants completed four days of training; the proportion of individuals that completed four training in the present study was considerably low and therefore impeded sub-analyses. Controlling for such methodological factors could strengthen the truthfulness and reliability of findings. Individuals between the two intervention groups did not differ statistically from each other in the baseline measures (except for the CAS); however there were marginal effects for the chosen and corresponding items, potentially indicating sample issues or non-homogenous groups. The images used in the training were used from previous research and it might not be representable to all participants. The present study asked participants about relevant items they typically acquire which were not included in the training (e.g. a variety of cosmetic products and accessories). Training to specific items has been found to be most effective and future studies should generate additional items that represent more categories. Further, the sample was small and potentially not homogenous (e.g. gender bias). A non-clinical sample was employed which may not have had significant issues with compulsive acquisition. Studying the effects of this training in a sample with higher levels of compulsive buying might generate different findings. No pre-intervention measure of spending diary was included which prevented measuring change in this variable. Future studies should analyse accuracy rate and response time of individuals when performing an inhibitory task and compare individuals scores on inhibition.

4.6 Conclusion

To conclude, the present study has found that response inhibition training reduced likeability ratings for stimuli-specific items more than the control intervention but not reporting of buying behaviour and hording cognitions. The findings need to be interpreted in light of the current limitations; however, the magnitude of the observed reduction could point to a potential of this training as a treatment approach to tackle CBD. Further studies are warranted that explore the underlying mechanisms of CBD in more detail, such as automatic versus control inhibition,

determinants of impulsive buying and their potential moderating role for training effectiveness and other methodological aspects of the actual training itself.

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Appendices

Appendix A. Study information sheet for participants (online)

INFORMATION SHEET FOR PARTICIPANTS

REC Reference Number: MR/16/17-27

Title of study : Does inhibition training reduce compulsive acquiring?

Invitation Paragraph

We would like to invite you to take part in an online study investigating whether a short course of online training reduces the amount people buy or obtain and take home.

Why have I been invited to take part?

The study is open to all students at King's College London, the University of Exeter and the University of Bath.

Do I have to take part?

No, your participation is entirely voluntary and you may withdraw any time without any consequences.

What will happen to me if I take part?

This will commence over a 2 week period. In the first week we will ask you to complete a few questionnaires and tasks online then do 4 x 10minutes of training over the next week. Afterwards we will ask you to do the questionnaires and online task before keeping a diary of the things you have bought or obtained for the next week. When the week is over we will ask you to complete questionnaires and online task again. The study is all online so it can be completed at your convenience and the total time spent on the study will be around 1.5 hours.

Incentives (where relevant)

Students from King's will receive a £5 Amazon voucher as reimbursement and a chance to win £25 for your time at the end of your study. You might also see a decrease in the amount of things that you buy or take home.

What are the possible benefits and risks of taking part?

This study allows us to learn more about acquisition and be able to develop new treatments. Apart from this, another benefit could be that you notice a reduction in your spending/collecting behaviour.

There are no known significant risks to undertaking the study, however it will require a portion of your time.

Will my taking part be kept confidential?

Yes, all data will be anonymized and analysed as a group so that you cannot be personally identified.

However, in order to send you the task and receive payment we will need your email address. This will be stored on an encrypted computer and only researchers involved in the study will have access to it. We will also only keep the list of emails and ID number for one year in line with the King's data policy. Therefore you may withdraw from the study at any until this point and your data will be destroyed, however after this point we will be unable to identify your data and therefore can no longer destroy it.

How is the project being funded?

The project forms part of student theses and are therefore funded by the universities involved.

What will happen to the results of the study?

The result of the study will be used as a Master's thesis but may also be published in a scientific journal and/or presented at conferences in order to share the information we collect.

Who should I contact for further information?

If you have any questions or require more information about this study, please contact me using the following contact details:

elif.peksevim@kcl.ac.uk

What if I have further questions, or if something goes wrong?

If this study has harmed you in any way or if you wish to make a complaint about the conduct of the study you can contact King's College London using the details below for further advice and information:

Dr Helena Drury (Helena.Drury@slam.nhs.uk)

The Chair, Tom Billins Senior Research Ethics Officer

rec@kcl.ac.uk

Thank you for reading this information sheet and for considering taking part in this research.

Elif Peksevim & Dr Helena Drury

Appendix B. Informed Consent

Consent form

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Study: Does cognitive training reduce compulsive acquisition?

King's College Research Ethics Committee Ref:MR/16/17-27

Thank you for considering taking part in this research. The person organising the research must explain the project to you before you agree to take part. If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join in.

I confirm that I understand that by ticking each box I am consenting to this element of the study. I understand that it will be assumed that unticked boxes mean that I DO NOT consent to that part of the study. I understand that by not giving consent for any one element I may be deemed ineligible for the study.

Please be aware that we are unable to compensate you with a £5 amazon voucher if you do not complete the whole study, however you will still be entered into the prize draw to win a £25 amazon voucher.

*Required

Do you provide consent to participate in this study? *

- ◯ I DO provide consent
- ◯ I DO NOT provide consent

1. *I confirm that I have read and understood the information sheet for the above study. I have had the opportunity to consider the information and asked questions which have been answered satisfactorily. *

- ◯ I DO confirm that this is true
- ◯ I DO NOT confirm that this is true

2.*I understand that I will be able to withdraw my data up to 30th September 2018 *

- ◯ I DO confirm that this is true
- ◯ I DO NOT confirm that this is true

3. *I consent to the processing of my personal information for the purposes explained to me. I understand that such information will be handled in accordance with the terms of the UK Data Protection Act 1998. *

- ◯ I DO confirm that this is true
- ◯ I DO NOT confirm that this is true

4.*I understand that my information may be subject to review by responsible individuals from the College for monitoring and audit purposes. *

- ◯ I DO confirm that this is true
- ◯ I DO NOT confirm that this is true

5*. I understand that confidentiality and anonymity will be maintained and it will not be possible to identify me in any publications *

- ○ I DO confirm that this is true
- ○ I DO NOT confirm that this is true

6. * I agree that the research team may use my data for future research and understand that any such use of identifiable data would be reviewed and approved by a research ethics committee. (In such cases, as with this project, data would not be identifiable in any report). *

- ○ I DO confirm that this is true
- ○ I DO NOT confirm that this is true

Please select one of the following options regarding training options: *

- ○ I would like researchers to prompt/send my training materials on consecutive days (4 days)
- ○ I would like researchers to only prompt me if have not completed training for 2 or more days
- ○ I would like researchers to prompt/send me training materials on alternate days eg (every other day)
- ○ Other: _____

Please choose one of the following option regarding the acquisition diary: *

- ○ I would like researchers to prompt me to do my acquisition study everyday for 1 week
- ○ I would like researchers to prompt me to do my acquisition study 2-3 times during the week
- ○ I would prefer not to be prompted to complete the acquisition diary during the week
- ○ Other:

Please provide your study ID *
This can be found in your email

Your answer

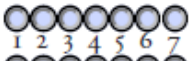
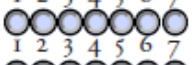
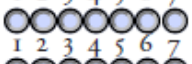
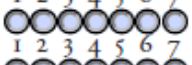
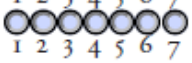
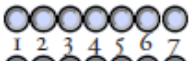
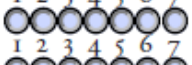
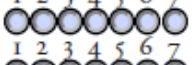
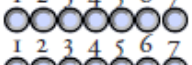
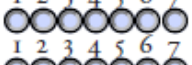
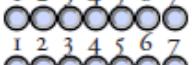
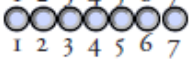
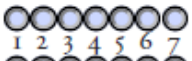
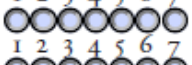
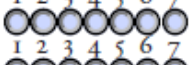
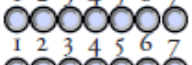
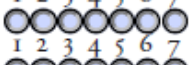
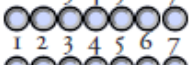
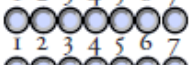
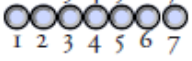
NEXT

Saving Cognitions Inventory (SCI)

Date: _____

Use the following scale to indicate the extent to which you had each thought when you were deciding whether to throw something away DURING THE PAST WEEK. (If you did not try to discard anything in the past week, indicate how you would have felt if you had tried to discard.)

1	2	3	4	5	6	7
not at all			sometimes			very much

1.	I could not tolerate it if I were to get rid of this.	
2.	Throwing this away means wasting a valuable opportunity.	
3.	Throwing away this possession is like throwing away a part of me.	
4.	Saving this means I don't have to rely on my memory.	
5.	It upsets me when someone throws something of mine away without my permission.	
6.	Losing this possession is like losing a friend.	
7.	If someone touches or uses this, I will lose it or lose track of it.	
8.	Throwing some things away would feel like abandoning a loved one.	
9.	Throwing this away means losing a part of my life.	
10.	I see my belongings as extensions of myself; they are part of who I am.	
11.	I am responsible for the well-being of this possession.	
12.	If this possession may be of use to someone else, I am responsible for saving it for them.	
13.	This possession is equivalent to the feelings I associate with it.	
14.	My memory is so bad I must leave this in sight or I'll forget about it.	
15.	I am responsible for finding a use for this possession.	
16.	Throwing some things away would feel like part of me is dying.	
17.	If I put this into a filing system, I'll forget about it completely.	
18	I like to maintain sole control over my things.	
19.	I'm ashamed when I don't have something like this when I need it.	
20.	I must remember something about this, and I can't if I throw this away.	

21. If I discard this without extracting all the important information from it, I will lose something. 1 2 3 4 5 6 7

22. This possession provides me with emotional comfort. 1 2 3 4 5 6 7

23. I love some of my belongings the way I love some people. 1 2 3 4 5 6 7

24. No one has the right to touch my possessions. 1 2 3 4 5 6 7

Saving Inventory – Revised

Date: _____

For each question below, circle the number that corresponds most closely to your experience DURING THE PAST WEEK.

0	1	2	3	4
None	A little	A moderate amount	Most/Much	Almost All/ Complete

1. How much of the living area in your home is cluttered with possessions? (Consider the amount of clutter in your kitchen, living room, dining room, hallways, bedrooms, bathrooms, or other rooms). 0 1 2 3 4
2. How much control do you have over your urges to acquire possessions? 0 1 2 3 4
3. How much of your home does clutter prevent you from using? 0 1 2 3 4
4. How much control do you have over your urges to save possessions? 0 1 2 3 4
5. How much of your home is difficult to walk through because of clutter? 0 1 2 3 4

For each question below, circle the number that corresponds most closely to your experience DURING THE PAST WEEK.

0	1	2	3	4
Not at all	Mild	Moderate	Considerable/ Severe	Extreme

6. To what extent do you have difficulty throwing things away? 0 1 2 3 4
7. How distressing do you find the task of throwing things away? 0 1 2 3 4
8. To what extent do you have so many things that your room(s) are cluttered? 0 1 2 3 4
9. How distressed or uncomfortable would you feel if you could not acquire something you wanted? 0 1 2 3 4
10. How much does clutter in your home interfere with your social, work or everyday functioning? Think about things that you don't do because of clutter. 0 1 2 3 4
11. How strong is your urge to buy or acquire free things for which you have no immediate use? 0 1 2 3 4

Saving Inventory – Revised

For each question below, circle the number that corresponds most closely to your experience DURING THE PAST WEEK:

	0 Not at all	1 Mild	2 Moderate	3 Considerable/ Severe	4 Extreme
12. To what extent does clutter in your home cause you distress?	◯	◯	◯	◯	◯
13. How strong is your urge to save something you know you may never use?	◯	◯	◯	◯	◯
14. How upset or distressed do you feel about your acquiring habits?	◯	◯	◯	◯	◯
15. To what extent do you feel unable to control the clutter in your home?	◯	◯	◯	◯	◯
16. To what extent has your saving or compulsive buying resulted in financial difficulties for you?	◯	◯	◯	◯	◯

For each question below, circle the number that corresponds most closely to your experience DURING THE PAST WEEK.

	0 Never	1 Rarely	2 Sometimes/ Occasionally	3 Frequently/ Often	4 Very Often
17. How often do you avoid trying to discard possessions because it is too stressful or time consuming?	◯	◯	◯	◯	◯
18. How often do you feel compelled to acquire something you see? e.g., when shopping or offered free things?	◯	◯	◯	◯	◯
19. How often do you decide to keep things you do not need and have little space for?	◯	◯	◯	◯	◯
20. How frequently does clutter in your home prevent you from inviting people to visit?	◯	◯	◯	◯	◯
21. How often do you actually buy (or acquire for free) things for which you have no immediate use or need?	◯	◯	◯	◯	◯
22. To what extent does the clutter in your home prevent you from using parts of your home for their intended purpose? For example, cooking, using furniture, washing dishes, cleaning, etc.	◯	◯	◯	◯	◯
23. How often are you unable to discard a possession you would like to get rid of?	◯	◯	◯	◯	◯

Oxford Handbooks Online

Compulsive Acquisition Scale FREE
The Oxford Handbook of Hoarding and Acquiring
Edited by Randy O. Frost and Gail Steketee

Print Publication Date: Jan 2014 Subject: Psychology Online Publication Date: Feb 2014
DOI: 10.1093/oxfordhb/9780199937783.005.0007

(p. 379) Compulsive Acquisition Scale

Please indicate below by circling the number corresponding to the extent to which each of these questions are true for you with "1" meaning "Not at all or Rarely" and "7" meaning "Very Much or Very Often".

Compulsive Acquisition Scale

	Not at All/ Rarely						Very Much/ Very Often
1. Do you buy things you never use?	1	2	3	4	5	6	7
2. Do you buy things you don't have the money for?	1	2	3	4	5	6	7
3. Do you pick things up that other people have discarded?	1	2	3	4	5	6	7
4. Do you feel compelled to buy something (for example, a good bargain)	1	2	3	4	5	6	7

Compulsive Acquisition Scale

even though you could do without it?							
5. Do you feel anxious or depressed when you don't buy something really wanted?	1	2	3	4	5	6	7
6. Do you buy things to make yourself feel better?	1	2	3	4	5	6	7
7. Do you feel like you absolutely have to have something you see while shopping?	1	2	3	4	5	6	7

Compulsive Acquisition Scale

8. Do you feel distressed or upset because you have bought things you don't need?	1	2	3	4	5	6	7
9. Do you think you spend too much time shopping?	1	2	3	4	5	6	7
10. Has excessive shopping resulted in financial difficulties for you?	1	2	3	4	5	6	7
11. Has excessive shopping	1	2	3	4	5	6	7

interfered with your social life or your job?							
12. Do you look through other people's trash (for example, dumpsters) for things to bring home?	1	2	3	4	5	6	7
13. Do you spend a longer time shopping than you intended?	1	2	3	4	5	6	7
14. Do you feel compelled to take flyers or handouts	1	2	3	4	5	6	7

Compulsive Acquisition Scale

from lectures or talks?							
15. Do you feel compelled to take free copies of magazines or newspapers when they are available?	1	2	3	4	5	6	7
16. Do you buy extras of things just in case you might need them?	1	2	3	4	5	6	7
17. Do you make special trips to collect things that are free or on sale?	1	2	3	4	5	6	7

Compulsive Acquisition Scale

18. Do you regret not taking something you could have gotten for free?	1	2	3	4	5	6	7