An Investigation of Attitudes and Attentional Biases in Trichotillomania

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Abstract

Trichotillomania (TTM) is a body focussed repetitive behaviour (BFRB) characterised by the repetitive pulling out of one's hair. It is a moderately new disorder having only been classified in 1987 and it is under-researched relative to other psychological disorders. This thesis investigates TTM by presenting a series of experiments designed to further understand attitudes towards, and attentional biases in, TTM. The experiments in this thesis address 3 central issues: stigmatising attitudes towards TTM; attentional bias pertaining to the experience of shame in TTM; and attentional bias towards hair-related stimuli in TTM. Experiment 1 investigated differences in ratings of stigma towards perceived controllable (TTM, compulsive skin-picking) and perceived uncontrollable (alopecia, psoriasis) hair-loss and skin-lesioning conditions in a TTM and control group. The main findings indicated that stigma ratings varied as a function of group: the public rated perceived controllable conditions with higher stigma than perceived uncontrollable conditions while TTM participants rated these conditions equally. Experiment 2 used a modified emotional Stroop task using shame-related words to investigate the affective correlate of shame in individuals with TTM and a control group. TTMs did not demonstrate different response latencies to shame-related words, relative to other word types or the control group, indicating no evidence of attentional bias towards shame-related linguistic stimuli. Experiments 3, 4 and 5 focussed specifically on disorder-stimuli (i.e., hair-related) linguistic stimuli in a series of lexical paradigms. Experiment 3 was a lexical decision task and Experiment 4 was a modified Stroop task: these paradigms investigated response latencies towards hair-related words in TTMs and a control group. The main findings for both experiments showed that TTMs do not demonstrate an attentional bias towards hair-related words, relative to other word types and the control group. Experiment 5 investigated higher-level judgements of hair-related words in a word rating task. The findings revealed a group-by-word-type interaction for

arousal ratings: TTMs rated hair-related words higher in arousal than body image and neutral words, and these ratings were higher than those of the control group for hair-related words. No group-by-word-type interaction for valence ratings was found. This indicates that TTMs rate hair-related words as more arousing but not more positive or negative, than other word types, relative to individuals without TTM. Finally, Experiment 6 utilised a modified dot probe paradigm to investigate attentional bias towards hair-related images. Our findings showed that TTMs disengage more slowly from hair-related images at a longer stimulus duration compared to neutral images, relative to control participants. This evidence is consistent with an attentional bias characterised by maintained attention towards hair-related stimuli in individuals with TTM. In conclusion, this thesis has presented evidence indicating that TTM (and other BFRBs) are associated with higher public stigma ratings than comparable perceived uncontrollable conditions. Results have also shown an attentional bias towards hair-related images but not words. This represents an important contribution towards the understanding of the processing of disorder-related stimuli in TTM. This may have implications for the maintenance mechanisms potentially involved in the hair-pulling condition.

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Finally, the topic of this thesis, trichotillomania, is one of the most important things in the world to me. We must do more for those afflicted by this hair-pulling condition that so many know so little about. I knew it was going to be very challenging entering into this research area and indeed, someone once told me: "To research trich in its infancy in a country like yours, you need to make yourself a martyr". At times, it really did feel like that but I had a few secret weapons: the CBSN, the TLC foundation for BFRBs and their incredible scientific advisory board, Joe's wing, and most of all, the fearless trichotillomania community who took part in so many of my studies. To the BFRB community, you are my second family and I hope that somehow, I have made you proud.

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For Paddy, who said “yes”.

I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

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Chapter One

Introduction

1.1 What is trichotillomania

The term "trichotillomania" (from the Greek *thrix*, hair; *tillien*, pulling out; *mania*, madness) was first coined by French dermatologist François Henri Hallopeau (1889) to describe repetitive pulling out of one's hair, resulting in hair loss. For the majority of the 20th century, trichotillomania (TTM) remained virtually unheard of and it was regarded as a rare behaviour (Grant, Stein, Woods, & Keuthen, 2012). TTM was not officially recognised as a coded category until its classification in the DSM III-R in 1987 (3rd ed., rev.; DSM-III-R; American Psychiatric Association, 1987) where it was listed as an impulse control disorder (a group of psychological disorders characterised by the inability and failure to resist impulses or urges). More recently, TTM was re-assigned to a brand new category as a body-focussed repetitive behaviour (BFRB) under the classification of obsessive-compulsive and related disorders (5th ed.; *DSM–5*, APA, 2013). This new category includes disorders characterised by obsessive thoughts and/or repetitive behaviours. Section 1.5 of this chapter will discuss the DSM classification of TTM in more detail.

1.2 Sensory aspects of TTM

Prior to hair extraction, hair-pullers often single out and focus on a particular hair(s) that attracts their attention, normally characterised by a perceived wiry and textured quality. Following hair extraction, it is not uncommon for hair-pullers to indulge in oral and/ or other stimulation by rubbing the extracted hair and its root against their lips/ fingertips/ parts of the body (Duke, Bodzin, Tavares, Geffken, & Storch, 2009; Mansueto, Sternberger, Thomas, & Golomb, 1997). Some hair-pullers proceed to swallow the root and even the hair resulting in the risk of developing trichobezoars (ingested hairballs in the stomach that can result in surgery) (Bouwer & Stein, 1998; Prazad et al., 2011; Ramdass & Mooteeram, 2011).

Our senses allow us to process information and experiences in multiple ways, for example, using sight, touch, smell/ taste, and sound. Typical sensory processing is characterised by the ability to process such stimuli adequately, and without trouble, when we experience them in our environment. However, "sensory processing disorders" refer to sensory issues experienced by individuals who report atypical responses to environmental stimuli. People with ASD (autism spectrum disorder) typically report atypical sensory processing (Robertson & Simmons, 2015; Thye, Bednarz, Herringshaw, Sartin & Kana, 2018). A qualitative research study by Robertson and Simmons (2015) invited participants (*N*=6) with a diagnosis of ASD to take part in a focus group discussing sensory processing issues (i.e., experiences of, and responses to, environmental stimuli). Themes characterising both negative and positive sensory experiences emerged from the discussion. The concept of control was an overarching theme in the focus group, in that individuals found sensory experiences less distressing if they felt they had some control over them. Emotional discomfort also emerged as being an issue when faced with stimuli requiring tolerance (e.g., room temperature) suggesting that threat is experienced. Of particular interest was that some participants reported being unable to process alternative sensory experiences once they had become fixated on a particular stimulus. Finally, coping strategies for tolerating aversive stimuli were discussed.

The concept of sensory processing is particularly relevant in TTM. Hair-pullers are individuals with many different motivations for pulling and no one model explains TTM in its entirety. The comprehensive behavioral (ComB) model of TTM (Mansueto et al., 1997) suggests that multiple factors, and how they interact, can explain hair-pulling: sensory; cognitive; affective; motor; and external cues. This section will consider how sensory issues may manifest in TTM, and the ComB model will be discussed in more detail in Chapters 4 and 5 of this thesis.

Both the pulling of hair and subsequent rituals provide multiple types of sensory stimulation for individuals with TTM: tactile stimulation (pulling out hair, feeling for wiry, coarse hairs; separating the hair from the root); visual stimulation (looking at roots, inspection of hair); and oral stimulation (rubbing root along lip, swallowing or biting pulled hair) (Duke et al 2009; Mansueto et al, 1997; Penzel, 2002; Woods et al., 2006). Typically, grooming behaviours such as pulling of hair and picking of skin are normal in the majority of individuals and are done on a daily basis. However, when do such routine behaviours become more than just a normal activity or small habit, and merit psychological attention? In the context of sensory dysregulation and TTM, people with TTM take their grooming behaviour to an extreme level and have difficulty regulating this, counteracting this with their hair-pulling behaviour. Further, hair-pulling is not reported as being painful by individuals with TTM as, but rather, as a pleasurable/ enjoyable sensation that positively reinforces the behaviour (Bottesi et al., 2016; Ghisi et al., 2013; Woods et al., 2006). Some hair-pullers refer to hair-pulling as serving to reduce unpleasant sensations such as tingling, itching and tension. If we put this in the context of TTM, sensory stimulation is achieved by seeking out and stimulating sites where nerve-endings are: the grooming of skin (i.e., the pulling out of hair) is a highly accessible choice for instant sensory stimulation and subsequent pleasure/ reward with immediate positive reinforcement.

Research into atypical sensory processing in TTM is relatively new, with only a handful of studies having investigated it to date. In a study by Houghton, Alexander, Bauer and Woods (2018), people with clinical BFRBs (*N*=26), subclinical BFRBs (*N*=48), and a control group (*N*=33) completed the Adult/Adolescent Sensory Profile (AASP) (Brown, N., Dunn, Cromwell & Filion, 2001). This 60 item self-report measure assesses responses to 6 categories of everyday sensory experiences: auditory; body position; movement; taste/ smell; touch; and visual. Responses on the AASP were used to categorise participants into one of 4 categories: low registration; sensation seeking; sensory sensitivity; and sensation avoiding. Findings revealed that the clinical level BFRB groups had significantly higher sensory sensitivity and sensory avoidance than both the subclinical and control group, demonstrating heterogeneity in the hair-pulling groups (clinical and subclinical) as well as compared to the control group. Further, when BFRB severity was considered (across both TTM groups: clinical and subclinical), increased BFRB severity correlated with increased sensory sensitivity and sensory avoidance. In another study (Falkenstein, Conelea, Garner & Haaga, 2018), participants (TTM, *N*=609; control group *N*=268) completed the self-report Sensory Over-Responsivity (SOR) Scale (Falkenstein et al., 2018) which measures distress and impairment for auditory and tactile over-responsivity in TTM. TTM participants had significantly higher scores than the control group on both the SOR-Hearing (auditory over-responsivity) and the SOR-Touch (tactile over-responsivity) subscales. Further, when higher TTM severity, and focussed vs automatic hair-pulling styles were considered, some significant positive correlations were revealed. As TTM severity increased, tactile over-responsivity increased, while focussed hair-pulling positively correlated with auditory over-responsivity.

As mentioned earlier, pain is not reported as being characteristic of hair-pulling in people with TTM (Bottesi et al., 2016; Ghisi et al., 2013; Woods et al., 2006). To investigate pain thresholds in people with TTM, Christenson et al. (1994) recruited TTMs (*N*=25) and a control group (*N*=31) and asked them to indicate their: (1) pain detection threshold; and (2) pain tolerance threshold, while an analgesiometer applied increasing pressure to the fingertips. Neither pain detection nor pain tolerance responses differed significantly between TTMs and controls. In a similar, recent study, Blum, Redden and Grant (2017) investigated if pain thresholds might be different in individuals with TTM, relative to a control group. TTMs (*N*=19) and controls (*N*=14) took part in a cold presser test. The cold presser test is a typically unpleasant experience where the hand is submerged in iced water and pain ratings are reported at 15 second intervals until the 3 minute test is complete. The research findings revealed that pain tolerance (the amount of time the hand stayed submerged as measured in seconds) did not significantly differ between TTMs and controls. Further, TTMs did not demonstrate lower ratings of pain, nor faster recovery time, upon removing their hand from the iced water.

In sum, research into the sensory experiences of people with TTM is in its infancy. Studies so far demonstrate that while pain perception does not differ between TTM and non TTM individuals, atypical sensory processing may be a characteristic of TTM. This is significant in terms of how this may manifest in hair-pulling for instant sensory stimulation and subsequent immediate pleasure/ reward.

1.3 Epidemiology of TTM

People with TTM experience both physical symptoms (hair-loss) and psychological symptoms involving the inability to control the behaviour (Roberts, O'Connor, Aardema, & Belanger, 2013). Affective correlates include depression (Tung, Flessner, Grant, & Keuthen, 2015), social inhibition (Woods et al., 2006), and shame (Singh, Wetterneck, Williams, & Knott, 2015; Weingarden & Renshaw, 2015). Shame will be covered more extensively in Chapter 2. Many TTM sufferers enshroud both their hair-pulling behaviours and subsequent hair loss in secrecy to conceal their condition from others (Weingarden & Renshaw, 2015). Cosmetics, wigs and false eyelashes are just a few examples of the many accessories that hair-pullers spend their money on to conceal hair loss. Furthermore, many sufferers abstain from normal activities such as swimming, sports and relationships for fear of being “revealed”. A large online survey of TTM (Woods et al., 2006) revealed that TTM accounts for disruption in many regular activities for hair-pullers. 72.6% of hair-pullers reported problems during studying, with 42.6% experiencing difficulties during actual school activities. In the working environment, 28.6% of hair-pullers reported interferences with their job duties weekly, and 18.2% had avoided a job interview because of their hair-pulling. People diagnosed with trichotillomania have an 80% likelihood of being diagnosed with another mental health disorder (Diefenbach, Mouton-Odum & Stanley, 2002).

The birth of the Internet has prompted individuals with TTM symptomology to come forward and report their hair-pulling condition to GPs. Therefore, prevalence of TTM continues to be scrutinised. A study of hair-loss in children being treated for alopecia postulated that prevalence of hair-pulling in children was 9.8% (Stroud, 1983). Adult prevalence rates remain unclear and continue to change. In a 2009 study, 0.6% of a community sample met the diagnostic criteria for TTM (Duke, Bodzin, Tavares, Geffken, & Storch, 2009). Duke, Keeley, Geffken and Storch (2010) propose that TTM is, in fact, underestimated in impact, under-diagnosed, or even misdiagnosed as a symptom of another disorder.

Limitations surrounding failure to meet clinical diagnostic criteria for TTM have prompted investigations of hair-pulling in non-clinical samples. For example, Duke, Keeley, Ricketts, Geffken and Storch (2010) found a 9.7% prevalence of hair-pulling symptoms being reported in college students, while Stanley, Borden, Bell, & Wagner's (1994) study of college students showed even higher rate of 15.3%. The TLC Foundation for Body-Focussed Repetitive Behaviours (BFRB.org, 2017) estimates that 4% of people in the USA are on the BFRB spectrum (this figure represents hair-pulling and skin-picking behaviours that are self-reported and/or meet diagnostic criteria). Females report hair-pulling predominantly more than males (Boughn & Holdom, 2002; Duke et al., 2010; Hautmann, Hercogova & Lotti, 2002; Papadopoulos, Janniger, Chodynicki & Schwartz, 2003; Sah, Koo & Price, 2008, Stanley et al., 1994). For example, Christenson (1995) showed that 92.5% of hair-pullers presenting at clinics for treatment were female. Lochner et al.'s (2005) study comparing TTM and obsessive compulsive disorder (OCD) recruited a

TTM sample of 54 patients, 49 of whom were female (a stark difference to the OCD sample where 130/278 participants were female). It is reasonable to speculate that this may be due to self-report being lower in males who can attribute hair loss to male pattern baldness. Further, Grant & Christenson (2007) found that men with TTM had a later age of onset and were more likely to have a comorbid diagnosis of anxiety.

1.4 TTM, comorbid diagnoses, and quality of life

TTM has been associated with several comorbid conditions. Many hair-pullers report that their hair-pulling severity increases at times when their anxiety levels are higher. Further, hair-pulling often results in elevated anxiety and the avoidance of social and intimate situations (Woods et al., 2006). Therefore, hair-pulling may not just occur in response to anxiety, but anxiety and associated disorders may be common comorbid and or/ subsequent diagnoses in individuals with TTM. This is supported by findings that TTM onset is typically earlier than comorbid anxiety disorder diagnoses (Grant, Mancebo, Mooney, Eisen & Rasmussen, 2015).

Studies using semi-structured interviews have revealed several prevalent comorbidities in people with TTM. In a study of 165 adults with TTM (Grant, Redden, Leppink & Chamberlain, 2017), 38 had a diagnosis of at least 1 comorbid anxiety disorder. Of this sample (*N*=38), there were comorbid diagnoses of major depression (63.2%), skin-picking disorder (36.8%), and OCD (2.6%). Another study using a semi-structured interview study of young adults in Sweden (Grzesiak, Reich, Szepietowski, Hadrys, & Pacan, 2017) investigated the prevalence of TTM and any comorbidies with anxiety and OCD. Of the sample (*N*=339), 12 individuals reported that they had pulled their hair during their lifetime, 8 of whom met the diagnostic criteria for TTM. Of the 8 individuals who met the diagnostic criteria for TTM, 5 had anxiety disorder diagnoses. More generally, the width of the affective correlates (not just anxiety) associated with TTM is vast. Whilst the actual hair-pulling disorder can greatly affect individuals with TTM, quality of life and distress might be somewhat mediated by comorbid diagnoses. Houghton et al. (2016) investigated both current and lifetime comorbidity rates in a sample of 85 individuals with TTM. Current rates of a comorbid psychiatric diagnosis were 38.8% and lifetime rates were 78.8%. The highest current comorbid diagnoses were skin-picking disorder and generalised anxiety disorder (both 12.9%), while the highest lifetime comorbid diagnoses were major depression (51.8%), alcohol abuse disorder (17.7%) post-traumatic stress disorder (15.3%), generalised anxiety disorder (14.1%), and skin-picking disorder (12.9%). Finally, Keuthen, Altenburger and Pauls (2014) sampled 110 people with TTM and revealed comorbid diagnoses including depression (52.7%), OCD (38.1%), generalised anxiety disorder (24.5%), skin-picking disorder (20%), and social anxiety disorder (19.1%).

1.5 The symptomology of TTM

Whilst causes of, and treatments for, TTM receive increasing attention in the research literature, we are still trying to understand the nature of the actual disorder. The DSM-III-R (1987) and DSM-IV-TR (2000) diagnostic criteria of TTM as an impulse control disorder assumed a homogenous pulling experience across hair-pullers: (1) a tension build-up prior to pulling; (2) the experience of relief/gratification during/immediately after pulling; and (3) noticeable hair-loss due to hair-pulling. Two studies investigating Italian self-reported hair-pullers (Bottesi, Cerea, Ouimet, Sica, & Ghisi, 2016; Ghisi, Bottesi, Sica, Ouimet, & Sanavio, 2013) showed that both samples reported increased pleasure and relief, and decreased anxiety following hair-pulling. Diefenbach et al. (2002) investigated the tension/relief aspect of hair-pulling by focussing on affective correlates of trichotillomania and pulling experiences. The impulse control disorder criteria were largely supported by their findings, where individuals with TTM reported an increase in relief during a hair-pulling episode followed by a decrease in tension and anxiety afterwards. However, the criteria were interpreted as overly restrictive, with 17-23% of hair-pullers reporting often not experiencing the tension/relief pattern when pulling. Tay, Levy and Metry (2005) reported that individuals with the hair-pulling condition often experienced hair-pulling episodes without the tension/relief aspect. In addition, clinicians often diagnose patients (particularly children) with TTM without the tension criteria being present (Flessner, Woods, Franklin, Keuthen & Piacentini, 2009).

In cases where the tension/relief model is not adhered to, hair-pullers have reported that hair extraction sometime occurs when they are in a somewhat “zoned out” state. To investigate this more closely, Lochner et al. (2004) compared dissociative experiences of OCD patients with trichotillomania patients, and results showed that 15.8% of OCD patients were high dissociators, compared with 18.8% of trichotillomania patients (measured by a self-report dissociative experience questionnaire). Therefore, as hair-pullers reveal differences in experiences prior to and during pulling, this has furthered investigation into the notion that pulling styles may not be homogenous.

The updated diagnostic criteria of TTM upon reclassification in the DSM-5 (APA, 2013) were intended to reflect the heterogeneity that exists and is reported by individuals with TTM. Two diagnostic criteria in the DSM-III-R (APA, 1987) and DSM-IV-TR (APA, 2000) were removed: (1) experiences of tension and relief surrounding hair-pulling, and (2) “noticeable” hair-loss as a result of pulling. Research into hair-pulling styles has identified two subtypes of pulling that are reflected these changes: (1) automatic hair-pulling, where the puller removes hair completely outside of their awareness; and (2) focussed hair-pulling, where the puller removes hair with a somewhat more compulsive quality whilst focussing complete attention on the activity (Flessner et al., 2008b; Flessner et al., 2009). Flessner et al. (2008a) investigated pulling styles in an online sample of 1545 individuals with TTM. Those who scored higher on automatic pulling had significantly higher hair-pulling severity, stress, and anxiety than those with lower automatic hair-pulling scores. A similar pattern of results was shown by individuals who scored high on focussed hair-pulling; however, as well as having significantly higher hair-pulling severity, stress, and anxiety than those with low focussed hair-pulling, they also reported more stress and disability. The authors highlight that focussed and automatic pulling are rarely mutually exclusive and most people with trichotillomania will engage in both types of pulling at least some of the time. Those engaging in both high-focussed and high-automatic hair-pulling reported more hair-loss, higher avoidance of social situations, and feeling vulnerable to other mental health conditions.

Triggers for, and regions of, pulling may also vary across automatic and focussed pulling. Flessner et al. (2009) suggest that focussed hair-pulling occurs more frequently in response to negative mood states (e.g., anxiety, stress and depression). Automatic pulling outside of one's awareness often takes place when concentrating on other activities (e.g., driving, studying). Eyelash-pulling has been shown to be significantly higher in groups of focussed pullers. Flessner et al. (2008c) showed that eyelash pulling was almost 4 times as likely to occur in a group of youths with low automatic pulling and high focussed pulling. This group also reported less scalp pulling. Further, Duke et al. (2010) showed that eyelash-pulling was significantly higher in groups of focussed pullers at 43.8% compared to automatic pulling groups at 5.7% (Duke et al., 2010). Consequently, variations in hair-pulling patterns reflect the heterogeneous nature of TTM.

1.6 TTM as an threat-related obsessive-compulsive and related disorder

Due to the repetitive, compulsive nature of the hair-pulling and TTM's reclassification as an obsessive-compulsive and related disorder in the DSM-5 (APA, 2013), it is prudent to attend to similarities and differences between TTM and obsessive-compulsive disorder (OCD). Both groups of individuals are aware that their behaviours are detrimental (pulling out of hair for TTM, intrusive thoughts followed by compulsive behaviours in OCD), yet they still find it incredibly difficult to delay or resist carrying out their behaviour (Brakoulias et al., 2011; Tukel, Keser, Karah & Olgun, 2001).

TTM shares several common characteristics with OCD, yet those separating the disorders are also extensive. Hair-pullers do not remove their hair as a means to remove intrusive thoughts (Woods et al., 2006). Furthermore, the hair-pulling individual is not always aware of their actions when engaging in automatic pulling (Flessner et al., 2008a; Flessner et al., 2008b; Flessner et al., 2008c; Flessner et al., 2009). Individuals with OCD on the other hand, carry out compulsive actions (e.g., washing, checking) to combat intrusive thoughts, and are constantly aware of these behaviours when doing so (APA, 2013,). The term *obsessive compulsive spectrum disorders* (OCSD) was coined by Hollander (1993) to describe a cluster of disorders characterised by impulsive and compulsive behaviours. Brakoulias et al. (2011) investigated rates of comorbidity in patients with OCD (N=77) and 5.1% also had a hair-pulling diagnosis. In a study of non-clinical hair-pulling prevalence in college students, Stanley et al. (1994) showed that OCD symptoms were higher in those who reported hair-pulling.

Lochner et al. (2005) interviewed 54 TTM patients and 278 OCD patients, revealing significant variations between the two groups. TTM patients reported significantly lower response to treatment (anti-depressants=42.9%, cognitive behavioural therapy=33.3%) compared to the OCD group (anti-depressants=90.7%, cognitive behavioural therapy=73.3%). However, the TTM group reported a generally higher adaptation to living with their disorder, while OCD patients reported higher disability due to their condition. Findings also revealed that TTM patients reported an earlier onset of their condition (11.8 years) in comparison to OCD patients (19.3 years), and they reported no intrusive thoughts prior to hair extraction. Gender distribution was more evenly spread for OCD whereas the majority of trichotillomania patients were female (91%). This is reflected frequently in studies investigating TTM and OCD (Boughn & Holdom, 2002; Hautmann, Hercogova & Lotti, 2002; Papadopoulos, Janniger, Chodynicki & Schwartz, 2003; Sah, Koo & Price, 2008).

Chamberlain et al. (2006b) compared TTM patients (*N*=17), OCD patients (*N*=20) and a control group (*N*=20) for indications of cognitive inflexibility (problems in shifting attentional focus) and motor inhibition (problems inhibiting motor behaviour). Cognitive flexibility was measured using the "intradimensional/ extradimensional shift task" (a visual discrimination task developed from the Wisconsin card-sorting task) to examine ability to shift attention between stimulus dimensions. Motor inhibition was measured using the "stop-signal" task which provides an estimate of the time taken to internally suppress a motor response. Both the TTM patients and control group demonstrated similar results on cognitive flexibility, while OCD patients required significantly more trials. However, similarities between TTM and OCD patients emerged in the stop-signal task where both groups exhibited impaired motor responses relative to the control group. Further, TTM patients exhibited significantly longer reaction times than OCD patients in the "stop-signal" task, and hair-pulling severity was significantly positively correlated with stop-signal reaction times.

1.7 TTM as a behavioural addiction

One of the most prominent differences separating trichotillomania from OCD is the concept of hair-pulling as a pleasurable behaviour (in contrast to repetitive OCD behaviours that are driven by intrusive thoughts). Hair-pullers report that both the actual act of hair extraction and subsequent "rituals" (e.g., inspection of roots) are highly satisfying. A wealth of literature supports this reward model of TTM (Diefenbach, Tolin, Meunier, & Worhunsky, 2008; Grant, Odlaug & Potenza, 2007; Grant, Odlaug, Woods, Keuthen, & Stein, 2012; Madjar, & Sripada, 2016; Meunier, Tolin, & Franklin, 2009; Woods et al., 2006). Disorders characterised by reward are known as addictions (e.g., smoking, alcohol use, gambling). Several characteristics of TTM are comparable with addictions, for example, repeated, failed attempts to quit the behaviour; "falling off the wagon"; withdrawals when resisting an urge to pull; and overindulging in pulling once failing not to pull has happened. Grant et al. (2007) suggested that these characteristics place TTM in the context of an addiction model. Lochner et al's. (2005) investigation of OCD and TTM patients showed that TTM group scored significantly higher on novelty seeking, a personality characteristic highly prevalent in addictions (Grant & Kim, 2002; Kim & Grant, 2001; Raymond, Coleman & Miner, 2003).

1.8 Investigating attitudes and attentional biases in TTM

As we can see, uncertainties surrounding the appropriate classification of TTM provide an excellent opportunity to further its understanding. The purpose of this thesis is to present a comprehensive series of studies designed to investigate attitudes towards, and attentional biases in, TTM. In this thesis, we use data from self-reported hair-pullers sourced from online support sites as opposed to clinical samples. As reviewed in section 1.3 of this introduction, prevalence rates for TTM are still uncertain and studies (e.g., Duke et al., 2009; Duke et al., 2010b; Stanley et al., 1994) highlight the importance of sampling individuals from non-clinical samples.

The investigation of attitudes towards TTM is crucially important. As this chapter has shown, TTM research is relatively in its infancy and the condition merits more investigation. Chapter 2 will begin by introducing the role of stigma in mental health. Stigma from the public has been shown to promote isolation and barriers to treatment in those with mental health conditions (Botha & Dozois, 2015; Chan & Mak, 2015; Corrigan, 2004). Given the relatively low number of individuals who present for treatment with TTM, and those who receive an incorrect diagnosis from health professionals, we will first present a study investigating stigmatising attitudes towards TTM (along with other conditions). It is possible that stigmatising attitudes towards TTM may be higher than that of other conditions and this in itself is important to investigate. This opening study will set the scene as to why it is important increase awareness and understanding of the under-researched condition of TTM.

We live in an environment where we are exposed to effectively unlimited stimuli, however, our brain has been conceptualised as a limited capacity processor (e.g., Moray, 1967). Classically, in order to deal with this sensory overload, Broadbent (1958) proposed the idea of a filtering system as way of selecting what is attended to. Essentially, to make sense of our environment, we selectively attend to some information more than others. It is beyond the scope of this thesis to consider the intricacies and various models of selective attention, and what will follow focusses on attentional bias.

An attentional bias reflects selective allocation of resources towards, or away from, a specific stimulus relative to other information that is accessible at the same time. A more detailed review of attentional biases will be presented throughout this thesis in the relevant chapters, however, in summary, attentional bias has shown to be important in the maintenance of several mental health disorders and extensive evidence has consistently indicated the existence of strong attentional biases in: anxiety disorders (Dresler et al., 2009; Mathews & MacLeod, 1985); addictive disorders (Cane et al., 2009; Cox et al., 2006; Fadardi & Cox, 2009; Shiffman, Sayette, Paty, Gwaltney & Balabanis, 2003; Waters, Field, Munafo & Franken, 2009); and depression (Kerr, Scott & Phillips, 2005; Mitterschiffthaler et al., 2008).

Experiment 2 of Chapter 2, and the experiments in Chapters 3 and 4 of this thesis will focus specifically on attentional processing in people with TTM symptomology. In attentional bias research, various paradigms exist. Typically, these tasks measure reaction times where a participant has to respond to a trial as quickly as possible and their response is measured in milliseconds (ms). The time that is taken for the response is indicative of their attentional processing of the stimuli presented in the task. Attentional bias paradigms and corresponding literature will be reviewed in the context of the relevant chapters in this thesis, but an overview will be presented here.

The Stroop task (Stroop, 1953) requires participants to name the ink colour of a word while ignoring the meaning of the word. Responses are typically slower when the semantic meaning of the word is incongruent with the colour of the word presented (e.g., “blue” in red ink) compared with congruent trials (e.g., “blue” in blue ink). The modified emotional Stroop task (Mathews & MacLeod, 1985) expands on this by using words with emotional significance as stimuli (e.g., high and low valence words, high arousal words). Then there are lexical decision tasks, where participants are presented with a letter string and have to respond as quickly as possible as to whether it is a word (e.g., hair, died) or a non-word (e.g., clat, nump). Words yield a quicker response than non-words because the time taken to search one’s lexical memory for a non-word takes longer, before making a response.

To date, only a handful of studies have employed paradigms investigating attentional processing in TTM and this literature will be reviewed in detail in the relevant chapters. We use modified emotional Stroop tasks in Experiment 2 (shame-related words in Chapter 2) and Experiment 4 (hair-related words in Chapter 3). Experiment 2 in Chapter 2 will look more closely at the affective correlate of shame by investigating attentional bias to shame-related words in a TTM population, relative to a control group. While literature that will be reviewed in Chapter 2 has shown that people with TTM experience shame more than the general population, to our knowledge, Experiment 2 is the first study to investigate lower-level cognitive biases to shame in a TTM sample. As reviewed earlier in this introduction, TTMs often report negative affect both before and after hair-pulling episodes, and this may be reflected in an attentional bias towards shame-related stimuli in our TTM sample. Experiment 2 contributes to this literature by presenting shame-related words (matched with positive and neutral words) in a modified emotional Stroop task to explore any differential attentional processing in people with TTM compared to a non hair-pulling control group.

Chapters 3 and 4 will move away from the theme of affective correlates (i.e., shame) towards the role of specific disorder-related stimuli, that is, hair-related stimuli. Chapter 3 presents three experiments that focus on the processing of hair-related words in a series of lexical studies. Experiment 3 in Chapter 3 uses hair-related words (matched with positive, neutral, and negative words) in a lexical decision task. Experiment 4 uses the same word-set in a modified emotional Stroop task. The aim of these studies is to identify any differences in the processing of hair-related words in a TTM group, relative to a non hair-pulling control group. Finally, Experiment 5 in Chapter 3 is a word-rating task where valence and arousal ratings are obtained for our hair-related words by both a TTM and control group.

The final experimental chapter, Chapter 4, develops from Chapter 3 by continuing to investigate attentional biases, but rather by exploring pictorial stimuli in a dot probe study using hair-related (and neutral) stimuli. Two images (one hair-related, one neutral) are presented simultaneously on either side of a fixation cross, competing for the viewer's attention. Upon the disappearance of the two stimuli, a cue appears to either the left or the right of the screen, replacing one of the previously presented stimuli. The participant has to respond quickly as possible to the location of the cue. Our use of images in Chapter 4 increases the ecological validity of our hair-related stimuli. Dot probe literature will be reviewed in significantly more detail in Chapter 4 this section of the thesis.

In sum, the literature presented throughout this thesis will provide a review of evidence that biased attitudes and disorder-related attentional biases are present in several mental health conditions, and that these impact on the experience and maintenance of these conditions. With existing attitude and attentional research into TTM being scarce, this thesis will use a series of specific paradigms to out more about the nature of attitudes and biases towards, and in, TTM. Findings can contribute the understanding of factors that may affect and maintain hair-pulling behaviours in people with TTM symptomology.

Chapter Two

Attitudes towards, and shame in, TTM

2.1 Introduction to attitudes towards TTM

The opening chapter of this thesis reviewed the nature and prevalence of TTM and other body focussed repetitive behaviours (BFRBs) such as compulsive skin-picking (CSP). TTM was not recognised as a mental health disorder until 1987 (DSM-III, 1987) and the disorder is often under-diagnosed (Duke et al., 2010). This would indicate that knowledge and understanding of TTM is scarce relative to other psychological disorders. Lacking knowledge of TTM has resulted in reduced awareness until recently, and BFRBs being difficult to understand and treat (Duke et al., 2009). Further, Chapter 1 highlighted the fact the TTM is also accompanied by negative affective correlates (e.g., shame) that are frequently reported by individuals with TTM (Singh et al., 2015; Tung et al., 2015; Weingarden & Renshaw, 2015; Woods, et al., 2006).

The first experiment in this chapter will follow on from a review of literature demonstrating that mental health conditions are often perceived as being *controllable.* This perception can affect attitude attributions from the public towards mental health conditions. The concept of perceived controllability is particularly applicable to BFRBs where hair-pullers are often told to just “stop” and reduce/ quit the behaviour (i.e., simply remove one’s hand from one’s hair or distract oneself). The review will then proceed to specifically investigate attitudes towards BFRBs. Experiment 1 explores stigmatising attitudes towards BFRBs using a vignette study portraying 5 different protagonists: 2 with hair-loss (1 TTM, 1 alopecia); 2 with skin-lesions (1 CSP, 1 psoriasis); and 1 control protagonist with depression. The aim of Experiment 1 is to investigate attitudes towards vignettes portraying similar observable physical symptoms but attributed to different underlying causes. Findings can highlight the importance of research into, and the understanding of, TTM (and its sister condition of CSP) in the UK.

2.1.1 The role of stigma in mental health

Research (Corrigan, 2004; Corrigan et al., 2010; Corrigan, Kosyluk & Rüsch, 2013) has investigated the effect of stigma on mental health by investigating how biased attitudes towards mental health conditions can result in lower self-worth and reduced recovery in people with mental health conditions. People with mental illness often experience public stigma (prejudice and discrimination from the public who have ideas about stereotypes of mental illness) and this often leads to isolation and reduced help-seeking (Botha & Dozois, 2015; Chan & Mak, 2015; Corrigan, 2004).

Attribution theory generally predicts that behaviours perceived as being controllable are more likely to be stigmatised than behaviours that are perceived as uncontrollable (Botha & Dozois, 2015; Boysen & Vogel, 2008; Corrigan, Markowitz, Watson, & Kubiak, 2003). In understanding this, we can tease apart the public's understanding of what may cause one's illness/ condition. Goldstein & Rosselli (2003) investigated how the public perceives depression by examining the attitudes of college students (*N*=66) towards: (1) cause; (2) degree of empowerment; (3) preferred treatment; and (4) stigma. The findings revealed that depression was understood to be caused by multiple factors: biological (e.g., chemical/ hormonal imbalance); psychological (e.g., cognitive biases, hopelessness); and environmental factors (e.g., stressful life events). Whilst the sample associated biological causes with less blame and greater help-seeking behaviours, the psychological model was linked with higher blame and increased stigma in terms of higher social distance. It can be concluded that under a psychological model, the public view psychological disorders as more controllable and therefore, those that are afflicted should be able to improve their mental health condition.

Weiner, Perry and Magnusson (1988) investigated perceived controllability in the context of attribution theory by investigating a range of ratings including pity, ratings of perceived controllability, blame, anger, and liking. Conditions such as cancer and blindness (perceived uncontrollable) were rated alongside conditions like drug abuse and obesity (perceived controllable). In the context of this chapter, results showed that conditions perceived as controllable received higher ratings of blame and less pity, while conditions perceived as uncontrollable were most likely to be physical-based conditions (as opposed to mental/ behavioural conditions). Corrigan et al. (2000) investigated attributions using the Psychiatric Disability Attribution Questionnaire (PDAQ, Weiner, 1988) which has items relating to controllability and stability (how much a disorder can change and respond to treatment). Participants (*N*=152) were asked to rate each disability group (mental retardation, cocaine addiction, psychosis, depression, cancer, and AIDS). Results showed that attributions across disabilities largely varied. In terms of controllability, cocaine addiction was rated as most controllable, followed by psychosis and AIDS, while depression and cancer were rated more favourably. When stability was considered, mental retardation was viewed most negatively. Physical conditions often receive higher ratings of dangerousness (Angermeyer & Dietrich, 2006) and unpredictability (Harré, 2001). It can be speculated that this is due to them being viewed as stable and understood to be difficult to change.

Negative attitudes have also been shown in school-children and adolescents towards disorders containing involuntary behaviours (e.g., Tourettes Syndrome) (Friedrich, Morgan, & Devine, 1996; Stokes, Bawden, Camfield, Backman, & Dooley, 1991). Tourettes syndrome (TS) is a neurodevelopmental disorder characterised by involuntary motor tics and vocalisations that are uncontrollable for the individual (American Psychiatric Association, 2013). In a qualitative study of peer perception of TS, Malli & Forrester-Jones investigated adolescents' (*N*=22) responses to this disorder. Themes emerging from the qualitative analysis largely indicated that TS is perceived as "Straying from the boundaries of normalcy" (p. 285). The complex behaviour seen in TS is often perceived as socially unacceptable and awkward (Malli & Forrester-Jones, 2017).

Misconceptions of behaviours deemed as "abnormal" demonstrate the need for increased awareness and understanding of mental health conditions.

2.1.2 The role of stigma, attitudes and perceived controllability in body focussed repetitive behaviours

Whilst attitudes towards mental health have been addressed in general, literature is somewhat scarcer when considering the role of attitudes and stigma towards BFRBs. Boudjouk, Woods, Miltenberger and Long (2000) showed video recordings of actors portraying either a hair-pulling or non-hair-pulling protagonist to adolescent participants (*N*=51). The protagonist with TTM was rated significantly lower on Lober's (1970) social acceptance scale compared to the non hair-puller. In another study, Marcks, Woods and Ridosko (2005) asked 225 college students to read a vignette that included a protagonist with hair-loss and then answer questions investigating their attitudes towards the protagonist. Participants read 1 randomly selected vignette and the vignettes varied in terms of: (1) gender (male protagonist/ female protagonist); and (2) disclosure/ nondisclosure of TTM (an explanation of hair-loss due to hair-pulling provided/ not provided). A main effect of TTM disclosure was revealed: participants attributed more negative peer perceptions and more social rejection to the protagonist whose hair-loss was disclosed as being a result of TTM, compared to the protagonist whose hair-loss was not explained as being a result of TTM. When no explanation of hair-loss due to TTM was provided, the female protagonist was viewed as needing more professional help than the male. Further, when the vignette contained an explanation of hair-loss due to TTM, males and females were viewed similarly in their need for professional help.

In a further vignette study depicting a protagonist with hair-loss, Ricketts, Brandt, and Woods (2012) expanded on hair-loss disclosure by presenting undergraduates (*N*=290) with vignettes portraying a protagonist with hair-loss explained by either: genetic (i.e., completely outside of the protagonist's control); TTM; or no cause given. Participants showed more negative perceptions of the protagonist when the cause of hair-loss was disclosed (genetic, TTM) compared to when no cause of hair-loss was provided. Further, as hair-loss severity increased, negative perceptions of the protagonist also increased. The authors explored if knowledge of TTM, as measured by the Familiarity with TTM Questionnaire (Woods, Fuqua & Outman, 1999), might influence their perceptions. Participants who had a higher familiarity with TTM attributed lower social rejection and lower negative social evaluation towards protagonists with hair-loss explained as being a result of TTM.

2.2 Experiment 1. An investigation of stigmatising attitude towards perceived controllable and uncontrollable hair-loss and skin-lesioning conditions

As reviewed thus far in Chapter 2, people with mental illness often experience stigma from the public and this can be predictive of social rejection and failure to seek treatment/ support. To date, only a handful of studies have investigated attitudes towards TTM (e.g., Boudjouk et al., 2000; Marcks, et al., 2005; Ricketts et al., 2012). We wanted to expand on this literature and investigate attitudes towards vignettes portraying protagonists with "matched" hair-loss (TTM, alopecia) and damaged skin (CSP, Psoriasis) conditions in a TTM and matched control group. By presenting protagonists with "matched" hair-loss and skin-lesioning conditions that have different causes but similar observable physical symptoms, we can see how the actual condition (and not the hair-loss and skin lesioning) is influencing the attitudes of the individual rating the protagonist. While Boudjouk et al. (2000), Marcks, et al. (2005) and Ricketts, et al. (2012) investigated attitudes towards hair-loss conditions, we were interested to look specifically at the attribution of stigma by employing Corrigan et al.'s (2003) attribution quotient (AQ-9) for stigmatising attitudes towards mental health conditions. For hair-loss, protagonists displayed TTM (perceived controllable) and alopecia (perceived uncontrollable). For damaged skin, protagonists displayed CSP (perceived controllable) and psoriasis (perceived uncontrollable). We included a control vignette of depression portraying a protagonist with no obvious physical symptoms (hair-loss, damage to skin).

Previous research by Ricketts et al. (2012) showed that the role of familiarity with TTM showed that TTM received lower social rejection and less negative social evaluation. For hypothesis 1, we wanted to explore if this knowledge could be transferred over to those who experience TTM and how it may influence their stigmatising attitudes towards BFRBs (TTM and CSP) compared with those without the hair-pulling condition. We predicted that the TTM group would assign lower stigmatising attitude scores towards the “perceived controllable” conditions of TTM and CSP, in comparison to the control group’s stigmatising attitude scores of TTM and CSP because of familiarity with, and experience of, having a BFRB.

Although alopecia and psoriasis are not mental health conditions, the observable physical symptoms are similar to those of TTM and CSP. Further, depression is a common affective correlate in TTM. Therefore, the experience of having a mental illness may result in similar ratings across all vignettes. For hypothesis 2, we predicted that the TTM group would show no differences in stigmatising attitude across all conditions.

Previous research has shown that behaviours perceived as being controllable receive more stigma than behaviours perceived as uncontrollable (Botha & Dozois, 2015; Boysen & Vogel, 2008; Corrigan, Markowitz, Watson, & Kubiak, 2003). As the experience of having a BFRB is typically unique to those who have, for example, TTM or CSP, it can be speculated that the control group would have less understanding of BFRBs. Therefore, hypothesis 3 predicted that the control group would score the “perceived controllable” conditions of TTM and CSP higher on stigma, than they would towards the perceived uncontrollable conditions (alopecia and psoriasis).

2.2.1 Method

2.2.1.1 Participants

Self-reported TTM participants were recruited via online support sites for hair-pulling symptoms. The sample consisted of females who reported that they had symptoms of hair-pulling. Control participants were recruited opportunistically via the School of Psychology's subject pool (http://experiments.psy.gla.ac.uk) and were females who reported no symptoms of hair-pulling behaviours. All participants were administered the Massachusetts General Hospital Hair-Pulling Scale (MGH-HS) to confirm classification into the hair-pulling and control groups: females who reported symptoms of TTM (*N*=53, MGH-HS=10-27) and the control group who reported no hair-pulling symptoms (*N*=53, MGH-HS=0). The TTM sample participated voluntarily (due to their geographical location) whilst control participants received one course credit for their participation. The study was approved by the University of Glasgow's ethics committee. Participant data is presented in Table 2.1.

Table 2.1. *Participant information.*

	Age			MGH-HS		
	M	**SD**	**Range**	**M**	**SD**	**Range**
Group						
TTM (*N*=53)	25.9	7.4	16-44	17.2	4.7	10-27
Control (*N*=53)	25.5	7.5	16-45	0	0	-

Note. TTM = trichotillomania; MGH-HS = Massachusetts Hospital Hair-Pulling Scale

2.2.1.2 Materials and measures

Hair-pulling severity: The Massachusetts General Hospital Hair-Pulling Scale (MGH-HS; Keuthen et al., 1995) is the most commonly used questionnaire to assess hair-pulling behaviours (see Appendix A). The scale contains 7 items on a five point numerical scale (0-4) where 0=no symptoms to 4=severe symptoms of hair-pulling. Only feelings/ behaviours over the past week are assessed. The 7 questions are divided into three categories: (1) rating of the urges to pull, 2) rating of the actual hair pulling, and (3) rating of the consequences of pulling. This is the most frequently cited hair-pulling scale in TTM research. The MGH-HS has been shown to demonstrate good internal consistency (α=0.80-0.89), (Diefenbach, Tolin, Crocetto, Maltby, & Hannan, 2005; Keuthen et al., 1995) exceptional test-retest reliability (r=0.97), (O'Sullivan et al., 1995) and strong convergent validity (r=0.63-0.75), (O'Sullivan et al., 1995).

Stigma: The Attribution Questionnaire (AQ-9; Corrigan et al., 2003) is a measure of stigma across 9 components: pity; danger; fear; blame; segregation; anger; help; avoidance and coercion (see Appendix B). The AQ-9 uses a 9-point Likert scale where a score of 1 indicates no stigmatising attitude and a score of 9 indicates the highest stigmatising attitude. For each vignette, the questions were amended to contain the protagonist's name. Examples items are presented in Figure 2.1

Item 1 (AQ-9): Depression (Rebecca)   Item 3 (AQ-9): Alopecia (Fiona)

Figure 2.1. *Example questions from the AQ-9.*

Vignettes: This vignette task contained 5 vignettes written for the purpose of the study and portraying symptoms consistent with DSM-IV[1] criteria. The 5 vignettes depicted 5 adult females who each had a different condition: (1) Olivia: TTM (perceived controllable hair-loss), (2) Fiona: alopecia (perceived uncontrollable hair-loss), (3) Anna:

[1] *Note.* At the time of Experiment 1, DSM-5 had not yet been published.

compulsive skin-picking (CSP) (perceived controllable skin-lesioning), (4) Angela: psoriasis (perceived uncontrollable skin-lesioning), and (5) Rebecca, a control vignette depicting major depression. Each vignette followed the same structure: a young adult female was introduced, her condition was not named but the symptoms were described along with the effect that the condition has on her daily life. Vignettes were presenting in a random order for each participant. Figure 2.2 presents examples of vignettes and all vignettes are presented in Appendix C.

TTM (Olivia)	Alopecia (Fiona)
Olivia Olivia is a 25 year old female whose friends are concerned about her thinning hair, eyelashes and eyebrows. A few weeks ago, her friends noticed her continually pulling out her hair whilst watching a movie and they often see her playing with her hair and eyelashes excessively. On examination, Olivia has several bald patches on her scalp and eyelids which require her to engage in fixing her hair and makeup before leaving the house. Olivia reports that she knows she should stop pulling out her hair but when she is pulling her hair, she is often not aware of it and cannot control the urges. Olivia's hair loss causes her to feel a lot of shame about her appearance, and as a result she has started to avoid social situations through fear of people learning of her behaviour. Olivia carries hair products, makeup and a mirror in her bag everywhere she goes in an attempt to conceal her hair loss from others.	**Fiona** Fiona is a 26 year old female who is attending a doctor's clinic to have her hair loss assessed. Her family is concerned as her hair has been falling out for several months and on examination, Fiona has bald patches on her scalp and eyelashes. Fiona reports that when washing her hair, it often falls out excessively. She has also reported clumps of hair on her pillow on waking up in the morning. This makes Fiona feel very self-conscious and she often gets very upset. She reports that her job is very stressful and that particularly stressful events seem to prompt her hair falling out. Her hair loss has resulted in her feeling out of control and vulnerable as she feels she can do nothing to curb the stress that prompts her hair to fall out. Fiona feels embarrassed about her hair loss and engages in a daily routine to conceal her bald patches.

Figure 2.2. *Example presentation of vignettes.*

2.2.1.3 Procedure

Participants were tested individually via a remote online experiment and received onscreen instructions. They were informed that the study required them to read 5 vignettes each followed by a questionnaire, concluding with a short questionnaire to assess any hair-pulling behaviours of their own. Participants viewed the first vignette and then immediately answered the AQ-9 (which personalised the corresponding protagonist by name) to assess their levels of stigmatising attitude towards the protagonist. On completion of this procedure for the first vignette, this procedure was repeated for the remaining four vignettes. Participants were then asked to complete the Massachusetts General Hospital Hair-pulling Scale (MGH-HS). All participants were debriefed as to the purpose of the experiment thanked for their participation, and invited to contact the experimenter should they have any questions.

2.2.2 Results

A repeated measures mixed ANOVA revealed that there was a significant main effect of group (TTM, control) on stigmatising attitudes: $F(1,104)=13.887$, $p<0.001$. The TTM group ($M=2.51$, $SD=0.26$) rated vignettes lower in stigma than the control group ($M=3$, $SD=0.25$).

The corresponding main effect of vignette (TTM, alopecia, CSP, psoriasis, depression) on stigmatising attitudes was also significant: $F(3.057, 317.933)=16.504$, $p<0.001$ (df adjusted for Greenhouse-Geisser). The descriptive data showed that across both groups, the depression vignette ($M=3.09$, $SD=0.91$) was rated highest for stigma. The TTM vignette ($M=2.28$, $SD=0.94$), the psoriasis vignette ($M=2.66$, $SD=0.85$) and the CSP vignette ($M=2.82$, $SD=0.96$) were rated lower than the depression vignette. The alopecia rating of stigma was the lowest ($M=2.51$, $SD=0.71$). To see where the significance lay for the main effect of vignette, we carried out a one-way repeated measures ANOVA with Bonferroni adjusted multiple comparisons to compare the overall AQ-9 ratings for each vignette. The significance for the main effect of vignette was attributed to the depression vignette being significantly higher than the TTM ($p=.001$), alopecia ($p<.001$), and psoriasis ($p<.001$) vignettes. The alopecia vignette was also rated lower in stigma than the skin-picking vignette ($p=.043$). Figure 2.3 presents the main effect of AQ-9 scores for each vignette.

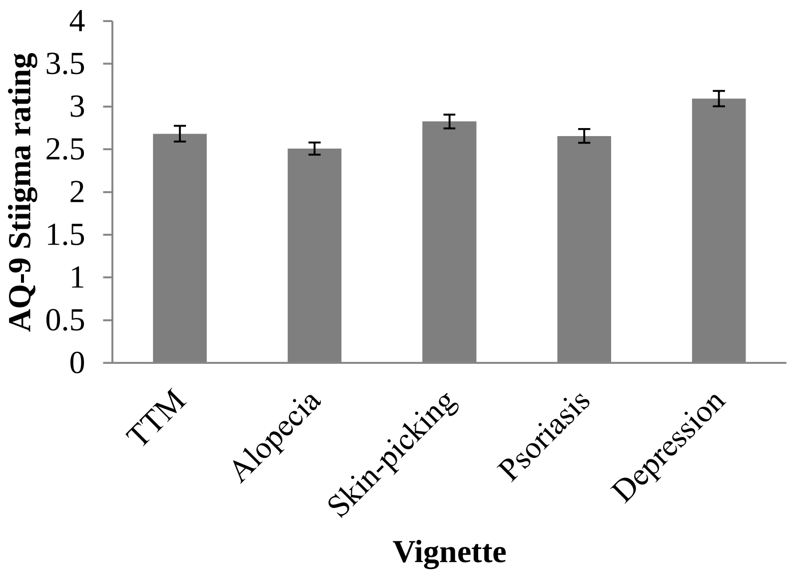


Figure 2.3 Mean stigma ratings (error bars display standard error) for main effect of vignette (TTM, alopecia, CSP, psoriasis, depression) across both groups (TTM, control). *Note*. TTM = trichotillomania. AQ-9 =Attribution Questionnaire.

We then tested hypothesis 1: "The TTM group will assign lower stigmatising attitude scores towards the "perceived controllable" conditions of TTM and CSP, in comparison to the control group's stigmatising attitude scores", by examining the group (TTM, Control) by vignette (TTM, alopecia, skin-picking, psoriasis, depression) interaction.

There was a significant group by vignette interaction: $F(3.057, 317.933)=5.925$, $p=0.001$ (df adjusted for Greenhouse-Geisser). As shown by the descriptive data in Table 2.2 and Figure 2.4, the TTM condition was assigned higher stigmatising attitude scores by the control group ($M=3.03$, $SD=1.09$) than the TTM group ($M=2.33$, $SD=0.61$). The alopecia vignette was also assigned slightly higher stigmatising scores by controls the control group ($M=2.65$, 0.72) relative to the TTM group ($M=2.37$, $SD=0.678$). The largest difference in mean stigmatising attitude scores was for the CSP vignette that received a higher score from the control group ($M=3.24$, $SD= 1.02$) compared to the TTM group ($M=2.41$, $SD=0.66$). The control group rated the psoriasis vignette with a slightly higher stigma score ($M=2.85$, $SD=0.97$) than the TTM group ($M=2.46$, $SD=0.67$). Finally, the smallest mean difference was found for the control vignette of depression, which received a slightly higher stigma score from the control group (*M*=3.22, *SD*=0.84) in comparison to the TTM subjects' stigmatising attitude rating (*M*=2.97, *SD*=0.97).

Table 2.2 *TTM and control group stigmatising scores across vignettes.*

Vignette		**Mean**	**SD**	**Range**
TTM				
	TTM	2.33	0.61	1.2-4.3
	Control	3.03	1.09	1.7-8.4
Alopecia				
	TTM	2.37	0.68	1.3-5.1
	Control	2.65	0.72	1.4-4.4
CSP				
	TTM	2.41	0.66	1.2-4
	Control	3.24	1.02	1.8-6.3
Psoriasis				
	TTM	2.46	0.67	1.3-4.4
	Control	2.85	0.97	1.6-6
Depression				
	TTM	2.97	0.97	1.4-5.4
	Control	3.22	0.84	1.7-5

Note. TTM = trichotillomania, CSP=skin-picking.

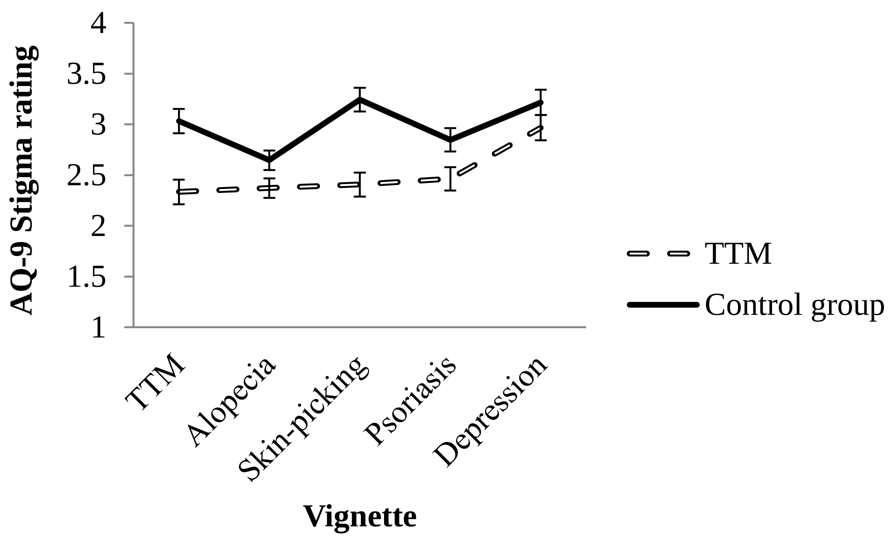


Figure 2.4 Mean stigma ratings (error bars display standard error) displaying the relationship between Group (TTM, Control) and vignette (TTM, alopecia, CSP, psoriasis, depression). *Note*. TTM = trichotillomania. AQ-9= Attribution Questionnaire.

To deconstruct the 2x5 interaction between group (TTM, Control) and vignette (TTM, alopecia, CSP, psoriasis, depression), we conducted 5 independent sample t-tests with bonferonni adjusted *p*-values of .01. The ANOVAs for the perceived controllable conditions of TTM and CSP revealed that there was a significant difference in stigma ratings between the control group and the TTM group. The control group rated the TTM vignette significantly higher on stigma than the TTM group: $F(1,105)=16.66$, $p<.001$. A similar pattern was observed for the skin-picking vignette: $F(1,105)=24.97$, $p<.001$.

Exploratory analyses showed that the control group rated the psoriasis vignette higher on stigma than the TTM group: $F(1,105)=5.6$, $p=.02$. A similar pattern was observed for the alopecia vignette: $F(1,105)=4.1$, $p=.045$. There was no difference between groups on stigma ratings of depression: $F(1,105)=2.02$, $p=.158$.

We further investigated the TTM participant group by testing hypothesis 2 which examined differences in stigmatising attitude for each vignette. We predicted that stigma scores would be similar across vignettes. A one way repeated measures ANOVA revealed a main effect of vignette: $F(4,208)=16.6$, $p<.001$. The significance was due to the TTM group rating the depression vignette significantly higher in stigma than the other 4 vignettes (all $p<.001$). The TTM group attributed higher stigma ratings to the non-physical condition of depression, rejecting hypothesis 2. Data are presented in Figure 2.5.

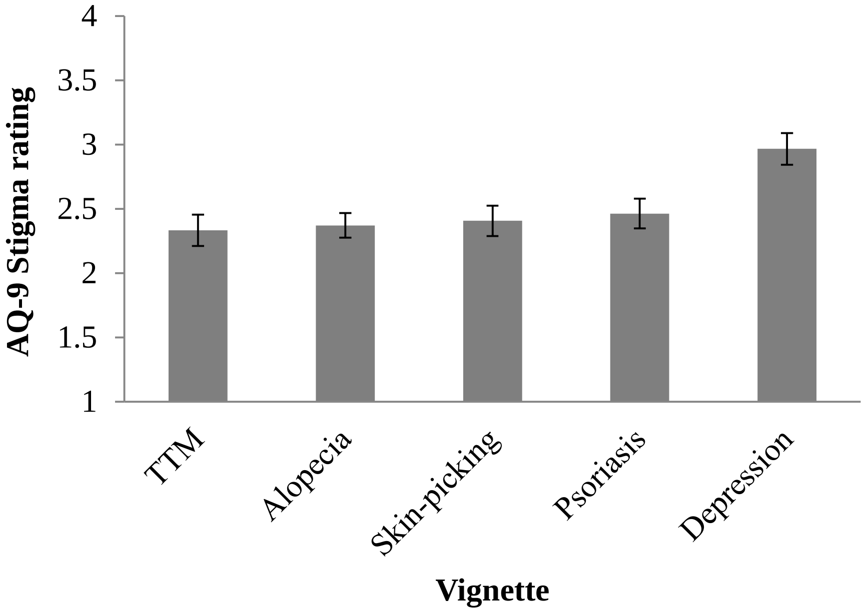


Figure 2.5 Mean stigma ratings (error bars display standard error) displaying mean stigma scores towards vignette (TTM, alopecia, CSP, psoriasis, depression) in the TTM group. *Note*. TTM = trichotillomania. AQ= Attribution Questionnaire.

For hypothesis 3, "The control group will score the "perceived controllable" conditions of TTM and CSP higher on stigma, than the perceived uncontrollable conditions (alopecia and psoriasis)", we carried out a one way repeated measures ANOVA to investigate any differences in stigma ratings in the control group. There was a main effect of vignette in the control group: $F(1,52)=8.348$, $p<0.001$. The significance was due to several differences in stigmatising scores. Skin-picking received higher stigma ratings than psoriasis ($p=.007$) and alopecia ($p<.001$). TTM had higher stigma ratings than alopecia ($p<.001$). Depression was rated higher in stigma than psoriasis $p<.001$. The control group did attribute higher stigma scores to the perceived controllable conditions of TTM and skin-picking, compared to alopecia and psoriasis, supporting hypothesis 3. Data are presented in Figure 2.6.

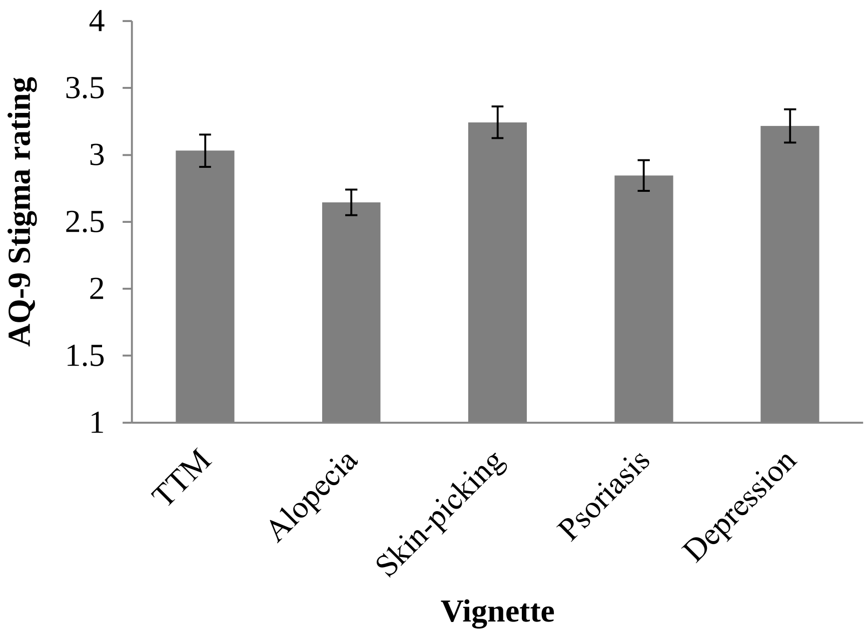


Figure 2.6 Mean stigma ratings (error bars display standard error) displaying mean stigma scores towards vignette (TTM, alopecia, CSP, psoriasis, depression) in the control group. *Note*. TTM = trichotillomania. AQ= Attribution Questionnaire.

Overall, the results for stigmatising attitude show that the control group rated protagonists portraying perceived controllable conditions higher in stigmatising attitudes, relative to their perceived uncontrollable counterparts. Stigma scores did not differ between groups for the three “perceived controllable” conditions of alopecia, psoriasis, and depression. The TTM group assigned depression (the least “physical” condition) significantly higher levels of stigma than the other 4 vignettes.

2.2.3 Discussion

This vignette study investigated higher-level cognitive views, specifically stigmatising attitudes, towards TTM (and CSP) relative to matched hair-loss and skin-lesion vignettes in a TTM and control group. Our results show that there are clear differences in attitudinal mechanisms of stigmatising attitudes between TTM and control group individuals. First, the results of our between group comparison showed that TTM and CSP are rated higher in stigmatising attitude by the normal population than by people with TTM. This indicates that lack of familiarity of having a BFRB (i.e., our control group) is related to higher stigma ratings towards while familiarity of having a BFRB (our TTM group) prompted lower stigma ratings. Duke et al. (2009) suggests that BFRBs are often viewed as controllable. This is consistent with Ricketts et al. (2012) who showed that participants without TTM rated hair-pulling protagonists lower in social rejection and negative social evaluation when they had a higher familiarity with TTM as measured by the Familiarity with TTM Questionnaire (Woods et al., 1999).

We then looked at within groups comparisons to see if certain vignettes received higher or lower stigma ratings. TTM participants rated the 4 conditions (TTM, alopecia, CSP, psoriasis) with observable physical symptoms equally demonstrating no effect of controllability across these 4 vignettes in the TTM sample. While TTM and CSP might be interpreted as being controllable conditions by the public, the role of familiarity with TTM experienced by our TTM group may have lowered their stigma ratings of conditions that others may perceive as controllable. We included a control vignette portraying a depression (a condition with no observable physical symptoms). Contrary to our prediction that TTMs would show similar stigma ratings across all 5 vignettes, differences in stigma ratings were revealed when depression ratings were observed. The depression vignette received significantly higher ratings of stigma from the TTM group relative to the other 4 conditions. In terms of attribution theory, Goldstein and Rosselli (2003) showed that depression was understood to be caused by several factors (biological, psychological, environmental) and that participants associated the psychological model with more blame, social distance, and stigma. Whilst people with TTM live daily with urges to pull their hair and sometimes obvious physical symptoms, it is possible that a more internalised condition like depression is viewed as something that one should be able to get help for due to the knowledge and treatments available.

We then examined the stigmatising attitudes of the control group towards each vignette. In line with our predictions, the control group rated the perceived controllable conditions of TTM and CSP significantly higher in stigma than the matched perceived uncontrollable conditions of alopecia and psoriasis. These findings reflect a wealth of literature in the larger field of mental health where behaviours that are viewed as being controllable receive more stigma than conditions viewed as uncontrollable (Botha & Dozois, 2015; Boysen & Vogel, 2008; Corrigan, 2003). These results are also in line with Marcks et al. (2005) who showed that disclosure of TTM as a cause of hair-loss resulted in negative peer perceptions and social rejection. It is clear from these findings that it is not the physical observable symptoms that drive stigma ratings in a control group, but the underlying cause of the symptoms that is provided to participants. Further, the control group rated depression significantly higher on stigma than psoriasis. One explanation for this is that physical conditions are usually those that are perceived as least controllable (e.g., Weiner et al., 1988) and given the severity of symptoms illustrated in our psoriasis vignette, this protagonist may have been viewed as much less at fault than the protagonist with depression.

Moving beyond the themes of stigma and perceived controllability, this study raises several implications for the field of TTM. Particularly, our study highlights the need for more education and awareness of TTM (and BFRBs) and the implications extend beyond that of the general public. Marcks, Wetterneck and Woods (2006) investigated healthcare providers' knowledge of TTM by surveying psychologists (*N*=39) and physicians (*N*=28). (It is important to note that at the time of the study, TTM was classified under the DSM-IV as an impulse control disorder). When the sample data were explored (*N*=67), 63% of healthcare providers understood that TTM provides gratification and 70% understood that tension precedes hair-pulling episodes to merit a diagnosis. However, in terms of classification, 54% of healthcare providers believed that TTM was a subtype of OCD with

28% believing that intrusive thoughts (characteristic of OCD) were related to hair-pulling behaviours. Intrusive thoughts are not typically characteristic of TTM and at the time of this study, TTM was classified as an impulse control disorder (DSM-IV-TR, 2000), not a subtype of OCD as the majority of healthcare providers believed. Given the rising number of people coming forward for treatment, awareness and education of BFRBs is not only relevant to the general public, but also expands to healthcare providers who can make a difference in the treatment experience of those with TTM.

Future research

Thus far, this chapter has considered the stigmatising attitudes and belief of others towards those with TTM. Self-stigma has negative implications for self-esteem, identity and self-worth (Chan & Mak, 2015; Corrigan, 2004; Corrigan, et al., 2010; Corrigan et al., 2013). It can therefore be argued that self-stigma may strongly facilitate the experience of shame in individuals.

2.3. Shame

2.3.1 Introduction to shame

Experiment 2 aims to move away from higher-level attitude attributions of TTM and focus specifically on lower-level cognitions in a TTM sample compared with a control group. Leading on from our review of affective correlates in Chapter 1, we chose to explore internalised shame in a TTM sample by investigating attentional biases towards shame-related words in an emotional Stroop task.

Shame is often compared to, and confused with, guilt, but differs in many ways. Whilst guilt can have many adaptive functions (e.g., "I did something bad, it was a bad thing to do, I won't do it again") in that it is the negative judgement of a behaviour, shame differs from guilt. Shame does not just result in the negative evaluation of one's behaviour; it results in the negative evaluation of oneself, one's identity, and is therefore, detrimental

(Covert, Tangney, Maddux, & Heleno, 2003; Tangney, Stuewig, & Mashek, 2007). Shame is associated with functional impairment, low self-efficacy, and poor life outcomes (Rockenbergera & Brauchle, 2011). It has also been shown to be a barrier to treatment: Hook and Andrews (2005) found that depressed out-patients would often not provide all the relevant information required for effective treatment and they explained this as resulting from feelings of shame. In a study of female patients with anorexia (*N*=30), bulimia (*N*=30), anxiety (*N*=30), and depression (*N*=30) (Grabhorn, Stenner, Stangier & Kaufhold, 2006), internalised shame was shown to be significantly higher in the eating disorder groups compared to the anxiety and depression groups. This was interpreted as being attributed to control over feelings of hunger and how one feels about one's body. Keen, George, Scragg and Peters (2017) examined the role of shame and how it is related to depression in schizophrenia by comparing schizophrenia (*N*=20) with control groups with depression (*N*=20), and rheumatoid arthritis (*N*=20). The depression and schizophrenia groups showed higher levels of shame than the group with rheumatoid arthritis. Further, in the schizophrenia group, higher levels of depression were associated with feelings of being shamed by others and this was not demonstrated in the control groups. The studies above highlight the link between shame and perceived stigma being prevalent in several groups with mental health conditions.

2.3.2 The potential role of shame in TTM

Currently, most treatment options for TTM are built around cognitive-behavioural paradigms for both adults (Dougherty, Loh, Jenike, & Keuthen, 2006; Mouton-Odum, Keuthen, Wagener, Stanley, 2006) and children (Flessner, 2011; Franklin, Edson, Ledley, & Cahill, 2011). This is based on the premise that hair-pulling behaviours and cognitions may be functionally related (i.e., experience of a particular belief/thought process may prompt and/or prolong hair-pulling episodes and therefore, hair-pulling behaviour as a whole). Therefore, cognitive-behavioural models focus on targeting such cognitions.

Townsley-Stemberger, Thomas, Mansueto and Carter (2000) investigated the negative effects of TTM by interviewing a clinical sample (*N*=67) who had sought treatment for their hair-pulling disorder. Results revealed daily distress, social impairments connected to pulling, social anxiety, feelings of unattractiveness, depression, and low self-esteem. Secrecy surrounding one's hair-pulling was also strongly linked to irritability.

Experiential avoidance is characterised by individuals experiencing negative unwanted thoughts, being reluctant to experience them, and trying to control and/ or escape from them (Kashdan, Barrios, Forsyth & Steger, 2006). Due to the affective correlates frequently identified in individuals with TTM, Norberg, Wetterneck, Woods and Conelea (2007) examined the role of experiential avoidance of unpleasant emotions, namely shame related to hair-pulling, beliefs about one's appearance, and fear of being negatively evaluated, with regards to one's hair-pulling in a sample of 404 people with TTM. When controlling for experiential avoidance as measured by the AAQ (Bond, 2003), this appeared to serve as a moderator for dysfunctional thinking: shame related to hair-pulling, beliefs about one's appearance, and fear of being negatively evaluated with regards to one's hair-pulling all decreased. Correlational analyses revealed that all variables were positively correlated with hair-pulling severity indicating that dysfunctional beliefs and severe hair-pulling may be functionally related.

As we can see, shame may have a greater role in TTM than is currently fully known. To date, only a handful of studies have looked at the role of shame in TTM and given the levels of affective correlates that enshroud TTM, it is worthy of investigation. The apprehension to disclose one's hair-pulling condition may be comparable to the secrecy surrounding eating disorders prior to the growth of literature in the field that prompted awareness of, and disclosure of, one's disorder (Swedo & Rapport, 1991; Townsley-Stemberger et al., 2000). Penzel (2003) and Casati, Toner and Yu (2000) suggested that shame experienced by hair-pullers is largely predictive of the decision to not disclose their hair-pulling to others. Townsley-Stemberger et al. (2000) reported that almost half of their sample diagnosed with TTM (N=67) kept their hair-pulling a secret. In a sample of 47 individuals with TTM, du Toit et al. (2001) found that 89.4% experienced shame, 31.9% had kept their hair-pulling a secret from close friends, and 17% had kept it a secret from their family.

Nobel (2012) compared a hair-pulling sample (*N*=114) with a control group (*N*=286) on the Experience of Shame Scale (EES; Andrews et al., 2002). The EES (Cronbach's alpha = .92) measures total shame and three dimensions of shame: "characterological" which refers to shame about aspects of the self; "behavioural" which is shame about actions and behaviours; and "body" shame that relates to shame about physical characteristics of oneself. The TTM group exhibited significantly higher levels of general shame relative to the control group. Further, characterological, behavioural, and body shame were also significantly higher in the TTM group. It may be speculated that due to the hair-pulling behaviours exhibited in TTM, the experience of shame does not necessarily drive the behaviour, but rather, may be an emotional response to the hair-pulling behaviour (Casati, Toner & Yu, 2000; Noble, 2012). However, no research so far has tested whether shame could be an emotional trigger for BFRBs (Weingarden & Renshaw, 2015). In line with this, affective states were investigated in a study of an Italian sample of individuals with TTM (Bottesi et al., 2016) using an online survey. Participants reported that feelings of shame, sadness and frustration increased from pre to post hair-pulling episode. Singh at al. (2016) investigated the role of shame in participants (*N*=542) reporting obsessive-compulsive and related disorders, specifically, OCD (*N*=152), TTM (*N*=248), and CSP (*N*=142). The results showed that shame was a predictor of quality of life in all obsessive-compulsive and related disorders groups (OCD, TTM, CSP). Further, they investigated characterological, behavioural and symptom-based shame in TTM and CSP participants. All subtypes of shame were significantly positively correlated with quality of life in the CSP group, and in the TTM group, this pattern was found for both characterological and body shame but not symptom-based shame. Clearly, the role of shame in TTM is one that is worthy of further investigation in TTM.

2.3.3 The emotional Stroop task

In a typical Stroop task (Stroop, 1935) that investigates selective attention, participants are asked to identify the ink colour of a letter string (typically, the name of a colour) whilst disregarding the meaning of the word. Participants demonstrate a reaction time latency when naming the ink colour of the written word. Literature has consistently shown that when the meaning of a word and its ink colour are congruent (e.g., green in green ink, red in red ink), response times are quicker than when the meaning of the word and its ink colours are incongruent (e.g., green in red ink, red in blue ink). Longer response latencies are attributed to colour-word interference (Stroop, 1935).

The Stroop task has been modified to investigate attentional bias towards emotional words (i.e., those carrying stronger arousal and valence ratings). First, in samples of populations with no diagnosed conditions, emotional words generally produce greater interference, and therefore, slower reaction times, in naming the ink colour of words (Dresler et al., 2009; Mckenna & Sharma, 1995; Watts, McKenna, Sharrock, & Trezise, 1986).

The emotional Stroop has been further modified by taking individual differences into account and comparing subgroups in attentional processing of stimuli. One of the earliest emotional Stroop studies (Mathews & MacLeod, 1985) was a modified Stroop task that included words with high emotional valence (e.g., money, freedom). Participants consisted of two groups: 24 participants with diagnosed anxiety and a control group of 24 participants reporting no emotional difficulties due to anxiety. In the task, all participants were presented with two word lists: 24 threat words (12 physical threat, 12 social threat) and 24 matched control words. The results firstly revealed a main effect of word type where anxious participants were slower to identify the ink colour of all the words, irrespective of word type. Secondly, a group by word type interaction was shown, where responses to identify the ink colour of social and physical threat words were slower in participants with a diagnosis of clinical anxiety. Mathews and MacLeod explained these findings in the context of an attentional bias to threat where the current emotional state of the anxious participants resulted in anxiety words being more capable of capturing their attention. Further, Dresler et al. (2009) investigated whether valence (positive or negative) or arousal level was more likely to provoke emotional attentional bias, whilst state (temporary) and trait (consistent) anxiety were monitored. Negative and positive words similar in arousal level were used. Results indicated that emotional words elicited longer reaction times than neutral words, but that there was no difference for valence (positive and negative emotional words). Regarding anxiety, state anxiety affected emotional interference, but trait anxiety did not. Finally, emotional words were recalled and recognised significantly more than neutral words.

The literature shows that people demonstrate a general bias towards threat when they have no diagnosed conditions (Dresler et al., 2009; Mckenna & Sharma, 1995; Watts, McKenna, Sharrock, & Trezise, 1986) and this bias is even more robust in individuals with anxiety compared to non-anxious individuals (Fox, Russo & Dutton, 2006; Koster, Crombez, Verschuere, Van Damme, & Wierserna, 2006; Mathews, A. & MacLeod, 1985; Ouimet, Gawronski & Dozois, 2009). As the emotional Stroop literature has expanded to investigate other diagnosed conditions, studies have shown that participants are slowed when presented with a words pertaining to addictions (Cane et al., 2009; Cox et al., 2006; Fadardi & Cox, 2009; Field, Munafo & Franken; 2009; Waters et al., 2003) and depression (Kerr, Scott & Phillips, 2005; Mitterschiffthaler et al., 2008).

Chapter 1 introduced TTM in the context of a behavioural addiction. The addiction related Stroop task has been used to investigate attentional biases in several addictive behaviours, namely smoking and alcohol. Fadardi and Cox (2009) used a computerised Alcohol-Stroop test to investigate the effects of alcohol on social (*N*=40), hazardous (*N*=89), and harmful (*N*=92) drinkers' attention. Hazardous and harmful drinkers demonstrated slower reaction times than social drinkers in naming the ink colour of alcohol-related words indicating that overindulgence in alcohol is related to attentional bias towards alcohol-related words. In a similar study on smoking behaviours, Cane et al. (2009) carried out an addiction-related Stroop task with 3 groups of participants: current smokers (*N*=21); those who had abstained for 24 hours and were trying to quit (*N*=21); and non-smokers (*N*=22). Current smokers and those who were trying to quit demonstrated similar attentional biases demonstrated by slower response times to smoking-related words. A second modified Stoop study was then conducted for marijuana smokers (*N*=17) compared with non-marijuana smokers (*N*=15) using marijuana-related words. A similar pattern of results was found as in study 1: marijuana-related words elicited slower response times in marijuana smokers than non-marijuana smokers.

The studies above strongly indicate that current drinking and smoking status can predict attentional biases (as demonstrated by slower response times) towards substance-related stimuli. However, might the relationship between attentional biases and substance use be bidirectional (i.e., could attentional biases *also* predict subsequent substance-use behaviours)? In a sample of 158 smokers, Waters et al. (2003) investigated whether attentional biases towards smoking-related stimuli might not only be a result of current smoking status, but also predictive of future smoking behaviours. An attentional bias to tobacco cues as demonstrated by slowed reaction times and more errors was found to be a predictor of relapse and subsequent smoking in participants. Field, Munafo and Franken (2009) also explored the potential bi-directional relationship between tobacco cues and attentional biases by carrying out a meta-analysis investigating associations of self-report cravings in substance abuse with attentional bias indicators. The results showed that although the correlation was weak, attentional biases and cravings were related.

2.3.4 How shame can be investigated in an emotional Stroop task

Before investigating shame in individuals with TTM, it is prudent to look at how the emotional Stroop task has been used to examine shame in other mental health conditions. Sippel and Marshall (2011) employed an emotional Stroop paradigm to investigate the processing of shame in individuals with posttraumatic stress disorder (PTSD) (*N*=47) using 12 shame words and 12 control words (see Table 2.3). The results revealed that participants with severe PTSD symptoms exhibited facilitated, faster responses to shame-related words in the emotional Stroop task.

Table 2.3. *Shame and neutral emotional Stroop stimuli (Sippel & Marshall, 2011).*

Shame-related words	Neutral words
belittle	brands
contempt	caller
exposed	closet
hide	dental
humiliated	fixing
incompetent	laying
insult	plates
mock	puzzle
pathetic	raises
reject	rental
scorn	sticks
shame	trucks

More generally, Sippel and Marshall's (2011) findings highlight the importance of the literature surrounding cognitive mechanisms underlying psychological conditions. Individuals prone to hypervigilance of socially threatening cues, for example, rejection and judgement (Chetomb, Novaco, Hamada, Gross & Smith, 1997) can create maladaptive self-schemas that consequently maintain the disorder. Paradigms investigating and demonstrating these biases (e.g., towards shame-related stimuli) may serve as early indicators of subsequent maintenance and/ or elevation of mental health conditions.

2.4 Experiment 2. An investigation of attentional bias towards shame-related words in TTM using an emotional Stroop task.

Given the evidence reviewed above, it is evident that shame is worthy of further investigation in individuals with TTM symptomology. It is important to investigate the attentional processing of shame-related stimuli given the endorsement of shame in individuals with TTM (Nobel, 2012; Singh et al., 2015; Weingarden & Renshaw, 2015). A TTM sample may interpret shame-related words as self-descriptive, therefore, affecting response times to name the ink colour relative to matched words (neutral, positive). Given the high frequency of shame exhibited in TTM, this study compared people with TTM and a control group without TTM symptomology on attentional processing of shame-related words in a modified emotional Stroop task. We predicted a group (TTM, control group) by word type (shame, neutral, positive) interaction: that the TTM group would have different response times to identify the ink colour of shame-related words, relative to the control group.

2.4.1 Method

2.4.1.1 Participants

TTM participants were those who self-reported symptoms of hair-pulling and were considered eligible if they scored more than 10 on the Massachusetts General Hospital Hair Pulling Scale (MGH-HS). Control participants were females who reported no such hair-pulling urges and scored 0 on the MGH-HS. Of the 132 participants who completed the study, 21 individuals (including 2 males) with scores of 1-9 on the MGH-HS were removed prior to analysis as their hair-pulling score was under the score of 10. Eighteen individuals who qualified for the control group were removed from the analysis as they were male. After this one participant was excluded from analysis as they gave a correct response on less than 65% of trials. After participant exclusion, our final sample consisted of 93 female participants: 44 TTM participants (mean age=24.5 years, SD=7.1, mean MGH-HS=17.2, SD=3.9) and 49 female control participants (mean age=22.5 years, SD=5.3 years, MGH-HPS=0). The TTM group and the control group did not differ significantly in age: $t(79.081)=1.5$, $p=.149$ (df adjusted as Levine's test for equality of variances was violated). All participants were native English speakers. The TTM sample participated voluntarily (due to location). Control participants who were students received one course credit for their participation and those who were not students participated voluntarily. Participant data is presented in Table 2.4.

Table 2.4. *Participant information.*

	Age			**MGH-HS**		
	M	**SD**	**Range**	**M**	**SD**	**Range**
Group						
TTM (*N*=44)	24.5	7.1	16-49	17.2	3.9	10-26
Control (*N*=49)	22.5	5.3	18-44	0	0	-

Note. TTM = trichotillomania; MGH-HS = Massachusetts Hospital Hair-Pulling Scale

2.4.1.2 Materials and stimuli

Questionnaires

Hair-pulling severity. The severity of hair pulling was assessed via the Massachusetts General Hospital Hair Pulling Scale (MGH-HS; Keuthen et al., 1995) which assesses urges to pull, actual hair pulling, and the consequences of hair pulling over the past week. The MGH-HS is presented in Appendix A.

Word selection. A pool of shame-related words was sourced from Sippel and Marshall (2011) who investigated bias to shame-related words in their study on shame processing bias in people with PTSD (Table 2.3 presents these items). To increase the size of the stimulus set, we added words to this list that were considered to convey shame. This list of words was then presented to participants (*N*=17) in a norming study to obtain ratings of the "most shameful" words that would be used in Experiment 2. Participants were asked to rate each word (see Appendix D for list of shame-related words) on a Likert scale of 1-10 where 1=not at all shameful and 10=extremely shameful. Mean scores across participants were calculated for each word, and the top 19 shame-related words were chosen for use in our Stroop study.

Word matching. The modified Stroop task comprised 3 word types (19 words per category): shame words (*blame, failure*); neutral words (*bread, feature*); and positive words (*bride, freedom*). Example stimuli are presented in Table 2.5 and the full stimulus list is presented in Appendix E.

Words across categories were matched for word length (number of letters). Word frequencies were obtained from the British National Corpus (BNC), a database comprising 90 million written word tokens (http://www.natcorp.ox.ac.uk/). In addition to word length and frequency, several other lexical ratings were obtained. These included a word's imageability (the ease of evoking a mental image), its age of acquisition (AoA; how early in life it is acquired), and its emotionality, assessed by its arousal (a measure of internal activation) and its valence (a measure of value or worth). Ratings were obtained from multiple sources as follows: imageability (Bird, Franklin, & Howard, 2001; Clark & Pavio, 2004; Cortese & Fugett, 2004; Morrison, Chappell, & Ellis, 1997; Stadthagen-Gonzalez & Davis, 2006; Wilson, 1988); AoA (Bird et al., 2001; Clark & Pavio, 2004; Morrison et al., 1997; Stadthagen-Gonzalez & Davis, 2006; Wilson, 1988); arousal and valence (Bradley & Lang, 1999). These norms are widely used and cited in language research studies and the lexical ratings obtained are from both British and North American samples. Norms obtained from British institutions are: Bird et al. (2001); Morrison et al. (1997); Stadthagen-Gonzalez and Davis, (2006); and Wilson (1988). Norms sampled from North American institutions: are Bradley and Lang (1999); Clark and Pavio (2004); and Cortese and Fugett (2004). This study and the others in this thesis sampled mainly British and North American participants, making these norms highly applicable across our samples.

Table 2.5. *Example emotional Stroop stimuli*

Word type and examples	Shame	Neutral	Positive
	blame	bread	bride
	failure	feature	freedom
	rejected	register	exciting
	worthless	telescope	honeymoon
Length	8.67	8.5	8.4
Frequency	11.2	10.1	9.3
Imageability	3.8	4.8	5.1
AoA	4.5	4.0	4.0
Valence*	2.1	5.3	7.4
Arousal*	5.8	4.2	5.9

**Note*. For both valence and arousal, only 4 words in the shame category had ratings, compared with 11 words in both the neutral category and the positive category. Units of measurement are as follows: Length in number of letters and Frequency in occurrences per million. The remaining variables are expressed in units on the following scales: Imageability from 1 (low) to 7 (high), AoA from 1 (early) to 7 (late), Arousal from 1 (low) to 9 (high), and Valence from 1 (negative) to 9 (positive).

Emotional Stroop Paradigm. The emotional Stroop paradigm utilised a remote online experiment (https://experiments.psy.gla.ac.uk//[2])**.** Each word was presented 3 times, 19 words per category (3x19 presented 3 times). There were 3 blocks with 57 stimulus presentations each. Words were matched with one of 4 colours: blue, green, red or yellow. Colours were assigned so that no one word (e.g., blame) was allocated the same colour more than once, meaning that for each presentation of a particular stimulus word, the ink colour was different. Participants were presented with a stimulus word on screen displayed in blue, green, red or yellow colouring. A keyboard was required to make the responses: C=blue, V=yellow, N=green, or M=red. The Stroop was presented on a grey background as shown in Table 2.6 and Figure 2.7.

[2] https://experiments.psy.gla.ac.uk// is an online interface built and maintained by webmaster Mr Marc Becirspahic. It uses the plugin Flash within the browser and is as accurate as any other software running on its own (outside the browser). This is the main interface used for online studies run by The School of Psychology.

Table 2.6. *Presentation of Stroop task*

Trial 1: 1000 millisecond blank screen
1 second fixation
500 milliseconds blank screen
Stimulus appears e.g. **blame**
Stimulus remains on screen until response is made
Trial 2: 1000 ms blank screen

Figure 2.7. Presentation of Stroop task

2.4.1.3 Procedure

Participants were tested individually via a remote online experiment and received onscreen instructions They gave their informed consent and gained permission to proceed with the experiment by verifying that they were a native English speaker. They were informed that the study required them to complete 1 questionnaire assessing hair-pulling behaviours and then to complete an emotional Stroop task requiring them to indicate the ink colour in which a word was displayed on screen.

First, participants were presented with the Massachusetts General Hospital Hair-pulling Scale (MGH-HS). All 7 items on the MGH-HS were presented on the same page so that previous answers could be viewed using the scrollbar. Once participants were satisfied that they had answered the 7 questions on the MGH-HS accurately, they pressed the "submit" option to proceed to the behavioural emotional Stroop task titled "colour naming task".

For the emotional Stroop task, participants were initially presented with 16 practice items (16 words written in different ink colour) to become accustomed to the task. Responses were made using the left middle and index forefinger on the C and V keys of the keyboard and by using the right forefinger and middle finger on the N and M keys. Participants were then presented with the 171 experimental items, with 2 programmed breaks.

Each trial consisted of the following: A blank black screen was presented for 1000 ms. A fixation cross (+) then appeared in the centre of the screen for 1000 ms, replaced by another blank screen for 500 ms. A word was then presented centrally until the participant responded by pressing either: C=blue, V=yellow, N=green, or M=red on the keyboard (See Figure 2.7). Experimental trials were presented in a different random order for each participant.

On completion of the experiment, all participants were debriefed as to the purpose of the experiment and invited to ask questions.

2.4.1.4 Design and analyses

A 2 x 3 mixed design was employed with independent variables of group (TTM, control group) as the between subjects factor and word type (shame, neutral, positive) as the within subjects factor. The dependent variable was the reaction time in milliseconds to identify the ink colour of the stimulus word.

2.4.2 Results

Incorrect responses (7.34%) were removed prior to analysis. We then removed trials that were too quick (<250 ms) or too slow (>1500 ms) and also removed trials that were considered outliers per participant (RTs +/-2 SDs) (9.19%). Total data loss accounted for 16.53% of the data.

Reaction time analysis

Table 2.7. *Mean RTs (and standard deviations) in ms to identify the ink colour of stimulus word as a function of Group (TTM, Control).*

	TTM	Control
Word Type	Mean *(SD)*	Mean *(SD)*
Shame	900 (132)	848 (138)
Neutral	891 (128)	852 (132)
Positive	892 (135)	851 (140)

Note. TTM = Trichotillomania.

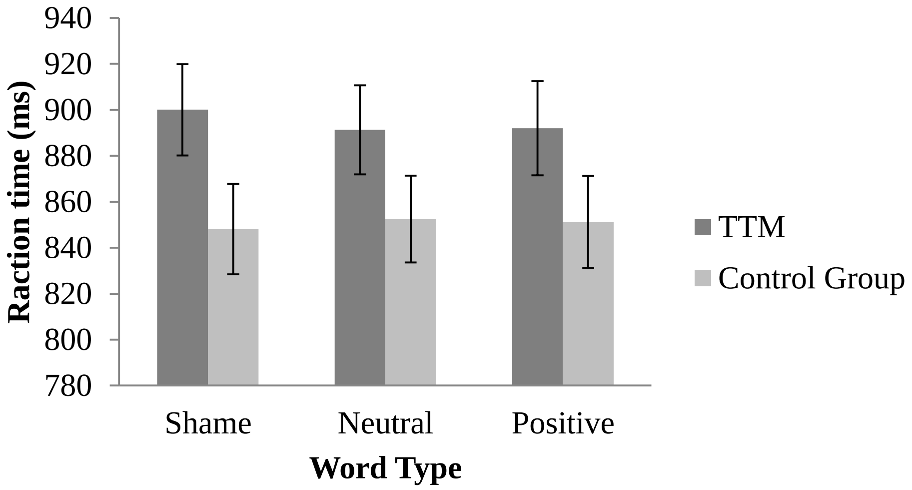


Figure 2.8. Mean RTs in ms (error bars display standard error) displaying the relationship between Group (TTM, Control) and Word Type (Shame, Neutral, Positive). *Note*. TTM = Trichotillomania.

Table 2.7 and Figure 2.8 present the mean reaction times in ms. To compare the RTs for the 2 groups for each word type, we conducted a 2 (TTM, Control) x 3 (Shame, Neutral, Positive) mixed design ANOVA to explore reaction times (in ms) to identify the ink colour of the word.

There was no main effect of group (TTM vs Control), $F(1,91)=2.58$, $p=.112$. The TTM group (M=894 ms, SD= 132 ms) was not significantly slower than the Control group (M=851 ms, SD=137 ms) to identify the ink colour across all word types. There was also no main effect of word type (Shame vs Neutral vs Positive), $F<1$. Across all participants, reaction times to identify the ink colour of shame words (*M*=873 ms, *SD*= 137 ms), neutral words (*M*=871 ms, *SD*= 131 ms), and positive words (*M*=871 ms, *SD*=139 ms) were not significantly different. Finally, when exploring the 2-way interaction between group and word type, this was non-significant (F<1). See Table 2.7 and Figure 2.8.

Percentage accuracy analysis

Table 2.8. *Mean percentage accuracy (and standard deviations) in % to correctly identify the ink colour of stimulus word as a function of Group (TTM, Control)*

	TTM		Control	
Word Type	Mean	SD	Mean	*SD*
Shame	93.42	7.11	90.91	8.23
Neutral	94.14	7.74	91.34	7.33
Positive	94.18	7.13	90.33	8.3

Note. TTM = Trichotillomania.

Table 2.8 presents the mean percentage accuracy data. To compare the accuracy for the 2 groups for each word type, we conducted a 2 (TTM, Control) x 3 (Shame, Neutral, Positive) mixed design ANOVA to percentage accuracy (in %) to identify the ink colour of the word.

The main effect of group (TTM vs Control) was significant $F(1,91)=4.166$, $p=.044$. The TTM group (*M*=93.91%, *SD*=7.33%) had higher accuracy rates across all words types compared to the Control group (*M*=90.86%, *SD*=7.95%). The additional main effect of word type (shame, neutral, Positive) was non-significant, F<1. Across all participants, percentage accuracy did not differ when identifying the ink colour of shame words (*M*=92.1, *SD*=7.78%), neutral words (*M*=92.15%, *SD*= 7.96%), and positive words (*M*=92.66%, *SD*=7.62%). Finally, the 2-way interaction between group and word type was non-significant: $F(1.801,163.929)=1.093$, $p=.333$ (df adjusted for Greenhouse Geisser). Individuals with TTM did not respond differentially to words relative to the control group.

2.4.3 Discussion

To our knowledge, this is the first emotional Stroop study that has investigated attentional bias towards shame-related words in a TTM sample. Our results did not support our hypothesis that individuals with the hair-pulling condition would show differential responses towards shame-related words, relative to a control group. Not only was there no significant difference in reaction times to identify the ink colour of a word presented between groups, this was also the case for all word types (shame, neutral, positive). While literature has shown that shame is experienced in individuals with TTM (du Toit et al., 2001; Nobel 2012; Singh at al., 2016; Weingarden & Renshaw, 2015), our results indicate that this endorsement of shame is not reflected in the results of our modified Stroop task investigating lower-level biases towards shame. Our TTM group and control group demonstrated similar reaction time latencies across all word types (shame, neutral, positive) indicating that shame-related words were not more salient to those with the hair-pulling condition. We did find a main effect of group when we examined percentage accuracy. The TTM had significantly higher accuracy in correctly identifying the ink colour of a word (regardless of word type) compared to the control group. On the surface, this does not appear to be theoretically informative; however, one can speculate that taking part in a study about one's mental health condition may prompt individuals to engage more.

The non-significant group (TTM, control) by word type (shame, neutral, positive) interaction illustrates that our TTM sample did not demonstrate an attentional bias to shame. One potential explanation for our pattern of results is that the characteristics of our self-reported TTM sample did not experience shame. The heterogeneity of our TTM sample (MGH-HS ranging from 10-26) shows that there was great variation within the sample and therefore, endorsement of shame may not have been strong enough to elicit a group effect when the group was considered as a whole. Literature in the field of TTM has shown that reports of negative affective correlates are rarely experienced by 100% of a TTM sample (for a review, see Woods et al., 2006). In spite of our robust participant recruitment where we only included individuals with a score of 10 and above in the MGH-HS (Keuthen et al., 1995) we must consider that not all hair-pullers had visible hair-loss. It would seem reasonable to conclude that a hair-puller with no visible hair-pulling may experience less shame than one whose hair-pulling must be concealed. Future studies employing attentional paradigms to investigate shame should also include a measure of shame to further explore experience of shame and its relationship to performance on attentional paradigms.

Limitations and future research

The current study has identified several areas that can be pursued. In Experiment 2, we classified shame-related words as *any* words conveying shame. Nobel (2012) explored subtypes of shame by investigating the role of total shame and also three dimensions of shame known as “characterological” (shame about aspects of oneself), “behavioural” (shame about one’s actions and behaviours), and “body” shame (relating to shame about one’s own physical characteristics). Nobel found that significantly higher levels of total, characterological, behavioural, and body shame were demonstrated by the TTM group relative to the control group. While Nobel’s (2012) study did not employ an attentional bias task, and therefore, our paradigm is not directly comparable, we must consider the use of other shame-related word types. The emotional Stroop task is a paradigm that explores lower-level cognition and this paradigm may be sensitive to specific word stimuli pertaining to subtypes of shame. Our emotional Stroop paradigm may have required more specific types of shame-related words (characterological, symptom-based, body shame). In TTM, the roles of shame subtypes are worthy of exploration. With regards to symptom-based shame, the actual act of hair-pulling in TTM (pulling, possible eating of hair, associated rituals such as playing with the hair) (Larson, 2007) is difficult to control and not just a simple habit. The role of body shame in TTM could be understood as being related to associated hair-loss and associated feelings of unattractiveness. A clinical sample interviewed by Townsley-Stemberger et al. (2000) reported that they experienced daily distress, social impairments connected to pulling, social anxiety, feelings of unattractiveness, depression, and low self-esteem. Further, secrecy surrounding one's TTM has been shown to relate to shame experienced by hair-pullers (Casati, Toner & Yu, 2000; Penzel, 2003; Townsley-Stemberger et al., 2000).

2.5 Chapter summary and conclusions

This chapter explored stigmatising attitudes towards TTM (and other conditions) and attentional biases towards shame-related words in TTM. Experiment 1's results demonstrated that when presented with protagonists portraying similar observable physical characteristics but different underlying causes, the normal population show significantly higher stigma towards those whose hair-loss and skin-picking is perceived as controllable. The implications of this study for the field of TTM are vast and highlight the need for more education and awareness of, BFRBs. As reviewed in Chapter 1, negative affective correlates are frequently experienced by people with TTM. Our study in Experiment 2 found no evidence that the affective correlate of shame is reflected by response latencies in a modified Stroop paradigm using shame-related words.

While this chapter investigated the affective correlates of TTM by exploring stigmatising attitudes towards, and the role of shame in, TTM, the following chapters will depart from this and focus specifically on attentional biases towards hair-related stimuli in individuals with TTM.

Chapter Three

Attentional bias to hair-related words

3.1 Introduction

This chapter aims to investigate attentional biases towards hair-related words in a series of experiments using linguistic paradigms. Existing literature addressing attentional bias using language in TTM is scarce and very few studies have looked solely at language in the field of TTM. The aim of this chapter is explore if similar to other psychological disorders, people with TTM will show an attentional bias to stimuli salient to their condition: hair-related words.

3.1.1 Words and emotion

Words can be characterised in terms of the emotional properties they possess. Large-scale rating studies of imageability (e.g., Bird, Franklin, & Howard, 2001; Clark & Pavio, 2004; Cortese & Fugett, 2004; Morrison, Chappell, & Ellis, 1997; Stadthagen-Gonzalez & Davis, 2006; Wilson, 1988); Age of Acquisition (Bird et al., 2001; Clark & Pavio, 2004; Morrison et al., 1997; Stadthagen-Gonzalez & Davis, 2006; Wilson, 1988); and arousal and valence (Bradley & Lang, 1999) have generated vast amounts of data norming the linguistic properties of words. For the purpose of this chapter, we will focus on valence and arousal. Valence and arousal (Bradley & Lang, 1999) refer to the emotional aspects of a word: valence encompasses positivity (attractiveness) and negativity (aversiveness) of a word; while arousal refers to how calm or exciting a word is interpreted to be.

3.1.2 Effect of emotion on language processing

Historically, studies using language have shown that negative linguistic stimuli are processed slowest and positive linguistic stimuli are processed fastest. Section 2.3.3 of this thesis provides a review. This slowing of the processing of negative words has been explained in the context of the evolutionary significance of threat where negative stimuli are detected due to what has been termed an automatic vigilance to threat-related stimuli. In terms of this theoretical perspective, threatening cues within the environment engage one's attention for longer in order to potentially facilitate enhanced processing of the threat (e.g., Larsen, 2004). This enhanced attentional engagement with potential threat stimuli increases the chance of survival when we process threat in this way. Therefore, this is a type of attentional bias that we see in the general population (Kuperman, Estes, Brysbaert & Warriner, 2014). However, the role of emotional and affective properties in word recognition (arousal and valence) may merit more attention than has previously been considered. In a meta-analysis of 1033 lexical stimuli (Larsen, Mercer & Balota, 2006) that were used in 32 studies using an emotional Stroop paradigm, word selection was not always robustly controlled: negative words eliciting slower response times to identify the ink colour were also longer and less frequent. Thus, earlier studies were problematic in that confounds existed such that the negative words used had lower frequency and longer length. This highlights the crucial importance of robustly matching linguistic stimuli in lexical reaction time paradigms.

In more recent and well-controlled work, Kahan and Hely (2008) demonstrated that valence only influenced lexical decision responses when words were low frequency (i.e., low frequency negative words had slower responses than low frequency positive words in a Stroop task). Scott, O'Donnell, Leuthold and Sereno (2009) showed similar slowed responses for low frequency positive and negative words but when words were high frequency, negative words elicited a slower response compared to positive words. Highly arousing words were also shown to be recalled superiorly over neutral words (Dresler, Meriau, Heekeran & van der Meer, 2009), especially when words are taboo, such as "whore" (Mackay, Shafto, Taylor, Marian, Abrams & Dyer, 2004). Evidently, support for the automatic vigilance perspective (in the context of negatively valenced linguistic stimuli) is not as clear as it was initially understood to be, in older literature.

3.1.3 Attentional bias to disorder-related linguistic stimuli

As reviewed in Chapter 1, language methodology has been extended and applied in the processing of linguistic stimuli in populations with psychological disorders. In particular, a wealth of research has focussed on the processing of disorder related stimuli in populations with, for example, anxiety (Dresler et al., 2009; Mathews & MacLeod, 1985), depression (Kerr, Scott & Phillips, 2005; Mitterschiffthaler et al., 2008) and addictions (Cane et al., 2009; Cox et al., 2006; Fadardi & Cox, 2009; Shiffman, Sayette, Paty, Gwaltney & Balabanis, 2003; Waters, Field, Munafo & Franken, 2009). The classification of words as positive or negative reflects general population norms (Bradley & Lang, 1999). However, in particular populations with psychological disorders, these norms may deviate somewhat from those of the general population. For example, using the ANEW ratings (Bradley & Lang, 1999) the word "bottle" that is neutrally valenced (6.1) and medium in arousal (4.47) for the general population but may be considered as more emotional for someone with a substance abuse condition (bottle would draw an association with alcohol). Spider, while negative (3.33) and medium in arousal (5.71) for the general population may be perceived as particularly arousing and negative for someone with a spider phobia.

Typically, the reaction time latencies (e.g., in lexical decision and Stroop studies) of disordered populations are compared with those of a control group. It is important to do so because although it is prudent to look at ratings within a single population, a group comparison approach allows one to explore differences in response latencies between a disordered group and a control group. Within this, between group effects may be identified even when the properties of word groups are not so rigorously controlled within groups. Diifferences between groups in terms of responses latencies will be the main focus. A difference in mean reaction time for disorder-related words would indicate that the attentional processing of these words differs between groups and this may indicate an attentional bias towards disorder-related words in the disordered group.

3.1.4 Language and attentional bias paradigms

The sections above have indicated that language can be used to investigate attentional bias in both the general population and disordered populations. Paradigms using words as stimuli are a means of investigating attentional biases in both healthy and clinical populations. Chapter 2 introduced the reader to the Stroop and reviewed literature on the emotional Stroop task. Whilst the Stroop task (Stroop, 1935) considers the role of *disengagement* from the meaning of a word before making a response, lexical decision tasks allow us to investigate attentional biases to potentially salient stimuli via *engagement* with a word. Developed in the early 1970s (e.g., Rubenstein, Garfield & Millika, 1970; Rubenstein, Lewis & Rubenstein, 1971), the lexical decision task is a paradigm used to investigate semantic characteristics of words. In a lexical decision task, participants are asked to judge if a letter string presented is a word or a pseudoword as quickly as possible, the primary dependent measure being the time taken to reach a decision and respond via keypress (Balota, Cortese, Sergent-Marshalll, Speieler & Yap, 2004). Upon viewing a letter string, one must first engage with the meaning of it in order to make the judgement of "word" or "pseudoword". Pseudowords take longer to process and respond to because the letter string is unfamiliar during the search of one's lexical memory. However, the majority of research is focussed on investigating reaction time differences between different types of *real* words. In relation to this, many lexical decision studies adopt a factorial design as the real words are divided into different categories of interest (e.g., positive vs negative). As reviewed above, negatively valenced stimuli have demonstrated delayed response times (Briesemeister, Kuchinke & Jacobs, 2011; Estes & Verges, 2008; Kuperman et al., 2014; Larsen, Mercer, Balota & Strube., 2008).

3.1.5 Language and TTM

Only a handful of studies have investigated attentional processing of linguistic stimuli in TTM. Stanley, Hannay & Breckenridge (1997) found that a clinical sample of TTMs (*N*=21) were significantly slower than control participants (*N*=17) on the Stroop task. Further, differences in the nature of cognitive biases in TTM and obsessive compulsive disorder (OCD) were been shown by Bohne, Keuthen, Tuschen-Caffier and Wilhelm (2005) who used a cued directed forgetting recall task to investigate cognitive inhibition (the inability to inhibit irrelevant information). Participants (TTM [*N*=21]; OCD [*N*=21]; control participants [*N*=26]) were: (1) asked to memorise a list of words that were negatively valenced TTM words (e.g., "balding") and neutral words (kitchen-related, e.g., "boiling"); and then (2) asked to forget these words in order to allow them to memorise new words (different negatively valenced TTM words and neutral words). They were then asked to recall and recognise as many words as possible, regardless of list-type. Both TTM and control participants were able to inhibit recall of TTM words, compared to OCD participants who were less able to do so. Participants were then asked to rate the words and TTM words were rated as more negatively valenced by TTM participants than the OCD and control group.

3.2 Experiment 3. An investigation of attentional bias towards hair-related words in TTM using a lexical decision task

The aim of this study was to investigate any processing differences for hair-related words in a TTM sample relative to a control group. Starting with a lexical decision task in our series of linguistic experiments, we aimed to investigate response times towards words that would be considered disorder-related words for TTM. We used hair-related words and matched these with anxiety, neutral, and positive words (matching criteria are presented in section 3.2.1.3). As there is little research to date on the processing of TTM-related linguistic stimuli, it is difficult to postulate whether or not hair-related words (e.g., hair, root) might be considered as positive, negative, or even neutral for individuals with TTM. The inclusion of 3 other word types (positive, negative, neutral) allowed us to compare reaction times to hair-related words with reaction times to three other word types. Should TTM participants process disorder-related stimuli similarly to other disordered populations do, we should expect slowed responses to hair-related words. Therefore, we predicted a group (TTM, control) by word type (hair-related, anxiety, neutral and positive words) interaction: that the TTM group would have slower response times to identify hair-related words as words relative to the control group.

3.2.1 Method

3.2.1.1 Participants

TTM and Control participants were recruited opportunistically through Psychology's Subject Pool as well as via advertisements displayed across campus. In addition, an electronic notice was posted on several TTM support group message boards.

TTM participants were self-reported sufferers and were considered eligible if they reported having urges to pull their hair. If they considered themselves to be in remission, however, they were excluded. Of the 28 TTM participants, 10 were male (mean age=33 years, all R-handed) and 18 were female (mean age=24 years, all R-handed). Control participants reported no such hair pulling urges. Of the 29 control participants, 9 were male (mean age=26 years, all R-handed) and 20 were female (mean age=23 years, 4 L-handed). All participants were native English speakers with normal or corrected-to-normal vision and had not been diagnosed with any reading disorder. They were paid a rate of £6 per hour for their participation. The study was approved by the University of Glasgow's ethics committee. Participant data is presented in Table 3.1.

Table 3.1. *Participant information.*

	Age			MGH-HS		
	M	**SD**	**Range**	**M**	**SD**	**Range**
Group						
TTM (*N*=28)	27	11.4	18-63	12.8	5.3	1-24
Control (*N*=29)	24	6	18-45	0	0	-

Note. TTM = trichotillomania; MGH-HS = Massachusetts Hospital Hair-Pulling Scale

3.2.1.2 Apparatus

The lexical decision task was run on a Mac G4 (OS 9.0.4) using PsyScope 1.2.4 PPC software. Stimuli were presented in 24-point Courier font (black letters on a white background) on a Hansol 2100A 19" colour monitor with 120 Hz refresh rate and a 1024 × 768 pixel resolution. At a viewing distance of approximately 86 cm, 3 characters of text subtended 1^{o} of visual angle. Responses were made via a PsyScope Button Box and RTs were recorded with millisecond accuracy.

3.2.1.3 Design and Materials

The experiment included the completion of a lexical decision task as well as several questionnaires. In the lexical decision task, a 2 (Group: TTM, Control) × 4 (Word Type: Hair, Anxiety, Neutral, Positive) mixed design was employed. The dependent variables were reaction time (RT) and percentage accuracy (%Acc). The questionnaires provided measurements of handedness, depression, OCD, trait anxiety, and hair pulling severity, and were included in order to be used as covariates in the analyses.

Lexical decision stimuli. Words in the hair-related condition were initially compiled. Two TTM self-reported sufferers generated a list of 55 words that they considered to be salient to their disorder. Words in the other 3 experimental conditions (Anxiety, Positive, and Neutral) were then chosen and were matched on a word-by-word basis to the word length (number of letters) and frequency (occurrences per million) of each Hair word. Thus, there was a total of 220 words, comprising 55 sets of word quadruples (Hair, Anxiety, Positive, Neutral). A complete list of the experimental words is presented in Appendix F.

As in Experiment 2, word frequencies were obtained from the British National Corpus (BNC) (http://www.natcorp.ox.ac.uk/). In addition to word length and frequency, several other lexical ratings were obtained. These included a word's imageability (the ease of evoking a mental image), its age of acquisition (AoA; how early in life it is acquired), and its emotionality, assessed by its arousal (a measure of internal activation) and its valence (a measure of value or worth). Ratings were obtained from multiple sources as follows: imageability (Bird, Franklin, & Howard, 2001; Clark & Pavio, 2004; Cortese & Fugett, 2004; Morrison, Chappell, & Ellis, 1997; Stadthagen-Gonzalez & Davis, 2006; Wilson, 1988); AoA (Bird et al., 2001; Clark & Pavio, 2004; Morrison et al., 1997; Stadthagen-Gonzalez & Davis, 2006; Wilson, 1988); arousal and valence (Bradley & Lang, 1999). The average values of stimulus variables across conditions are presented in Table 3.2.

Table 3.2. *Example lexical decision stimuli.*

	Hair	**Anxiety**	**Positive**	**Neutral**
Example Item	*hair*	*died*	*hope*	*news*
Length	6.76 (2.1)	6.76 (2.1)	6.76 (2.1)	6.76 (2.1)
Frequency	8.98 (21.3)	9.30 (20.1)	10.12 (23.4)	9.69 (20.7)
Imageability	5.40 (1.0)	4.22 (0.8)	4.88 (1.1)	5.00 (1.1)
AoA	3.23 (0.9)	4.19 (1.1)	4.17 (0.9)	3.82 (1.2)
Arousal*		5.80 (0.8)	6.01 (0.7)	4.22 (0.7)
Valence*		2.47 (0.7)	7.47 (0.7)	5.28 (0.4)

**Note*: For both valence and arousal, no words in the hair-related category had ratings. Units of measurement are as follows: Length in number of letters and Frequency in occurrences per million. The remaining variables are expressed in units on the following scales: Imageability from 1 (low) to 7 (high), AoA from 1 (early) to 7 (late), Arousal from 1 (low) to 9 (high), and Valence from 1 (negative) to 9 (positive).

Nonword stimuli comprised pronounceable, orthographically legal pseudowords (e.g., *sart*). For each word quadruple, a set of four length-matched pseudowords were generated, resulting in a total of 220 pseudowords. All pseudowords are listed in Appendix G.

Edinburgh Handedness Inventory. The handedness questionnaire (Oldfield, 1971) was included to assess dominant handedness in everyday activities. It comprises 12 items with responses made on a 3-point scale (1=left hand; 2=either hand; 3=right hand). Scores range from 12-36. The questionnaire and its assessment of handedness appear in Appendix H.

Hair-pulling severity. The severity of hair pulling was assessed via the Massachusetts General Hospital (MGH) Hair Pulling Scale (MGH-HS; Keuthen et al., 1995) which assesses urges to pull, actual hair pulling, and the consequences of hair pulling over the past week. The MGH-HS is presented in Appendix A.

3.2.2.4 Procedure

Participants were tested individually in a lab. They were informed that the study required them to complete a lexical decision task (deciding whether a letter string is a word vs. a nonword) and then answer a variety of questionnaires. TTM participants were additionally informed that they would complete questionnaires about their hair-pulling behaviour.

For the lexical decision task, participants were initially presented with 16 practice items (8 words, 8 nonwords) to become accustomed to the task. Word responses were made using the right forefinger on the right (green) key of the Button Box, labelled “W,” and nonword responses with the left forefinger on the left (red) key, labelled “NW.” Participants were then presented with the 440 experimental items (220 words, 220 nonwords), with 3 programmed breaks.

Each trial consisted of the following: a blank white screen was presented for 1000 ms. A fixation cross (+) then appeared in the centre of the screen for 200 ms, replaced by another blank screen for 500 ms. A letter string was then presented centrally until the participant responded. Experimental trials were presented in a different random order for each participant.

After the lexical decision task, participants were asked to complete the Edinburgh Handedness Inventory questionnaire. Those in the TTM group were also given the MGH-HS questionnaire. On completion of the experiment, all participants were debriefed as to the purpose of the experiment.

3.2.2 Results

Incorrect responses to identify words as words (3.72%) were removed prior to analysis. We then removed trials that were too quick (<250 ms) or too slow (>1500 ms) and also removed trials that were considered outliers per participant (RTs +/-2 SDs) (6.38%). Total data loss accounted for 10.10% of the data.

Reaction time analysis

Overall, the TTM group (*M*=622 ms, *SD*=92 ms) was slower than the control group (*M*=594 ms, *SD*=79 ms) to respond to words (regardless of word types). A repeated measures mixed ANOVA revealed the corresponding group main effect to be non-significant: $F(1,55) = 1.6$, $p = 0.21$.

The additional main effect of word type was significant: the descriptive data show that relative to the neutral word condition (*M*=608 ms, *SD*=18 ms), anxiety words were responded to more slowly (*M*=624 ms, *SD*=22 ms) and positive words more quickly (*M*=587 ms, *SD*=19 ms); hair-related words (*M*=613 ms, *SD*=21 ms) did not differ from neutral words. A repeated measures mixed ANOVA showed that the main effect of word type was significant: $F(3,165) = 30.231$, $p < .001$). After Sidak pairwise comparisons, the main effect of word type was attributed to the presence of positive and anxiety words (Table 3.3 and Figure 3.1). Across both the TTM and control group, positive words were responded to faster than anxiety, hair and neutral words (all $p < .001$), and anxiety words were responded to slower than neutral words ($p = 0.002$).

Table 3.3. *Sidak pairwise comparisons for word type.*

Word type	Hair	Anxiety	Positive	Neutral
Hair	-	.116	.000	.860
Anxiety	.116	-	.000	.002
Positive	.000	.000	-	.000
Neutral	.860	.002	.000	-

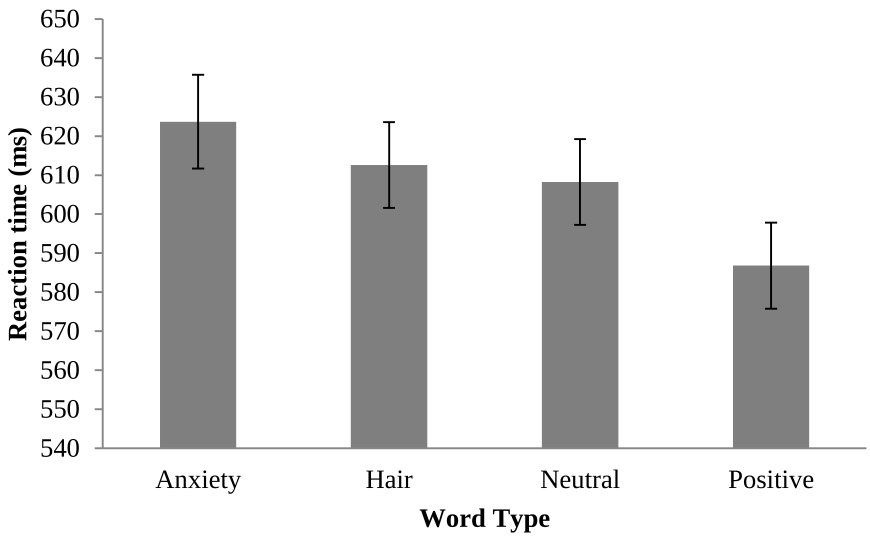


Figure 3.1. Mean RTs in ms (error bars display standard error) for each word type across all participants.

Our ANOVA also revealed that there was no group (TTM, Control) x word type (Anxiety, Hair, Neutral, Positive) interaction (*F*<1). See Table 3.4 and Figure 3.2.

Table 3.4. *Mean RTs (and standard deviations) in ms to identify the word as a function of Group (TTM, Control).*

	TTM		Control	
Word Type	Mean	SD	Mean	*SD*
Anxiety	639	99	608	79
Hair	627	91	598	81
Neutral	621	86	596	82
Positive	601	90	573	75

Note. TTM = trichotillomania.

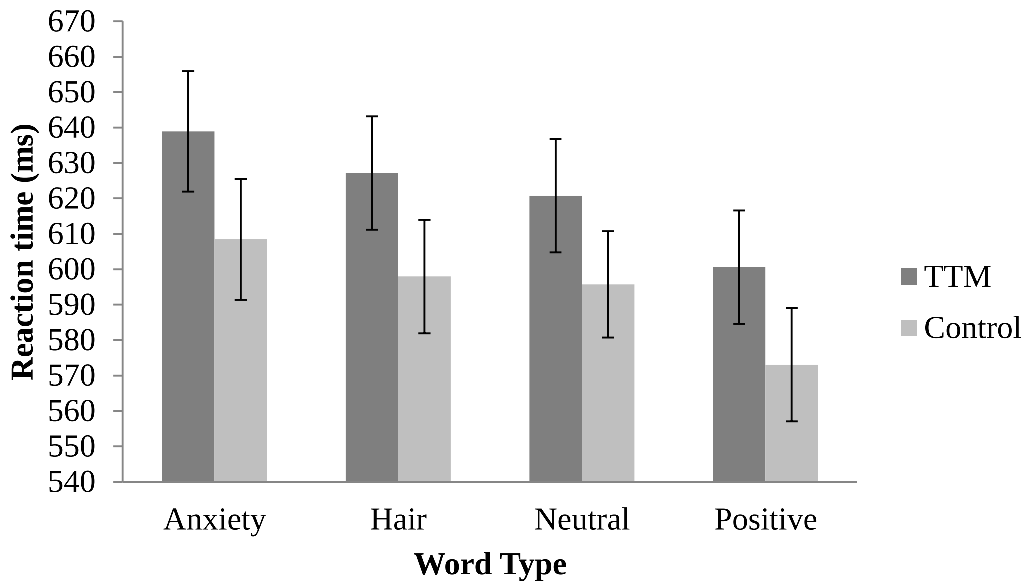


Figure 3.2. Mean RTs in ms (error bars display standard error) displaying the relationship between Group (TTM, Control) and Word Type (Anxiety, Hair, Neutral, Positive). *Note*. TTM = Trichotillomania.

Percentage Accuracy Rate

Overall, the TTM group (*M*=96.4%, *SD*=3.5%) showed no differences in their lexical decision responses compared with the control group (*M*=96.2%, *SD*=3.8%). A one-way repeated measures ANOVA revealed the corresponding group main effect to be non-significant (*F*<1).

The additional main effect of word type was, however, significant. In comparison with the neutral word (*M*=95.1%, *SD*=4.2%%) condition, the percentage accuracy rate in the task was higher for hair related words (*M*=95.8%, *SD*=3.6%); for anxiety words (*M*=96.2%, *SD*=3.8%); and also for positive words (*M*=98.0%, *SD*=2.4%) as shown in Figure 3.4. The repeated measures mixed ANOVA showed that main effect of word type was significant (F (3, 165) = 15.614, $p < .001$). Sidak pairwise comparisons revealed that the main effect of word type was due to the presence of positive and anxiety words (see Table 3.5 and Figure 3.3). Across both the TTM and control group, positive words had a significantly higher accuracy rate than anxiety (p=.002), and hair and neutral words (both

p<.001). Accuracy was also higher in anxiety words in comparison to neutral words (p=.022).

Table 3.5. *Sidak pairwise comparisons for word type.*

Word type	Hair	Anxiety	Positive	Neutral
Hair	-	.872	.000	.445
Anxiety	.872	-	.002	.022
Positive	.000	.002	-	.000
Neutral	.445	.022	.000	-

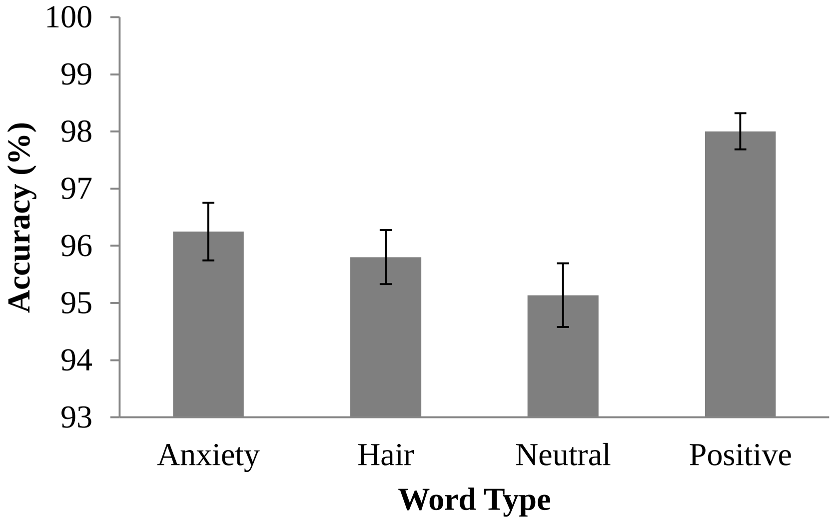


Figure 3.3. Effect of word type on percentage accuracy rate for all 57 participants. *Note*. Error bars display standard error.

3.2.3 Discussion

The results of the lexical decision study show that hair-pullers do not respond differentially to hair-related words or other word types, relative to the control group. First, when lexical decision reaction times were compared between the TTM and control group, no significant between group effect emerged. Secondly, there was also no between group difference for accuracy rate. The TTM group responded similarly to the control group in terms of accuracy in the identification of words in the lexical decision task. This indicates no evidence of an attentional bias to disorder-related stimuli in our TTM group.

When the main effect of word type (hair-related, anxiety, neutral, positive) was explored, our results demonstrated a robust effect of word type across both reaction time and percentage accuracy for identifying a word as a word. The reaction time analysis revealed that positive words received the quickest responses relative to anxiety, hair-related, and neutral words. The slowest responses were produced by anxiety words across all participants. This word type effect has been demonstrated by previous research (Briesemeister, Kuchinke & Jacobs, 2011; Estes & Verges, 2008; Kuperman et al., 2014; Larsen, Mercer, Balota & Strube., 2008). It is particularly noteworthy that this main effect of word was found when we robustly controlled our stimuli for (1) Word length; (2) Frequency of occurrence (MRC Psycholinguistic Database); (3) Imageability (Bird, Franklin, & Howard, 2001, Bristol Norms, Clark & Pavio, 2004, Cortese & Fugett, 2004, - [1-syllable], Morrison et al., 1997, and the MRC Psycholinguistic Database); and (4) Age of acquisition (Bird et al., 2001, Bristol Norms, Clark & Pavio, 2004, Morrison et al., 1997, and MRC Psycholinguistic Database).

Analysis of percentage accuracy revealed that positive words received a significantly higher percentage of correct responses than anxiety, hair-related, and neutral words. In addition, neutral words produced the lowest percentage accuracy with significantly lower accuracy than anxiety words. This is consistent with research findings demonstrating the processing advantage of emotion words over neutral words (e.g., Kousta et al., 2009).

The absence of a group by word type interaction across both reaction time and percentage accuracy bears implications for the predicted attentional bias to lexical hair-related stimuli in our TTM sample. First, regarding the hair related stimuli, it was hypothesised that hair related words would act as salient disorder-related words for the

TTM group but neutral words for the control group. However, similar to the control group, TTM participants demonstrated no reaction time differences when presented with hair-related lexical stimuli. This finding rejects the hypothesis that hair-related words are salient to and can produce an attentional bias in individuals with TTM; a phenomenon consistently observed in anxiety related (Dresler et al, 2009; Estes and Verges, 2008) and addiction literature (Cousijn et al., 2011; Cox et al., 2006; Cane et al., 2009; Fadardi and Cox, 2009).

In summary, our lexical decision task demonstrated sensitivity to word type manipulations only. The absence of a group by word type interaction is indicative of there being no attentional bias to hair related stimuli in people with trichotillomania. However, it is unclear if the lexical decision task was the most appropriate to elicit a response bias towards hair-related words in people with TTM. Further investigation of the characteristics of this proposed attentional bias to hair related stimuli will allow us to identify the most suitable tasks to measure the bias.

3.3 Experiment 4. An investigation of attentional bias towards hair-related words in TTM using an Emotional Stroop task

Experiment 2 presented an emotional Stroop task using shame-related words in a TTM sample TTM and control group. Whilst the lexical decision task in Experiment 3 allowed us to observe attention to potentially salient stimuli via *engagement* with a stimulus, the emotional Stroop paradigm allows us to look at how participants *disengage* from the meaning of a word prior to naming the colour. Therefore, by utilising our stimulus word list from Experiment 3 (55 hair related, 55 anxiety, 55 neutral, 55 positive) in a Stroop paradigm, we could observe whether a paradigm based on *disengagement* from a potentially salient stimulus demonstrates any biased responses to particular word types. Using an online study, a large sample size allowed us to divide those reporting TTM symptoms into 2 groups: TTM-High (MGH-HS=10-28) and TTM-Low (MGH-HS=1-9).

We were interested to see if hair-pulling severity would play a role in responses in our Stroop task. The inclusion of the TTM-Low group was exploratory. We predicted a group (TTM-High, control group) by word type (hair-related, anxiety, neutral and positive words) interaction: that the TTM-High group with higher hair-pulling severity would have slower response times to identify the ink colour of hair-related words as words relative to the control group.

3.3.1 Method

3.3.1.1 Participants

Self-reported TTM participants were recruited via online support sites for hair-pulling symptoms. The sample consisted of females who reported that they had symptoms of hair-pulling and had sought support for their hair-pulling behaviour. Control participants were recruited opportunistically via the School of Psychology's subject pool (http://experiments.psy.gla.ac.uk) and were females who reported no symptoms of hair-pulling behaviours. All participants were administered the Massachusetts General Hospital Hair-Pulling Scale (MGH-HS) to confirm classification into the hair-pulling and control groups. Results from the MGH-HS classified participants into three groups: TTM-High (*N*=70, MGH-HS=10-28), TTM-Low (*N*=19, MGH-HS=1-9), and Normal Control (*N*=68, MGH-HS=0). Control participants were matched with TTM-High participants for age. Out of the original sample of 171, 14 individuals (7 TTM-High, 7 Control) were removed prior to analysis, as their overall responses per word type were outwith +/- 2 SDs of the overall word type rts and/or error rate. After participant exclusion, our final sample consisted of 157 female participants. Participant data is presented in Table 3.6. All participants were native English speakers. The majority of the self-reported TTM sample participated voluntarily (due to location) whilst control participants received £3 or one course credit for their participation. The study was approved by the University of Glasgow's ethics committee.

Table 3.6. *Participant information*

	Age			MGH-HS		
	M	**SD**	**Range**	**M**	**SD**	**Range**
Group						
TTM-High (*N*=70)	28.8	10.6	17-60	15.3	5.23	10-28
TTM-Low (*N*=19)	28.6	10.9	18-51	5.3	1.9	1-9
Control (*N*=68)	28.9	10.3	17-59	0	0	-

Note. TTM = trichotillomania; MGH-HS = Massachusetts Hospital Hair-Pulling Scale

3.3.1.2 Materials and measures

Hair-pulling severity. The Massachusetts General Hospital Hair Pulling Scale (MGH-HS) (Keuthen et al., 1995) was used to assess hair-pulling severity and the full questionnaire is presented in Appendix A.

Word matching. The hair Stroop task comprised the same stimulus set that was used in Experiment 3 and contained 4 word types (55 words per category): Hair words (*hair*, *eyelashes*); Anxiety words (*died*, *disgraced*); Neutral words (*news*, *sentiment*); and Positive words (*hope*, *evergreen*).

Hair Stroop paradigm. The Stroop paradigm utilised a custom-made remote online experiment using Flash Adobe software (http://experiments.psy.gla.ac.uk). Each trial consisted of the following: a blank screen with a central white fixation cross (+) was presented for 1000 ms followed by a blank screen for 300 ms. Another blank screen then appeared for 500 ms. Next, a word was presented on screen in one of 4 possible colours (blue, green, red or yellow) and remained until the participant made a response. Responses were made using the left middle and index forefinger on the C and V keys of the keyboard and by using the right forefinger and middle finger on the N and M keys. Colours were assigned to words so that no one word (e.g., blame) was allocated the same ink colour (e.g., blue) more than once. Experimental trials were presented in a random order for each participant. Participants first completed 16 trials to become familiar with the task. Each word was presented twice. In total, there were 440 stimulus presentations, 55 words per category (4 x 55 presented twice). This resulted in 4 blocks with 110 stimulus presentations each and 3 programmed breaks. Figure 3.4 shows the Stroop presentation.

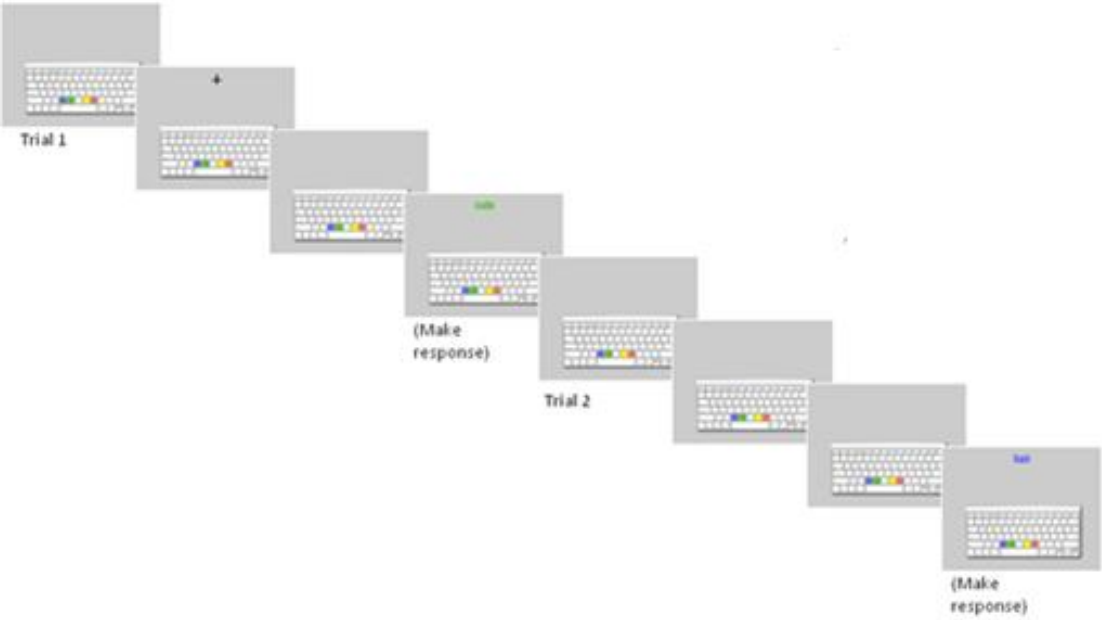


Figure 3.4. Presentation of Stroop task

3.3.1.3 Procedure

Before the experiment, participants reported whether or not they experienced TTM symptomology. No individuals withdrew from the experiment after this initial screening. Participants were informed that the study required them to view a series of words one at a time and identify the ink colour of the word presented, followed by a brief questionnaire that would ask them about any hair-pulling behaviours that they may have/not have. They then completed the Stroop task individually via remote online experiment. On completion of the Stroop task, participants completed the MGH-HS to confirm allocation to either the TTM-High, TTM-Low, or the Control group and to provide a hair-pulling severity score for those with hair-pulling behaviours.

3.3.2 Results

Incorrect responses (3.75%) were removed prior to analysis. We then removed trials that were too quick (<250 ms) or too slow (>1500 ms) and also removed trials that were considered outliers per participant (RTs +/-2 SDs) (5.68%). Total data loss accounted for 9.43% of the data.

Reaction time analysis

We conducted a 3 (Group: TTM-High, TTM-Low, Control) by 4 (Word Type: Anxiety, Hair-related, Neutral, Positive) repeated measures ANOVA to explore reaction times (in ms) to identify the ink colour of the words presented.

A significant main effect of group on rts to identify the ink colour of words was revealed: $F(2, 154)=5.274$, $p=0.006$. The descriptive data showed that rts were slowest for the TTM-High group (M=710 ms, SD=95 ms) and quickest for the control group (M=653 ms, SD=109 ms). The TTM-Low group was in between (M=689 ms, SD=116 ms). Sidak multiple comparisons revealed the main effect was attributed to the TTM-High group being significantly slower than the Control group ($p=0.004$). The data are presented in Figure 3.5.

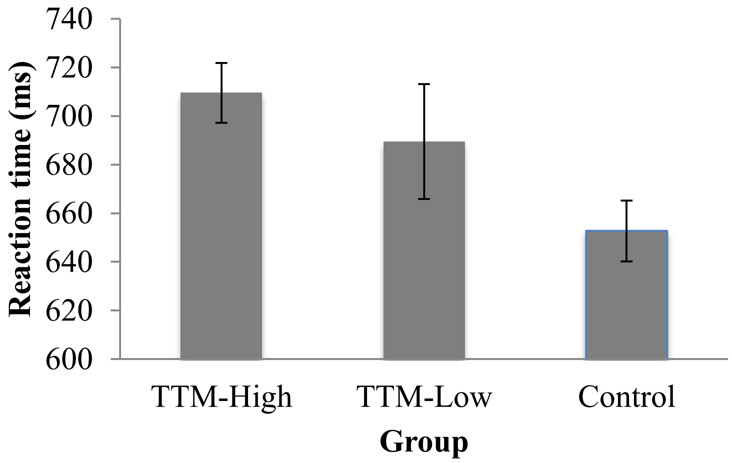


Figure 3.7. Mean RTs in ms (error bars display standard error) for main effect of group (TTM-High, TTM-Low, Control). *Note*. TTM = Trichotillomania.

The additional main effect of word type on rts to identify the ink colour of words was also significant: $F(3, 462)=7.466$, $p<0.001$. The descriptive data showed that relative to neutral words (*M*=680 ms, *SD*=105 ms), anxiety words (*M*=684 ms, *SD*=108 ms) and hair-related words (*M*=687 ms, *SD*=110 ms) were responded to more slowly. Positive words were responded to the quickest (*M*=678 ms, *SD*=104 ms). To examine where the differences lay, Sidak adjusted pairwise comparisons revealed that significant differences in reaction times lay between anxiety and positive words ($p=.037$), hair-related and neutral words ($p=.014$), and hair-related and positive words ($p<.001$). The main effect of word type is shown in Figure 3.6.

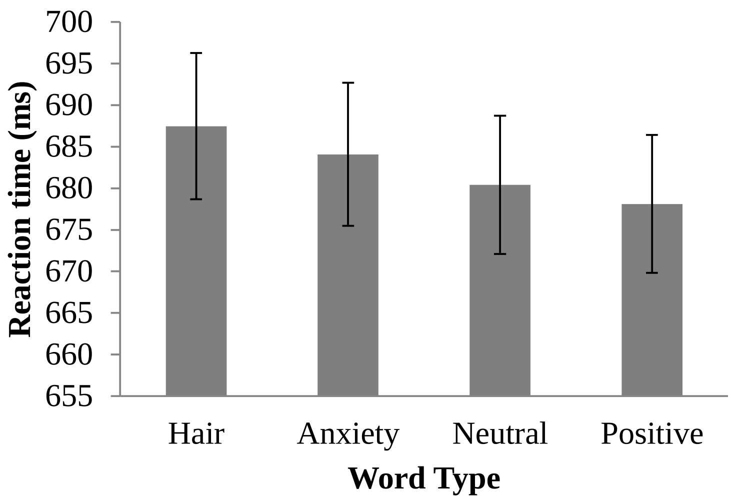


Figure 3.6. Mean RTs in ms (error bars display standard error) for main effect of Word Type (Anxiety, Hair-related, Neutral, Positive).

Finally, the repeated measures mixed ANOVA revealed that there was no Group by Word Type interaction: $F(6,462)=1.455$, $p=0.192$. Group classification did not affect reaction times to identify the ink colour of specific word types. The data are presented in Table 3.7 and Figure 3.7.

Table 3.7 *Mean RTs (and standard deviations) in ms to detect the ink colour of a stimulus word for Group (TTM-High, TTM-Low, Normal Control), and Word Type (Anxiety, Hair-related, Neutral, Positive).*

	TTM-High Mean *(SD)*	**TTM-Low** Mean *(SD)*	**Control Group** Mean *(SD)*
Anxiety	713 (96)	690 (108)	652 (112)
Hair	716 (99)	695 (125)	656 (111)
Neutral	707 (93)	688 (113)	651 (107)
Positive	702 (92)	685 (118)	651 (177)

Note. TTM = Trichotillomania

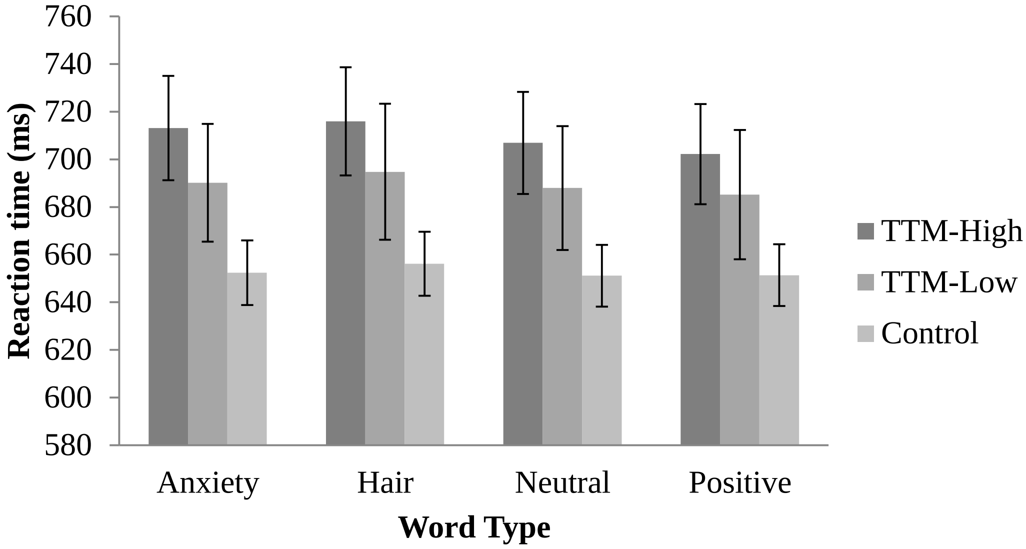


Figure 3.7. Mean RTs in ms (error bars display standard error) displaying the relationship between Group (TTM-High, TTM-Low, Control) and Word Type (Anxiety, Hair-related, Neutral, Positive). *Note*. TTM = Trichotillomania.

Accuracy analysis

Table 3.8 displays the mean percentage accuracy times in ms. We conducted a 3 (Group: TTM-High, TTM-Low, Control) by 4 (Word Type: Anxiety, Hair-related, Neutral, Positive) mixed design ANOVA to explore reaction times (in ms) to identify the ink colour of the words presented.

The main effect of group was non-significant (F<1). There were no differences between groups in identifying the ink colour of words, regardless of word type. The corresponding main effect of word type was significant: F(2.842,437.634)=8.04, p<.001 (degrees of freedom adjusted for Greenhouse-Geisser). The descriptive data showed that relative to neutral words, (M=96.42%, SD=3.39%), hair-related words (M=95.56%, SD=2.87%) and positive words (M=96.4%, SD=3.26%) had a lower percentage of accurate responses. Anxiety words (M=96.47%, SD=3.39%) had the highest percentage accuracy.

To examine where the significance lay for the main effect of word type, Sidak adjusted pairwise comparisons revealed that significant differences in percentage accuracy lay between anxiety and hair words (p=.001), hair-related and neutral words (p<.001), and hair-related and positive words (p=.001). The group by word type interaction was non-significant, F<1.

Table 3.8. *Mean percentage accuracy (and standard deviations) to detect the ink colour of a stimulus word for Group (TTM-High, TTM-Low, Normal Control), and Word Type (Anxiety, Hair-related, Neutral, Positive).*

	TTM-High Mean *(SD)*	**TTM-Low** Mean *(SD)*	**Control Group** Mean *(SD)*
Anxiety	96.28 (3.6)	96.46 (2.95)	96.67 (3.31)
Hair	95.51 (3.05)	95.12 (2.88)	95.75 (2.7)
Neutral	95.97 (4.11)	96.51 (2.31)	96.84 (2.74)
Positive	96.21 (3.55)	96.08 (3.51)	96.69 (2.89)

3.3.3 Discussion

To our knowledge, this is the first modified Stroop study that has investigated the attentional processing of hair-related words in a TTM sample. There was a significant main effect of group where hair-pullers took longer to name the ink colour of a word compared to the control group, regardless of word type. This is in line with the findings of Stanley et al. (1995) who found that a clinical TTM sample had significantly slower responses on a Stroop task then a control group. The corresponding main effect of word type was also significant: both hair-related and anxiety words had longer reaction times than positive words across participants. This is consistent with our lexical decision study in Experiment 3 where anxiety words also elicited longer response time than positive words. However, the main effect of word type in the current Stroop study was attributed not only to anxiety words, but also to hair-related words eliciting longer reaction times than neutral and positive word types across participants. This is particularly interesting because although this does not fit into an attentional bias model, our overall participant sample including control participants showed delayed responses to hair-related words. It is unclear why this was the case and further studies using hair-related stimuli may contribute to a theoretical explanation. Experiment 5 will investigate this further in a non-reaction time linguistic study.

When investigating any interaction of group by word type, the TTM-High group did not show differential, delayed responses to hair-related words, in comparison to the control group. Moreover, within the TTM-High group, neither hair-related nor anxiety words produced longer reaction times relative to neutral and positive words. As reviewed previously, literature strongly indicates individuals with psychological disorders respond differentially to linguistic stimuli pertaining to their condition. Our results separate TTM from other disorders in terms of an attentional bias to disorder-related cues and this is unusual. We did not find evidence that self-reported TTM sufferers process hair-related linguistic stimuli differentially.

Our inclusion of a TTM-Low group (those who reported hair-pulling symptoms of MGH<10) demonstrated that were no differences in response times between the TTM-Low group, compared to the TTM-High group and control group. Yet, it was reasonable to include this participant group to fully explore reaction times in our large TTM sample.

Thus far, our linguistic studies using reaction time data have yielded no group by word type interactions. Therefore, the next study aims to address responses to hair-related words using a word-rating task without a reaction time component.

3.4 Experiment 5. Word-rating task: valence and arousal of hair-related, body image and neutral words

The introduction to this chapter reviewed literature on the emotional properties of words, particularly valence and arousal from neutral words. To recap, emotional words differ in valence and arousal from neutral words (e.g., Scott, O'Donnell & Sereno, 2012). The majority of our 55 hair-related words used in Experiments 3 and 4 did not have ANEW (Bradley & Lang, 1999) arousal and valence ratings. Therefore, using a word-rating task, we aimed to: (1) obtain norms for our hair-related words; and (2) explore whether individuals with TTM assign different arousal and valence ratings to hair-related words compared with a control group without TTM symptomology. We matched our hair-related word and neutral words with 55 body image words. The decision to replace anxiety and positive words with a different word type was motivated by the requisite to have a word type that would potentially carry salience surrounding physical appearance and self-image. TTM can have observable physical symptoms which give rise to negative affective correlates and these are often related to one's perception of their physical appearance due to, for example, hair-loss (e.g., Townsley-Stemberger et al., 2000; Weingarden & Renshaw, 2015). Therefore, we wanted to compare arousal and valence ratings for hair-related, body image, and neutral words in a TTM-High, TTM-Low and control group to see if ratings of hair-related words would be different than ratings of body image words. If this is the case, we can tease apart how one feels about one's image, not just pertaining to general self-image but particularly in relation to TTM. Should the TTM group assign stronger arousal and valence ratings to hair-related words relative to body image words, this would indicate that hair-related words are particularly salient to them.

For ratings of arousal, we predicted an interaction between group (TTM-High, TTM-Low, control) and word type (hair-related, body image, neutral). Specifically, we predicted that the TTM-High group would assign higher arousal ratings to hair-related words than the TTM-Low and control group. Further, we predicted that within the TTM-High group, arousal ratings of hair-related words would be higher than ratings of body image and neutral words due to their hair-pulling severity. For ratings of valence, we considered that the nature of TTM (craving for, and gratification from, hair-pulling contrasted with negative affective correlates associated with their hair-pulling condition) would potentially cancel out any effect of positive and negative ratings of hair-related words. Therefore, for ratings of valence, we predicted no group (TTM-high, TTM-low, control group) by word type (hair-related, body image, neutral) interaction. As in Experiment 4, the inclusion of the TTM-Low group was exploratory to observe if hair-pulling severity plays a role in word ratings.

3.4.1 Method

3.4.1.1 Participants

TTM participants were female self-reported individuals recruited via online support sites for symptoms of hair-pulling. Control participants were recruited opportunistically via the School of Psychology's subject pool (http://experiments.psy.gla.ac.uk) and were females who reported no symptoms of hair-pulling behaviours. Results from the Massachusetts General Hospital Hair-pulling Scale *(*MGH-HS*),* administered after the Norming task were used to classify participants into two groups: TTM-High (MGH-HS=10-28), TTM-Low (MGH-HS=1-9), and Normal Controls (MGH-HS=0). The TTM sample participated voluntarily (due to location) whilst control participants received one course credit for their participation. All participants were native English speakers. The study was approved by the University of Glasgow's ethics committee. Participant data is shown in Table 3.9.

Table 3.9. *Participant information.*

	Age			MGH-HS		
	M	SD	Range	M	SD	Range
Group						
TTM-High (*N*=47)	26.2	8	16.56	17.5	4.3	10-28
TTM-Low (*N*=19)	22.6	6	18-53	6.5	2.3	1-9
Control (*N*=69)	25.3	10.6	17-64	0	0	-

Note. TTM = trichotillomania; MGH-HS = Massachusetts Hospital Hair-Pulling Scale

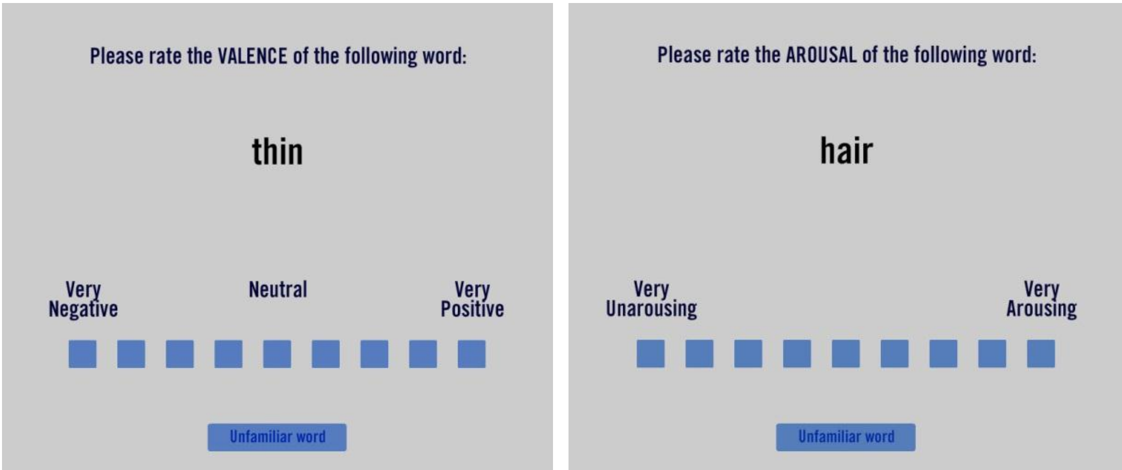
3.4.1.2 Materials and measures

Hair-pulling severity. The Massachusetts General Hospital Hair Pulling Scale (MGH-HS) (Keuthen et al., 1995) was used to assess the severity of hair-pulling behaviours (see Appendix A).

Word matching. The Norming task comprised 3 word types (55 words per category): hair-related words (*hair*, *eyelashes*); body image words (*food, laxatives*); and neutral words (*news*, *sentiment*).

Words were matched on a word-by-word basis to the word length (number of letters) and frequency (occurrences per million). There was a total of 165 words comprising 55 sets of word triples (hair-related, body image, neutral). Word frequencies were obtained from the British National Corpus (BNC; http://www.natcorp.ox.ac.uk/). Words were also matched based on imageability (Bird, Franklin, & Howard, 2001; Clark & Pavio, 2004; Cortese & Fugett, 2004; Morrison, Chappell, & Ellis, 1997; Stadthagen-Gonzalez & Davis, 2006; Wilson, 1988); and age of acquisition (Bird et al., 2001; Clark & Pavio, 2004; Morrison et al., 1997; Stadthagen-Gonzalez & Davis, 2006; Wilson, 1988). A complete list of the experimental words is presented in Appendix I.

Norming task. The norming task used a custom-made remote online experiment at http://experiments.psy.gla.ac.uk. Each trial consisted of the following: a word was presented on screen and participants were asked to indicate either a valance rating of the word on a scale of 1 to 9 (where 1=very negative, 5=neutral, 9=very positive) or their arousal rating of the word on a scale of 1-9 (where 1=very un-arousing, 9-very arousing). Block 1 consisted of valence judgements for all 165 words and block 2 consisted of arousal judgements for all 165 words. Block and trial order was randomised for each participant. In total, there were 330 stimulus presentations (55 hair-related words; 55 body image words; 55 neutral words presented twice). The word rating task was presented on a grey background as shown in Figure 3.8. There was an opportunity for a break between blocks.



Example valence trial (block 1) *Example arousal trial (block 2)*

Figure 3.8. Presentation of word rating task. *Note.* Block and trial were randomised for each participant.

3.4.1.3 Procedure

Participants were tested individually via a remote online experiment and received onscreen instructions. They were informed that the experiment required them to view a series of words twice and that their task was to assign a rating to each word one at a time. Participants viewed a word on screen and used their mouse to indicate their rating of the word on the scale provided (as shown in Figure 3.8). On completion of rating a word stimulus rating, the next stimulus word was presented on screen. Once all 165 words in the first block had been presented and rated, participants had the opportunity to take a short break before completing the second block. On completion of the norming task, all participants completed the MGH-HS and were then presented with a debrief as to the purpose of the experiment.

3.4.2 Results

Arousal

It was predicted that: (1) TTM-High participants would assign higher arousal ratings to hair-related words, than control participants. Also, we predicted that: (2) within the TTM-High group, higher arousal ratings would be assigned to hair-related words than body image and neutral words.

Table 3.10 *Mean arousal ratings across group for each word type*

	TTM-High		**TTM-Low**		**Control**	
Word Type	Mean (*SD*)	Range	Mean (*SD*)	Range	Mean (*SD*)	Range
Hair-related	4.79 (1.18)	2.00-7.02	4.48 (0.73)	3.31-5.91	4.27 (0.95)	1.58-6.36
Body image	4.12 (1.23)	1.69-6.80	4.59 (1.29)	3.29-5.96	4.22 (1.02)	1.78-7.33
Neutral	4.06 (1.24)	1.33-6.36	4.58 (0.77)	2.66-6.04	4.33 (0.92)	1.66-5.82

Note. 1=not at all arousing, 9=extremely arousing.

A repeated measures mixed ANOVA revealed no main effect of group on arousal ratings of words, $F<1$. The mean arousal ratings across word type for the TTM-High group (M=4.33, SD=0.41), TTM-Low Group TTM-High (M=4.54, SD=0.06) and the Control group (M=4.28, SD=.05) were not significantly different. The additional main effect of word type was only marginally significant, $F(1.832,241.781)=2.759$, p=.07 (degrees of freedom adjusted for Greenhouse-Geisser). The mean arousal rating of hair related words (M=4.51, SD=0.95) was not significantly higher than the arousal ratings of body images words (M=4.31, SD=0.99) or neutral words (M=4.32, SD=0.98). Data are presented in Table 3.10 and Figure 3.9.

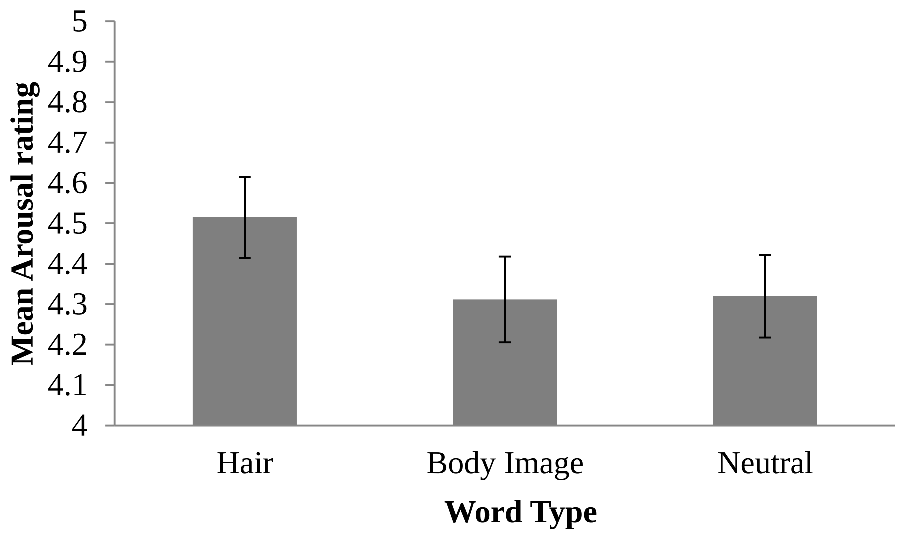


Figure 3.9. Mean arousal ratings (error bars display standard error) for main effect of Word Type (Hair, Body Image, Neutral).

The group by word type interaction was significant, $F(3.663, 241,781)=5.757$, $p<0.001$ (degrees of freedom adjusted for Greenhouse-Geisser). To deconstruct the 3x3 interaction between Group (TTM-High, TTM-Low, Control) and Word Type (Hair, Body Image, Neutral), we conducted 3 one-way ANOVAs with Sidak multiple comparisons. The ANOVA for hair-related words revealed that the significance lay between the TTM-High (M=4.79, SD=1.18) and Control Group (M =4.27, SD=0.95) arousal ratings for hair-related words (p=0.022). TTM-Low participants (M=4.48, SD=0.73) did not differ in arousal ratings from the TTM-High and control group. The data are presented in Figure 3.10.

The ANOVAs and Sidak post hoc multiple comparisons for body image and neutral words revealed no differences in arousal ratings between groups (all $p>0.5$). TTM-High participants rated body image words only slightly lower in arousal (M=4.13, SD=1.23) than the control (M=4.22, SD=1.02) and TTM-Low (M=4.59, SD=1.29) participants. Arousal ratings of neutral words only varied slightly between TTM-High (M=4.06, SD=1.24), TTM-Low (M =4.58, SD=0.77) and control (M=4.33, SD=0.92) participants.

In summary, our 3x3 interaction between Group (TTM-High, TTM-Low, Control) and Word Type (Hair, Body Image, Neutral) was driven by significantly different arousal ratings of hair-related words between the TTM-High and control group.

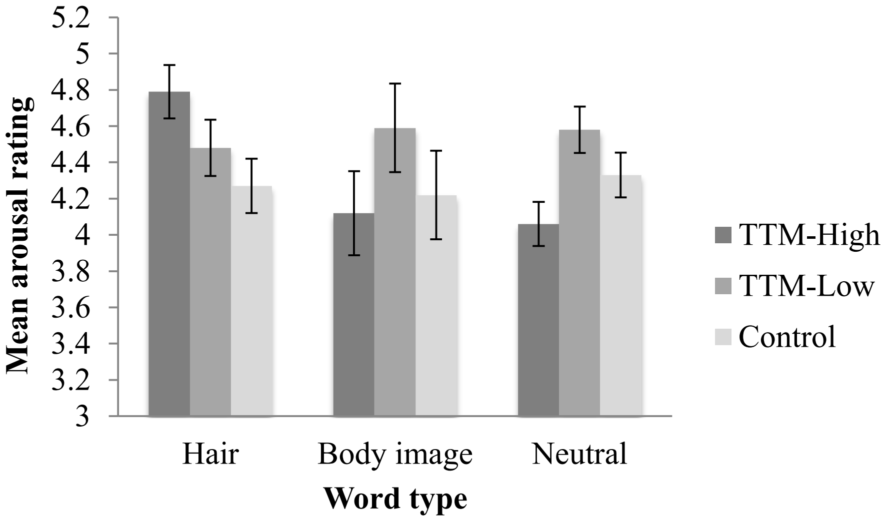


Figure 3.10. Mean arousal ratings (error bars display standard error) displaying the relationship between Group (TTM-High, TTM-Low, Control) and Word Type (Hair, Body Image, Neutral). *Note*. TTM = Trichotillomania.

Finally, we conducted a repeated-measures ANOVA for the TTM-High group to compare arousal ratings across word type. There was a main effect of word type, $F(2,92)=10.96$, $p<.001$. Sidak pairwise comparisons revealed that arousal ratings for hair words ($M=4.79$, $SD=1.18$) were significantly higher than for body image words ($M=4.13$, $SD=1.23$, $p<.001$) and neutral words ($M=4.06$, $SD=1.24$, $p=.001$). There was no significant difference in arousal ratings between body image and neutral words ($p=.978$).

Our arousal results supported both our predictions that the TTM-High group (1) assigned higher arousal ratings to hair-related words than did the control group, and (2) assigned higher arousal ratings to hair-related words than body image and neutral words.

Valence

It was predicted that valence ratings for words would be the same for each group. A repeated measures ANOVA revealed no main effect of group on valence ratings of words, $F(2,132)=1.449$, $p=.239$. Valence ratings assigned by the TTM-High group

(*M*=4.78, *SD*=0.60), TTM-Low group (*M*=4.93, *SD*=0.37) and the control group (*M*=4.78, *SD*=0.41) across all word types did not yield any significant differences. The additional main effect of word type was significant, $F(2,264)=262.04$, $p<.001$. Sidak pairwise comparisons revealed that valence ratings for hair-related words (*M*=4.99, *SD*=0.51), body image words (*M*=4.16, *SD*=0.43) and neutral words (*M*=5.34, *SD*=0.40) were all statistically significantly different from one another (all $p<.001$). See Figure 3.11.

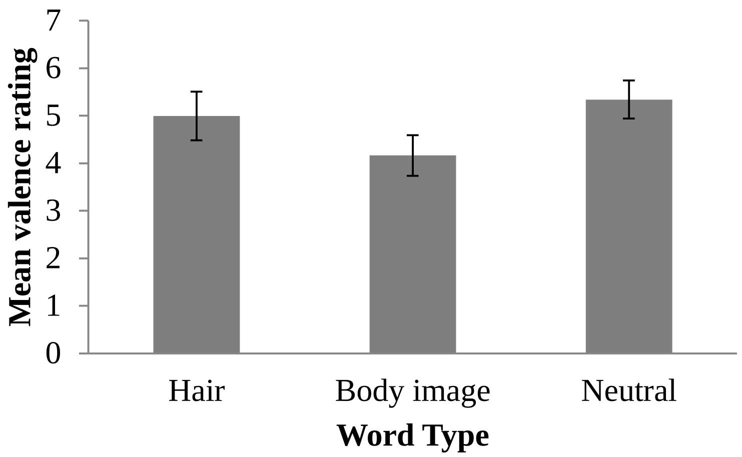


Figure 3.11. Mean valence ratings (error bars display standard error) for main effect of Word Type (Hair, Body Image, Neutral).

The group by word type interaction was non-significant, $F<1$. Hair-related words were rated similarly for valence by the TTM-High (*M* =4.92, *SD*=0.66), TTM-Low (*M* =5.09, *SD*=0.44), and control (*M* =4.97, *SD*=0.43) groups. For body image words, ratings of valence were similar for TTM-High (*M*=4.12, SD=0.61), TTM-Low (*M*=5.09, SD=0.44), and control participants (*M*=4.13, SD=0.40). Finally, a similar pattern emerged for neutral words, where ratings of valence were similar for TTM-High **(***M*=5.29, SD=0.53), TTM-low (*M*=5.47, SD=0.41), and control (*M*=5.26, SD=0.40) participants. See Table 3.11 and Figure 3.12.

Table 3.11. *Mean valence ratings across group and word type.*

	TTM-High		TTM-Low		Control	
Word Type	Mean (*SD*)	Range	Mean (*SD*)	Range	Mean (*SD*)	Range
Hair-related	4.92 (0.66)	2.98-6.44	5.09 (0.44)	4.13-5.80	4.97 (0.43)	3.42-6.37
Body image	4.12 (0.61)	2.13-5.38	4.24 (0.27)	3.64-4.71	4.13 (0.40)	2.76-4.93
Neutral	5.29 (0.53)	3.95-6.84	5.47 (0.41)	4.75-6.53	5.26 (0.40)	3.56-6.48

Note. 1=very negative, 5=neutral, 9=very positive.

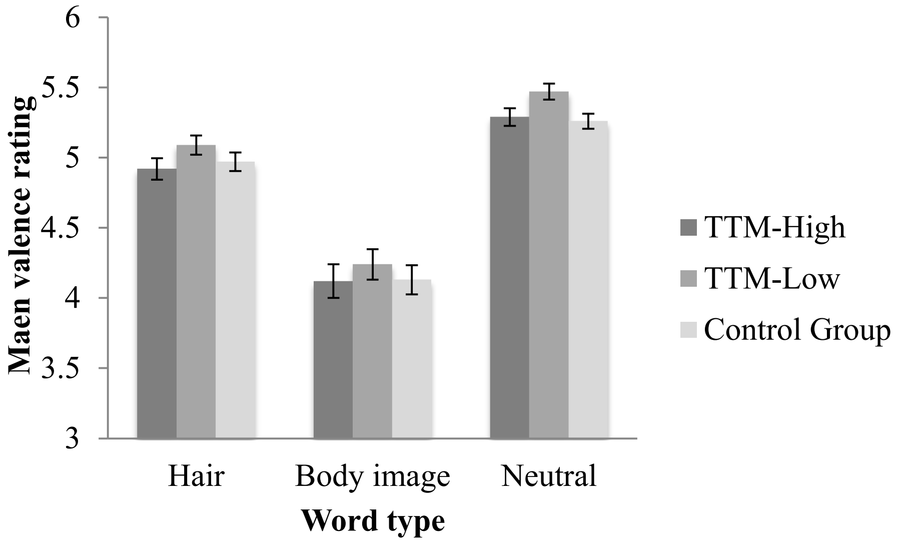


Figure 3.12. Mean valence ratings (error bars display standard error) displaying the relationship between Group (TTM-High, TTM-Low, Control) and Word Type (Hair, Body Image, Neutral). *Note*. TTM = Trichotillomania.

Our valence results supported both our predictions in that the TTM-High, TTM-Low, and control group assigned similar valence ratings to all word types.

3.4.3 Discussion and summary of chapter

The results of our word-rating task are the first in this thesis to support the presence of a bias in emotional processing of linguistic stimuli in self-reported hair-pullers. TTM-High participants assigned higher arousal ratings to hair-related words both in comparison to the control group and relative to other word types. These findings concur with attentional bias literature suggesting that emotionally salient stimuli are perceived as more arousing to individuals with addictions (e.g. Cousijn et al., 2011; Nees et al., 2011) and depression (Liu et al., 2012).

Due to the nature of the hair-pulling condition, it was predicted that valence ratings of hair-related words would vary across hair-pullers cancelling out any valence effect in the group as a whole. For example, the word "hair" could have a positive valence for hair-pullers who perceive "hair" as something desirable, yet it could have a negative valence for hair-pullers who perceive it as something that causes a daily struggle and results in hair-loss and low feelings of self-control.

Our word rating results illustrate that hair-related stimuli do not need to be negatively nor positively valenced to be considered arousing. Accordingly, our results indicate that disorder-specific emotionality may serve as a factor in the maintenance of TTM when one's attention is captured by stimuli pertaining to the hair.

3.4.4 Reanalysis of hair-related lexical decision and Stroop data

From results of our word-rating study, we revisited our lexical decision and Stroop data that used hair-related words. 55 independent t-tests were carried out to compare ratings of hair-related words between the TTM-High (N=47) and Control (N=69) group. Due to the exploratory nature of the investigation, Bonferonni corrected alpha levels were not adjusted. TTM participants rated 15 words significantly higher in arousal than did control participants, and 5 additional words were marginal. These words are presented in Table 3.12.

Table 3.12. *P-values for independent sample t-tests comparing arousal ratings between the TTM and control group.*

Word	*p*-value
follicle	$p<.001$
hair	$p<.001$
ingrown	$p<.001$
pluck	$p<.001$
pull	$p<.001$
regrowth	$p<.001$
tweezers	$p<.001$
root	$p=0.001$
coarse	$p=0.002$
scalp	$p=0.003$
pick	$p=0.006$
eyebrows	$p=0.007$
pleats	$p=0.014$
wiry	$p=0.024$
bald	$p=0.035$
wig	$p=0.053$
curly	$p=0.058$
bulb	$p=0.065$
eyelids	$p=0.086$
dandruff	$p=0.098$

3.4.4.1 Reanalysis of lexical decision data

Using the top 15 most arousing hair-related words, a 2 x 4 repeated measures ANOVA compared reaction times in milliseconds between TTM (N=28) and Normal Control (N=29) participants to our 4 word types: hair-related; anxiety/threat; neutral; and positive in a lexical decision experiment. Our aim was to see if using the "strongest" hair-related words would result in the Group x Word Type interaction that we did not obtain in experiment 4. Consistent with the findings of this experiment, there was a robust effect of word type, but no group by word type interaction, nor a main effect of group. In order to ensure that a group by word type interaction would not be obtained, the analysis was run again, this time including the 6 additional marginally significant hair-related words. The same patterns of non-significant results for a Group x Word Type interaction were maintained.

3.4.4.2 Reanalysis of Stroop data

Our aim was to see if using the "strongest" hair-related words would result in the Group x Word Type interaction that we did not obtain in experiment 5. Using the 15 strongest hair-related words with their matched items for anxiety/threat, neutral, and positive, another 2x4 repeated measures ANOVA was run to compare reaction times in milliseconds between TTM (*N*=70) and Normal Control (*N*=68) participants. On reanalysis, there was *no* effect of word type this time and no group by word type interaction. There was a main effect of group. In using the strongest hair-related words, we lost the main effect of word type from our 55 item hair-related Stroop. As the effects are not marginal, the decision was taken to not re-run the data with the additional 6 marginal items.

After revisiting the lexical decision and hair-related Stroop data, we are satisfied that our linguistic reaction time studies show no attentional bias to hair-related stimuli in participants endorsing symptoms of hair-pulling.

Chapter 4

Attentional bias to hair-related images

4.1 Introduction: transitioning from language to images in attentional bias in TTM

So far in this thesis, individuals with TTM have not demonstrated attentional biases in reaction time linguistic paradigms. The last experiment in Chapter 3 used a word-rating task and showed that people with TTM assign emotionality to hair-related linguistic stimuli by rating these words as more arousing than other word types (body image, neutral). This brings us up to date with the most recent and final experiment in this thesis. It is arguable that images have higher ecological validity than words due to them being more representative of everyday attention allocation. In this chapter, we will use a competitive dot probe paradigm presenting hair-related images that compete with matched neutral images to test attentional processing of more ecologically valid stimuli.

4.1.1 How images can be used in attentional bias

People demonstrate dissimilarities when they are exposed to external cues indicating reward and threat and these dissimilarities can be explained as being due to individual differences. For example, an addiction-related stimulus such as a wine bottle will not elicit the same response across all individuals because people vary in their interpretation of the stimulus. Similarly, a threat-related stimulus such as a spider will not elicit the same fear response across a single population. Cousijn, Goudriaan and Wiers (2011) investigated the concept of approach-bias using images. Using an Approach Avoidance Task (AAT) designed to measure biases in automatic action tendencies, they compared approach-bias towards cannabis and neutral images in heavy cannabis users (*N*=32) and a control group (*N*=32). After exposure to an image (either cannabis related or neutral), participants had to pull or push a joystick to increase or decrease the size of the image. Their findings revealed that heavy cannabis users exhibited an approach bias to cannabis related images as they opted to increase the size of these images. Pictorial paradigms are a powerful means of observing attention and how biases might moderate disorder-related behaviour. This chapter will now focus on how images (particularly dot probe paradigms) allow us to explore the complex nature of attention within a single paradigm.

4.1.2 Attentional processing of images in the dot probe task

As introduced in Chapter 1, an attentional bias reflects selective allocation of resources towards, or away from, a specific stimulus relative to other information that is accessible at the same time (Cisler, Bacon & Williams, 2009; Cisler & Koster, 2010). Typically, these biases are demonstrated in response to salient stimuli in the presence of competing neutral stimuli; for example, selective allocation of attention is directed towards stimuli pertaining to threat (Fox et al., 2002) and reward. Further, research has shown that in individuals with clinical conditions, an attentional bias to condition-related stimuli is also manifested (Koster, Crombez, Verschuere & De Houwer, 2004; Rudaizky, Basanovic, & MacLeod, 2014; Salemink, van den Hout & Kindt; 2007; Yiend & Mathews, 2001). The aim of this chapter is to investigate attentional biases in a population with symptoms of TTM and to observe if there are any differences in attention allocation towards hair-related stimuli. Consequently, this may help to explain why some individuals with TTM are unable to resist urges to pull their hair, even when the consequences of the behaviour frequently affect them both physically and psychologically. Finally, it may also shed light on the nature of TTM in terms of its current classification.

The dot probe task (Macleod, Mathews & Tata, 1986; Posner, Snyder & Davidson, 1980) is a paradigm investigating attentional bias. Participants view a fixation cross displayed on screen and then a salient experimental (e.g. disorder-related) and neutral stimulus are presented simultaneously to either side of the fixation cross location. On disappearance of the stimuli, a probe is then presented, appearing to the left or right of the fixation cross, replacing one of the previously presented stimuli. The location of the probe changes per trial. Participants respond by identifying the location of the probe, which either replaced the disorder-related stimulus or the neutral stimulus and response times in milliseconds (ms) are recorded. Modifying the stimulus duration within the dot probe paradigm allows closer investigation of different types of attentional processing. At short stimulus onset asynchronies (SOAs), for example, 250 ms, enhanced attentional engagement is demonstrated when detection of a probe replacing disorder-related stimuli is quicker than a probe replacing non disorder-related stimuli. Disengagement, on the other hand, is somewhat more complex. At longer SOAs (e.g., 1000 ms), probe detection provides more meaningful information about the nature of attentional maintenance. To identify the location of a probe replacing a neutral stimulus, attention must be shifted away from the disorder-related stimulus position on the other side of the fixation cross to the location where the neutral stimulus was presented.

4.1.3 The dot probe task and attentional bias to threat

A wealth of literature demonstrates the existence of strong attentional biases for threat-related stimuli using versions of the dot probe paradigm. However, the nature of cognitive biases is not straightforward. Early orientation towards and speeded disengagement from threat stimuli are indicative of early threat detection and avoidant coping mechanisms respectively (Dennis & Halberstadt, 2013; Koster, Crombez, Verschuere, Van Damme & Wiersema, 2006; Lee, Franklin, Turkel, Goetz and Woods (2012). Early disengagement suggests that individuals divert their attention away from threat upon immediate assessment of a stimulus as undesirable. On the other hand, delayed disengagement (slower orienting of attention away from) threat cues is also common in attentional bias literature. Opposite to avoidance, this can be diagnostic of too much attention towards aversive stimuli, inadvertently maintaining one's attention, in both non-anxious (Fox, et al., 2002) and highly anxious individuals (Koster et al., 2004; Rudaizky, et al., 2014; Salemink et al.; 2007; Yiend & Mathews, 2001).

4.1.4 The dot probe task and attentional bias to reward

To further understand attentional biases, it is appropriate to also consider the role that reward may play in predicting if one will have an attentional bias towards a salient stimulus. Conditions characterized by reward (e.g. addictions) demonstrate biases driven not by threat, but rather, by gratification. In contrast to biases driven by threat, reward biases are attributed to continued positive reinforcement provided by performance of the compulsive behaviour. In studies of overeaters, an attentional bias was identified in high external eaters (those sensitive to external food cues, regardless of hunger) (Brignell, Griffiths, Bradley & Mogg, 2009) and obese participants (Kemps, Tiggemann, & Hollitt, 2014) in response to food stimuli. Early attentional engagement at short SOAs (but not differential disengagement at longer SOAs) was also revealed in a dot probe task presenting sexually explicit cues to a group of hypersexual male participants (Mechelmans et al., 2014). In a study of active smokers compared with non-smokers in a spatial cueing task, Chanon and Sours (2010) found that smokers demonstrated early attentional engagement (at the shorter SOA) compared to non-smoking controls when locating a probe replacing smoking-related images.

Loeber et al. (2011) used a dot probe paradigm to assess attention to health warnings on cigarette packs. Their results revealed that light smokers (N=39; <20 cigarettes per day) tended to avoid cigarette packs containing pictorial health warnings (but not written health warnings), and focussed on the competing neutral picture. For heavy smokers (N=20; >20 cigarettes per day), there was no difference in attention allocation between pictorial health warnings and neutral pictures. These findings indicate that attentional bias toward smoking related cues reduces as the smoking habit increases. This has implications for smoking reduction, where heavy smokers appear less likely to be manipulated by health warnings.

4.1.5 The potential roles of threat and reward in TTM

As discussed earlier in this thesis, TTM was originally classified as an impulse control disorder (DSM-IV-TR, APA, 2000) before being reclassified as an obsessive-compulsive and related disorder (DSM-5, APA, 2013). Although this is a more appropriate classification than impulse control disorder due to the repetitive nature of hair-pulling, Odlaug, Chamberlain, Schreiber and Grant (2013) point out that the presence of strong impulsive characteristics in TTM are still difficult to overlook: (1) the over-valuation of available rewards (manifested in the immediate gratification from the pull), and (2) the under-evaluation of the longer-term negative effects (hair loss and affective correlates, i.e., shame, isolation, etc.). Therefore, TTM and its dual characteristics of threat and reward present us with an excellent opportunity to use images to explore how attentional processing might be maintaining TTM and its severity.

The majority of adult (Diefenbach, Tolin, Meunier, & Worhunsky, 2008; Grant, Odlaug, Woods, Keuthen, & Stein, 2012; Lochner et al., 2011), child and adolescent (Meunier, Tolin, & Franklin, 2009; Walther et al., 2014) hair-pullers report the act of hair-pulling as pleasurable. The immediate gratification from hair-pulling supports a positive reinforcement model of TTM (Roberts et al., 2013) which lies in direct contrast with the negative affective correlates also associated with hair-pulling (i.e., shame, depression). The nature of attentional biases in TTM is, therefore, complex. Attention allocation towards hair-pulling stimuli may represent reward-anticipation from pulling or threat detection from associated affective correlates. See Table 4.1 for an illustration.

Table 4.1. *Reward and threat model of TTM.*

Reward model of TTM	Threat model of TTM
"I enjoy pulling my hair, so hair-related images will grab and keep my attention."	"Pulling my hair makes me upset, so hair-related images will grab and keep my attention."

Note. TTM=trichotillomania

4.1.6 The dot probe task and TTM

Recent research by Lee, Franklin, Turkel, Goetz and Woods (2012) presented results supporting a model of facilitated early disengagement from hair-related and threat stimuli. In an exogenous dot probe cueing paradigm, participants (13 TTM, 20 Control) viewed hair-related, threat, and neutral images. Images were presented one at a time flanking either the left or right hand side of a central fixation cross for a duration of 250 ms, 500 ms or 1500 ms. After stimulus offset, a dot probe was presented on either the same or opposite side as the stimulus. There was no evidence of enhanced attentional engagement for hair-related stimuli across all stimulus durations for TTM and Control participants: that is, when the probe replaced the hair-related stimulus location, detection was no quicker than for probes replacing threat and neutral stimulus locations. When attentional disengagement was observed at the 1500 ms SOA when the probe replaced the location opposite to hair-related and threat stimuli, a between group difference was observed. The TTM group diverted their attention away from both hair-related and threat stimuli and located the probe more quickly compared with neutral stimuli. They did so more quickly than the control group whose ability to disengage from hair-related and threat cues to locate the probe was not as speedy. Lee et al. conclude that the similar pattern of results for early disengagement in individuals with TTM for both hair-related and threat images supports a model of attentional avoidance characterized by threat.

While these results suggest that hair-related stimuli are perceived negatively, it is possible that the pattern of results was due to particular aspects of Lee et al.'s (2012) experimental design. In their dot probe task, images flanked only one side of the central fixation cross automatically attracting attention (relative to a blank presentation on the other side). This means that participants did not have a choice of images competing for their attention during the stimulus presentations. Furthermore, Lee et al.'s hair-related images depicted 5 classic images of head hair only rated as being prototypical from a sample of 60 in a pilot study. This may have excluded a wider variety of hair-related scenes that could have provoked a different response in participants and, hence, a different pattern of results. Head hair, eyebrows and eyelashes are the most prominent areas for TTMs to pull from (Woods et al., 2006). Also TTMs report hairs of different textures and colours to be most interesting (Duke et al., 2009). Therefore, a more diverse and identifiably stronger set of hair-related images normed as having a high level of pulling urge, will allow us to investigate attentional processing more thoroughly. Finally, Lee et al. (2012) had a small sample size of 13 TTM participants. We recruited a larger set of self-reported TTM participants from a pool of people with varying hair-pulling severity. Further, our sample reported having sought support for their hair-pulling behaviour to allow for a representative group of hair-pullers who have felt impaired by their TTM symptomology.

4.2 The current study

This study aimed to compare people with TTM and a control group without TTM symptomology on attentional processing of hair-related images. As hair-related images have been shown to produce a bias for TTM participants (Lee et al., 2012), our study aimed to further investigate this by employing a modified version of the dot probe task where hair-related and neutral images competitively flanked both sides of a central fixation cross simultaneously. This allowed us to look more closely at attentional processing by introducing an image competing for participants' attention.

In our dot probe task, images were presented at two different stimulus durations, 250 ms and 1000 ms, followed by a 50 ms blank screen before a response was made. This means there was a short (300 ms) and long (1050 ms) stimulus onset asynchrony (SOA). In examining responses to stimuli at the short (300 ms) and long (1050 ms) SOAs, we were able to investigate the nature of attentional biases occurring in response to the stimuli: (1) attentional engagement where one's attention is initially grabbed by a stimulus at the early stages of attentional processing (300 ms SOA), and (2) attentional disengagement where one's attention is/is not maintained by a stimulus at a later stage of attentional processing (1050 ms SOA).

Due to the nature of symptoms, and therefore, potentially varied biases in TTM, we predicted an interaction between group (TTM vs Control), image type (hair-related vs neutral), and stimulus onset asychrony (300 ms vs 1050 ms). Individuals with TTM experience both reward-related (craving for, and gratification from, hair-pulling) and threat-related (negative affective correlates) symptoms associated with their hair-pulling condition. First, we hypothesized that the TTM group would demonstrate quicker engagement with hair-related images relative to neutral images at the early 300 ms SOA due to vigilance for stimuli (i.e., disorder-related images) pertaining to their hair-pulling condition. Secondly, we also hypothesized that the TTM group would demonstrate delayed (slower) disengagement from hair-related images relative to neutral images at the longer 1050 ms SOA compared to the control group. The TTM group should find these images maintain their attention more than the competing neutral images that are not disorder-related and so, take longer to disengage their attention from to identify the probe in the opposite neutral image location at the 1050 ms SOA.

4.2.1 Method

Before moving onto our dot probe task, it was necessary to first norm the images that would be used in the task. A picture rating pre-test served as an exploratory norming study for our dot probe study investigating attention to hair-related stimuli in people with symptoms of trichotillomania.

4.2.1.1 Participants

Forty-five self-reported TTM participants were recruited via TTM online support sites. The sample consisted of females who reported that they had symptoms of hair-pulling. Thirty-nine control participants were recruited opportunistically via the School of Psychology's subject pool (http://experiments.psy.gla.ac.uk) and word of mouth and were females who reported no symptoms of hair-pulling behaviours. All participants completed the Massachusetts General Hospital Hair-Pulling Scale (MGH-HS) (Keuthen et al., 1995) to confirm classification into the hair-pulling and control group. The TTM sample participated voluntarily (due to location) whilst control participants received one course credit for their participation. Participant data is presented in Table 4.2. The study was approved by the University of Glasgow's ethics committee.

Table 4.2. *Participant information*

Characteristic	TTM (*N*=45)	Control Group (*N*=39)
Age % (*N*)		
16-24	40 (18)	23.1 (9)
25-34	31.1 (14)	25.6 (10)
35-44	17.8 (8)	20.5 (8)
45-54	11.1 (5)	30.8 (12)
MGH-HS score		
Mean (*SD*)	16.3 (4.1)	-
Range	10-27	-

Note. TTM = trichotillomania; MGH-HS = Massachusetts Hospital Hair-Pulling Scale

4.2.1.2 Materials and measures

Hair-pulling severity. The Massachusetts General Hospital Hair Pulling Scale (MGH-HS) (Keuthen et al., 1995) was used to assess hair-pulling severity. The MGH-HS is presented in Appendix A.

Stimuli. The pictorial norming task contained 29 hair-related images: 9 depicting eyebrows and eyelashes, 6 depicting hairstyles and head hair; 6 depicting close-up images of hair/stubble; and 8 depicting hair appliances and cosmetic appliances (see Figure 4.1 for examples and Appendix J for the full set of images). All images were selected or created for the purpose of the study and were sized to 10 cm x 10 cm.

Figure 4.1. Examples images in picture rating pre-test.

4.2.1.3 Procedure

We used a remote online experiment custom made on surveymonkey.com. Participants were informed that the study required them to view a series of images and rate them. There were 3 experimental blocks. Within each block, all 29 images were rated one at a time on a 9 point likert scale: block 1 - ratings of urge to pull one's own hair (where 1=extremely strong, 5=neutral, 9=not at all); block 2 - ratings of emotion/affect (where 1=very sad, 5=neutral, 9=very happy); and block 3 - ratings of attractiveness/valence (where 1=extremely attractive, 5=neutral, 9=extremely unattractive). Once a response to a trial was made, participants pressed "next" and the next image appeared on screen. In total, there were 87 stimulus presentations (29 urge ratings, 29 emotion ratings, 29 attractiveness ratings). In each block, images were presented so that image type differed from trial to trial (i.e., "head hair" image, followed by "hair and cosmetic appliance" image, followed by "close up" image, and so on). The order of the images was the same for each participant and for each block. The norming task was presented on a white background as shown in Figure 4.2. On completion of the norming task, participants were requested to complete the Massachusetts General Hospital Hair-pulling Scale (MGH-HS) to assess the severity of any hair-pulling symptoms and confirm classification to either the TTM or control group.

Example “urge” rating Example emotion/affect rating Example valence rating

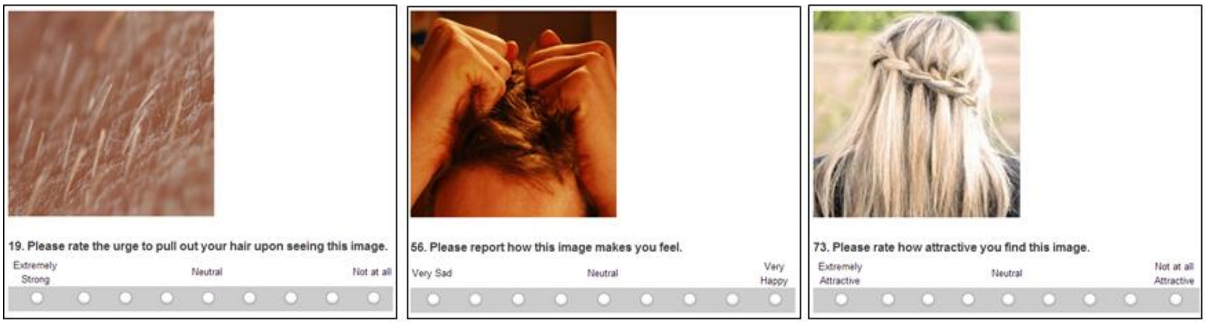


Figure 4.2. Example picture rating trials

4.2.2 Results

Ratings of urge

Our first aim was to identify the images rated highest in urge-inducing qualities (as indicated by a lower rating on the 9 point Likert scale) by the TTM group compared with ratings by the control group. Twenty-nine Bonferroni corrected independent t-tests with adjusted alpha levels of 0.0017 were carried out to compare ratings of images between TTM and Normal Control participants. TTM participants rated 20 images significantly higher in urge to pull (all $p < 0.001$). Data for all images are presented in Table 4.3. The top 8 images as rated by the TTM group are shown in Figure 4.3.

Table 4.3 *Ratings of urge to pull one's own hair upon viewing hair-related images*

Image	Rank /29	Image type	TTM mean rating (*SD*)	Range (min-max)		Control group mean rating (*SD*)	Range (min-max)		Significance level
21	1	Close-up hair	3.5 (2.8)	1	9	8.0 (2.1)	1	9	*p*<0.001
20	2	Close-up hair	3.6 (2.7)	1	9	7.7 (2.2)	1	9	*p*<0.001
19	3	Close-up hair	4.2 (2.2)	1	9	8.2 (1.7)	1	9	*p* <0.001
18	4	Close-up hair	4.5 (2.6)	1	9	8.1 (1.8)	1	9	*p*<0.001
5	5	Eyebrows/eyelashes	4.5 (3.2)	1	9	7.6 (2.1)	1	9	*p*<0.001
17	6	Close-up hair	4.5 (3.1)	1	9	7.9 (2.2)	1	9	*p*<0.001
11	7	Head hair	4.7 (2.8)	1	9	8.2 (1.5)	1	9	*p*<0.001
2	8	Eyebrows/eyelashes	4.8 (3.3)	1	9	8.0 (1.8)	1	9	*p*<0.001
16	9	Close-up hair	5.2 (2.8)	1	9	8.5 (1.3)	1	9	*p*<0.001
4	10	Eyebrows/eyelashes	5.4 (3.2)	1	9	8.3 (1.5)	1	9	*p*<0.001
6	11	Eyebrows/eyelashes	5.8 (3.1)	1	9	8.8 (0.8)	1	9	*p*<0.001
29	12	Appliances	5.9 (2.9)	9	6	8.1 (1.9)	9	7	*p*<0.001
3	13	Eyebrows/eyelashes	6.1 (3.1)	1	9	8.3 (1.6)	1	9	*p*<0.001
14	14	Head hair	6.3 (2.6)	1	9	8.5 (1.4)	1	9	*p*<0.001
1	15	Eyebrows/eyelashes	6.4 (2.9)	1	9	8.7 (1.0)	1	9	*p*<0.001
7	16	Eyebrows/eyelashes	6.7 (2.8)	1	9	8.9 (0.7)	1	9	*p*<0.001
15	17	Head hair	6.7 (2.3)	2	9	8.6 (1.2)	2	9	*p*<0.001
8	18	Eyebrows/eyelashes	6.8 (2.9)	1	9	8.8 (0.9)	1	9	*p*<0.001
9	19	Eyebrows/eyelashes	6.9 (2.4)	2	9	8.7 (1.0)	2	9	*p*<0.001
12	20	Head hair	7.1 (2.4)	2	9	8.8 (0.9)	2	9	*p*<0.001
13	21	Head hair	7.7 (2.1)	2	9	8.8 (0.8)	2	9	*p*=0.003
10	22	Head hair	7.9 (1.9)	1	9	8.7 (1.1)	1	9	*p*=0.032
27	23	Appliances	8.1 (2.0)	1	9	8.9 (0.7)	1	9	*p*=0.028
28	24	Appliances	8.2 (1.7)	2	9	8.9 (0.7)	2	9	*p*=0.018
26	25	Appliances	8.3 (1.7)	2	9	8.8 (0.9)	2	9	*p*=0.117
23	26	Appliances	8.4 (1.5)	3	9	8.9 (0.6)	3	9	*p*=0.044
24	27	Appliances	8.4 (1.4)	3	9	8.9 (0.6)	3	9	*p*=0.038
22	28	Appliances	8.4 (1.3)	4	9	8.9 (0.6)	4	9	*p*=0.046
25	29	Appliances	8.7 (0.9)	5	9	8.9 (0.6)	5	9	*p*=0.341

Note. A lower rating indicates a higher rating of urge to pull one's hair. TTM = trichotillomania.

Figure 4.3. Most urge-inducing 8 images as rated by TTM participants.

Ratings of emotion/affect

Upon identifying our top 8 rated images for urge to pull one's hair, we then compared ratings of emotional effect for these 8 hair-related images between TTM and control participants. Eight Bonferroni corrected independent t-tests with adjusted alpha levels of 0.00625 were carried out to compare ratings of images between TTM and Normal Control participants. TTM participants rated 4 images significantly lower in emotional affect than the control group (see Figure 4.4). The emotionality ratings of the 8 top rated images for urge are displayed in Table 4.4.

Table 4.4. *Ratings of emotional affect upon viewing hair-related images*

Image	**Rank /29**	**Image type**	**TTM mean rating (*SD*)**	**Range (min-max)**		**Control group mean rating (*SD*)**	**Range (min-max)**		**Significance level**
21	1	Close-up hair	3.5 (2.1)	1	9	4.2 (1.1)	1	6	*p*=0.053
20	2	Close-up hair	3.5 (1.7)	1	5	4.6 (0.7)	2	6	*p*<0.001
19	3	Close-up hair	4.0 (1.4)	2	9	4.7 (0.5)	3	5	*p*=0.006
18	4	Close-up hair	4.3 (1.3)	1	9	4.7 (0.5)	3	5	*p*=0.079
5	5	Eyebrows/eyelashes	3.8 (1.5)	1	6	4.8 (0.5)	3	5	*p*<0.001
17	6	Close-up hair	3.8 (1.7)	1	9	4.6 (0.9)	2	7	*p*=0.009
11	7	Head hair	4.3 (1.6)	1	9	4.7 (0.6)	3	5	*p*=0.146
2	8	Eyebrows/eyelashes	3.8 (1.4)	1	9	4.6 (0.6)	3	5	*p*=0.001

Note. A lower rating indicates a lower rating of emotional affect (1=very sad, 9= very happy). TTM=trichotillomania.

Figure 4.4. Hair-related images eliciting significantly different emotional effect between the TTM and control group.

Ratings of attractiveness/valence

Finally, we compared the attractiveness/valence ratings of the images rated as highest in urge to pull one's hair, by TTM and Normal Control participants. Eight Bonferroni corrected independent t-tests with adjusted alpha levels of 0.00625 were carried out to compare ratings of images between TTM and Normal Control participants. TTM participants rated only 1 image significantly lower in attractiveness. The attractiveness ratings of the 8 top rated images for urge are displayed in Table 4.5.

Table 4.5. *Ratings of attractiveness for hair-related images*

Image	Rank /29	Image type	TTM mean rating (*SD*)	Range (min-max)		Control groupl mean rating (*SD*)	Range (min-max)		Significance level
21	1	Close-up hair	7.4 (2.5)	1	9	8.0 (2.0)	1	9	*p*=0.196
20	2	Close-up hair	7.5 (2.1)	1	9	7.5 (2.0)	1	9	*p*=0.919
19	3	Close-up hair	7.7 (1.7)	3	9	6.9 (1.9)	3	9	*p*=0.070
18	4	Close-up hair	7.0 (1.5)	4	9	6.3 (1.9)	1	9	*p*=0.048
5	5	Eyebrows/eyelashes	6.4 (1.7)	2	9	5.9 (1.2)	4	9	*p*=0.144
17	6	Close-up hair	8.0 (1.5)	3	9	7.5 (2.0)	1	9	*p*=0.222
11	7	Head hair	6.6 (2.0)	1	9	6.4 (2.0)	2	9	*p*=0.629
2	8	Eyebrows/eyelashes	7.5 (1.6)	3	9	6.6 (1.5)	5	9	*p*=0.012

Note. A lower rating indicates a higher rating of attractiveness. TTM=trichotillomania

4.3 Experiment 6. An investigation of attentional bias towards hair-related cues in a dot probe task in TTM

Using the top-rated images for urge-inducing qualities, we carried out our dot probe study to investigate attentional bias towards hair-related images in TTM**.**

4.3.1 Method

4.3.1.1 Participants

Thirty-one self-reported TTM participants were recruited via online support sites for hair-pulling symptoms. The sample consisted of females who reported that they had symptoms of hair-pulling and had sought support for their hair-pulling behaviour. Forty-three control participants were recruited opportunistically via the School of Psychology's subject pool (http://experiments.psy.gla.ac.uk) and were females who reported no symptoms of hair-pulling behaviors. All participants were administered the Massachusetts General Hospital Hair-Pulling Scale (MGH-HS) to confirm classification into the hair-pulling and control group. Participant data is presented in Table 4.6. The TTM group scored significantly higher than the control group on TTM severity as measured by the MGH-HS ($t(30)=18.93$, $p<.001$). The TTM group was also significantly older than the

Control group ($t(72)=2.06$, $p=.044$). The study was approved by the University of Glasgow's ethics committee.

Table 4.6. *Participant information.*

	Age			MGH-HS		
	M	SD	Range	M	SD	Range
Group						
TTM (*N*=31)	31	13	16-63	15.3	5.23	5-25
Control (*N*=43)	26	9.8	18.58	0	0	-

Note. TTM = trichotillomania; MGH-HS = Massachusetts Hospital Hair-Pulling Scale

4.3.1.2 Materials and measures

Hair-pulling severity. The Massachusetts General Hospital Hair Pulling Scale (MGH-HS) (Keuthen et al., 1995) was used to assess hair-pulling severity and is presented in Appendix 1.

Stimuli. An initial set of 29 images was previously normed in our picture norming pre-test (see section 4.2 and Appendix J for the full image set). We selected the 8 hair-related images that were rated highest in inducing hair-pulling urges in the TTM group compared to the control group. The final 8 hair-related images were then matched with a control neutral image for content (i.e. colour, shape). Each neutral image was selected as having an overall similar visual pattern as its hair-related counterpart, while being clearly different and lacking hair-related content. All images were resized to 310 x 310 pixels. Images are presented in Figure 4.5.

Figure 4.5 Hair images matched with neutral images. *Note*. H = Hair-related image, N = Neutral Images. *Note*. Images are not to scale.

Dot probe task. The dot probe task employed the final image set as shown in Figure 4.5. We utilized a custom-made dot probe experiment using Flash Adobe software (http://experiments.psy.gla.ac.uk[3]). Each trial (see Figure 4.6) consisted of the following: a blank screen with a central white fixation cross (+) was presented for 300 ms followed by a blank screen for 500 ms. Next, two images (one Hair-related, one Neutral) were displayed, one on the left of the presentation screen, and one on the right, for a duration of either 250 ms or 1000 ms. Next, a blank screen was presented for 50 ms and a then probe appeared on either the left of the right of the screen replacing one of the previous stimulus locations. The probe remained until participants responded by pressing the "c" key with the left forefinger to make a left dot probe location and by pressing the "m" key with the right forefinger to make a right dot probe response. Experimental trials were presented in a random order for each participant. Participants first completed 8 trials (one Hair-related, one Neutral) to become familiar with the task.

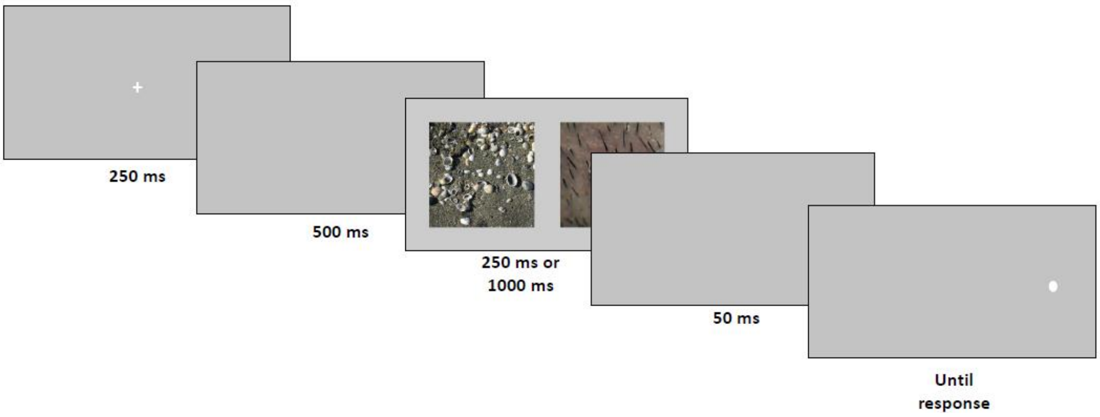


Figure 4.6. Dot probe paradigm trial sequence. *Note*. Fixation cross, stimuli, and probe are not to scale.

A 2 (stimulus duration[4]: 250 ms, 1000 ms) x 2 (Group: TTM, Control) x 2 (Target Image: Hair-related, Neutral) x 2 (Probe location: left of fixation cross, right of fixation

[3] https://experiments.psy.gla.ac.uk// is an online interface built and maintained by webmaster Mr Marc Becirspahic. It uses the plugin Flash within the browser and is as accurate as any other software running on its own (outside the browser). This is the main interface used for online studies run by The School of Psychology.

[4] Images were presented for either a 250 ms or 1000 ms stimulus duration followed by a 50 ms blank screen before probe detection. This resulted in a 300 ms or 1050 ms stimulus onset asynchrony (SOA) respectively.

cross) mixed design led to 8 conditions being presented: (1) 250 ms left hair-related probe, (2) 250 ms left neutral probe, (3) 250 ms right hair-related probe, (4) 250 ms right neutral probe, (5) 1000 ms: left hair-related probe, (6) 1000 ms left neutral probe, (7) 1000 ms right hair-related probe, (8) 1000 ms right neutral probe. In addition to the original matched image pairing (e.g. H1 and N1), each image was also paired with the other 7 control images, e.g. H1-N1, H1-N2, H1-N3, and so on. Trials were counterbalanced for Target Image (left, right). Participants were presented with 512 trials in total with 1 programmed break. There were two blocks (also randomized per participant) with 256 trials in each block.

4.3.1.3 Procedure

Before the experiment, participants reported whether or not they had symptoms of TTM. Those who did self-report TTM symptoms were selected if they had sought support for their hair-pulling behaviours. No individuals from either the TTM or the Control group withdrew from the experiment after this initial screening. Participants were informed that the study required them to view a series of pairs of images and then detect the location of a dot, followed by a brief questionnaire that would ask them about any hair-pulling behaviours that they may have/not have. They then completed the dot probe task individually via remote online experiment. On completion of the dot probe task, participants completed the MGH-HS to confirm allocation to either the TTM or the Control group and to provide a hair-pulling severity score for the TTM group.

4.3.2 Results

Incorrect responses (1.52%) were removed prior to analysis. Trials with RTs < 250 ms and > 1500 ms (0.98% of the total data) were also removed prior to analysis. Total data loss accounted for 2.5% of the data.

Table 4.7 and Figure 4.7 present the mean reaction times in ms to identify the location of the probe. To compare the attentional engagement and disengagement scores for the two SOAs, we conducted a 2 (SOA: 300 ms vs 1050 ms) x 2 (Group: TTM vs Control) x 2 (Target Image: Hair-related vs Neutral) mixed-design ANOVA to explore reaction times (in ms) to identify the location of the probe (left/right of the fixation cross).

Table 4.7. *Mean RTs (and standard deviations)in ms to detect the location of the probe as a function of SOA (300 ms, 1050 ms) Group (TTM, Normal Control), and Target Image (Hair-related, Neutral).*

	300 ms SOA		**1050 ms SOA**	
	TTM	**Control**	**TTM**	**Control**
Target Image	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*
Hair-related	493 (78)	452 (56)	508 (75)	460 (60)
Neutral	509 (97)	461 (56)	539 (102)	467 (64)

Note. TTM = Trichotillomania, SOA = Stimulus Onset Asynchrony.

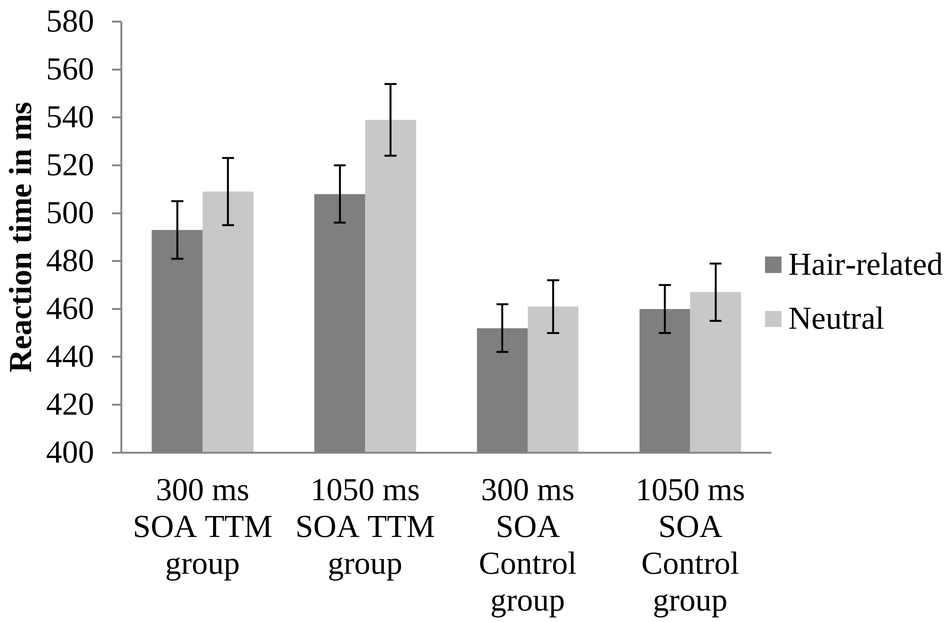


Figure 4.7. Mean RTs in ms (error bars display standard error) displaying the relationship between SOA (300 ms, 1050 ms) Group (TTM, Normal Control), and Target Image (Hair-related, Neutral). *Note*. TTM = Trichotillomania, SOA = Stimulus Onset Asynchrony.

There was a significant main effect of stimulus duration (300 ms vs 1050 ms), where responses to detect the probe were slower for images presented at the 1050ms SOA (*M*=489 ms, *SD*=80 ms) than at the 300 ms SOA (*M*=475 ms, *SD*=74), $F(1,72)=5.96$, *p*=.017. There was also a main effect of Group (TTM vs Control), *F*(1,72)=11.06, *p*=.001 where the TTM group was slower (*M*=512 ms, *SD*=89 ms) than the Control group (*M*=460 ms, *SD*=59 ms) in identifying the location of the probe. Finally, the main effect of Target Image (Hair-related vs Neutral) was also significant *F*(1,72)=21.65, *p*<.001. Location of the probe following presentation of Hair-related images (*M*=475 ms, *SD*=69 ms) was quicker than for Neutral images (*M*=489 ms, *SD*=84 ms).

We investigated this further by examining interactions between SOA, Group, and Target Image. There was no 2-way interaction of SOA by Group (*F*<1) nor SOA by Target Image (*F*<1). However, when examining Group by Target Image, there was a significant 2-way interaction, *F*(1,72)=6.05, *p*=.016. Finally, a 3-way interaction of SOA (300 ms vs 1050 ms), Group (TTM vs Control), and Target Image (Hair-related vs Neutral) was also significant, *F*(1,72)=4.97, *p*=.029 (see Figure 4.7).

Next, to explore the interactions more closely, we examined whether SOA (300 ms vs 1050 ms) was moderating reaction times to locate the probe for both Group (TTMs vs Controls) and Target Image (Hair-related vs Neutral). Repeated measures ANOVAs for both the 300 ms and 1050 ms SOA were carried out to examine Group (TTM vs Control) and Target Image (Hair-related vs Neutral).

300 ms SOA. There was a main effect of Group where the TTM group were slower (*M*=501 ms, *SD*=87 ms) than the Control group (*M*=457 ms, *SD*=56 ms) in detecting the location of the probe: *F*(1,72)=7.29, *p*=.009. There was also a main effect of Target Image, where responses were quicker when the probe replaced a Hair-related image (*M*=470 ms, *SD*=69 ms) compared to a Neutral image (*M*=481 ms, *SD*=79): *F*(1,72)=15.69, *p*<.001. There was no 2 x 2 interaction of Target Image and Group: *F*(1,72)=1.73, *p*=.192. TTM and Control participants did not differ in the time taken to identify the probe when it replaced either a Hair-related or Neutral image at the shorter SOA.

1050 ms SOA. A main effect of Group was revealed. The Control group (*M*=464 ms, *SD*=62 ms) was quicker than the TTM group (*M*=524 ms, *SD*=90 ms) in detecting the location of the probe, $F(1,72)=12.19$, $p=.001$. There was also a significant main effect of Target Image where responses for locating the probe were quicker when it replaced Hair-related images (*M*=481 ms, *SD*=70 ms) compared to Neutral images (*M*=497 ms, *SD*=89 ms), $F(1,72)=17.98$, $p<.001$. There was also a 2 (Group) by 2 (Target Image) interaction at the 1050 ms SOA. $F(1,72)=7.68$, $p=.007$. As shown in Table 4.6 and Figure 4.7, at the longer SOA, participants with TTM symptomology took significantly longer than control participants to identify the location of the probe when it replaced a Neutral Target Image, $t(46.8)=3.45$, $p<.001$ (df adjusted for Greenhouse Geisser).

Further exploratory analysis of TTM severity

The greater variability in response times within the TTM group (compared with the Control group) motivated an additional exploratory analysis. The aim was to examine whether or not TTM severity as measured by the MGH-HS predicted response times within the TTM group and to confirm that there was no variability in response times within the TTM group based on hair-pulling severity. A median split divided the TTM group into two sub groups: TTM High (N=16, MGH-HPS=16-25) and TTM Low (N=15, MGH-HPS=5-15). Descriptive data are presented in Table 4.8. A mixed-design ANOVA comparing SOA (300 ms, 1050 ms), Group (TTM High, TTM Low), and Target Image (Hair-related, Neutral) was carried out.

Table 4.8. *Mean RTs (and standard deviations) in ms to detect the location of the probe as a function of SOA (300 ms, 1050 ms), TTM severity (TTM High, TTM Low), and Target Image type (Hair-related, Neutral).*

	300 ms SOA		**1050 ms SOA**	
	TTM High	**TTM Low**	**TTM High**	**TTM Low**
Target Image	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*
Hair-related	500 (72)	486 (81)	502 (68)	514 (83)
Neutral	520 (111)	498 (80)	547 (118)	530 (85)

Note. TTM = Trichotillomania, SOA = Stimulus Onset Asynchrony.

There was a significant main effect of SOA (300 ms, 1050 ms), $F(1,29)=5.07$, $p=.032$) where responses to locate the probe were faster at the 300 ms SOA. However, there was no main effect of Group, $F<1$. TTM severity did not affect reaction times to identify the location of the probe. A main effect of Target Image was revealed between the TTM High and TTM low group, $F(1,29)=10.2$, $p=.003$. Reaction times to locate the probe were quicker when the probe replaced a Hair-related Target Image compared with Neutral images.

To further examine any variability in the TTM group overall, we examined interactions. There was no 2-way interaction of SOA by Group ($F<1$) and the 2-way interaction of SOA and Target Image type was marginal, $F(1,29)=3.58$, $p=.069$. The 2-way interaction of Group by Target Image was also non-significant, $F(1,29)=1.73$, $p=.198$. Finally, the 3-way interaction of SOA (300 ms vs 1050 ms), Group (TTM High vs TTM Low), and Target Image (Hair-related vs Neutral) was also non-significant: $F(1,29)=1.76$, $p=.196$. This exploratory analysis supports the idea that the TTM participants' severity did not bias responses in locating the probe.

4.3.3 Discussion

This study investigated attentional bias to hair-related cues in individuals with and without TTM symptomology. To our knowledge, this study is the first to investigate attention to hair-related cues in a modified dot probe paradigm using images competing for attention. Our findings indicate that TTM is not characterised by quicker attentional engagement towards hair-related stimuli. Although responses at the earlier stage of attentional processing (300 ms SOA) were quicker across all participants when the probe replaced a hair-related image, the bias was not stronger for the TTM group.

Further, our results suggest that individuals with TTM have difficulty disengaging from hair-related stimuli at later stages of attentional processing (1050 ms SOA). They exhibited greater slowing to identify the probe when it replaced a neutral image at the 1050 ms SOA, compared to the control group. Our evidence for delayed disengagement suggests that hair-related stimuli have an advantage over neutral stimuli in maintaining the attention of individuals with TTM.

Previously, the findings of Lee et al. (2012) suggested an attentional avoidance model for TTM (i.e., quickly diverting one's attention away from information perceived as emotionally threatening). This is contrary to our results demonstrating attention maintenance upon viewing hair-related stimuli. Lee et al. showed via a single-target dot probe paradigm that people with TTM demonstrated faster disengagement from hair-related images. In their study, at the longer SOA, the TTM group identified the probe more quickly when it replaced the location opposite to hair-related stimuli, relative to neutral stimuli (the same trend was found for threat stimuli). Lee et al. explained their pattern of results in terms of threat detection: TTM participants quickly disengaged from hair-related and threat cues that they perceived as threatening. Early disengagement in response to threatening stimuli is supported by some literature (e.g., Dennis & Halberstadt, 2013; Koster et al., 2006), however, should we consider and expand on a threat model of TTM, our pattern of results are in line with the majority of experimental evidence where threat detection is characterized by *delayed* disengagement (Fox et al., 2006; Koster et al., 2004; Rudaizky et al., 2014; Salemink et al., 2007; Yiend & Mathews, 2001). Fox et al., (2002) suggested that difficulty disengaging from material perceived as threatening might be due to rumination, this is, continued reflection of an unpleasant stimulus. Further, attentional biases attributed to rumination are also thought to maintain other mental health conditions such as depression (Clasen, Wells, Ellis & Beevers, 2013).

According to the comprehensive behavioral (ComB) model of TTM (Mansueto et al., 1997) hair-pulling can be viewed in the framework of an ABC model: Antecedents (i.e., stimuli/ cues that prompt urges to pull one's hair); Behaviours; and Consequences. In the context of our results from the dot probe study that utilised hair-related images portraying stimuli/ cues that capture the attention of individuals with TTM, it is noteworthy to consider the first part of the framework, antecedents, in more detail. External cues include locations associated with pulling (e.g., bathroom, car) and objects associated with pulling (e.g., implements such as tweezers). Internal cues comprise affective states (e.g., boredom, excitement) and sensations (e.g., texture/visual appearance of hair). It is the external antecedents that are relevant to our results demonstrating delayed disengagement as we used pictorial stimuli depicting hair-related stimuli. Upon first view, external cues may not appear to be directly related to hair-pulling (viewing tweezers would not elicit a hair-pulling urge in all individuals who view them), however, for a hair-puller who frequently uses tweezers to pull, this stimulus can become associated with hair-pulling and therefore prompt a hair-pulling urge.

In the context of our modified dot probe paradigm, we must consider how hair-pulling urges can be reinforced by the actual hair-pulling behaviour. It is difficult to tease apart and understand the exact nature of the attentional bias that is underlying the delayed disengagement from hair-related cues demonstrated in our results. As suggested by Mansueto et al. (1997) both positive and negative reinforcement seem to be provided by hair-pulling as a means of regulating emotions. In the context of a threat model, identification of, and trouble disengaging from, hair-related cues would indicate that these cues are interpreted as negative and therefore difficult to disengage from. The delayed disengagement demonstrated in our results in response to hair-related cues could be due to one of, or several reasons: because they fulfil the threat model or that they serve as a distraction from unpleasant emotions that are associated with hair-pulling cycles and therefore, as a reward model of attentional bias in TTM. Two studies investigating Italian samples of self-reported hair-pullers (Bottesi et al., 2016; Ghisi et al., 2013) showed negative states that increased pre to post pulling included shame, sadness, anger and frustration. At the same time, both samples reported increased pleasure and relief, and decreased anxiety pre to post pulling. Thus, potentially both threat and reward are relevant in the hair-pulling experience.

Our additional exploratory analysis aimed to detect any variance within the TTM group by comparing the TTM High group (*N*=16, MGH-HS=16-25) and TTM Low group (*N*=15, MGH-HS=5-15) on reaction times to locate the probe. At both the short (300 ms) and long (1050 ms) SOA, attentional processing of hair-related stimuli, relative to neutral stimuli, was not affected by hair-pulling severity. This suggests that our overall TTM group (*N*=31) group was homogenous in their attentional processing of hair-related stimuli, as reflected by the similar reaction times to locate the probe in the TTM High and TTM Low group. Our sample of self-reported hair-pullers was selected on the basis of them having previously sought support for their hair-pulling behavior. Emotional affective correlates such as associated distress and shame (Roberts et al., 2015; Singh et al., 2015; Weingarden et al., 2015) are common precursors for support-seeking in TTM and this sampling method provided a homogenous group to investigate biased attentional processing.

The fact that we normed the images in terms of urge inducing qualities was a strength of our study. Prior to a hair-pulling episode, multiple cues can trigger an urge to pull one's hair, and rituals often follow post-pull (e.g., touching of the hair, examining the root) (Madjar & Sripada, 2016). As multiple cues can trigger an urge to pull and we normed our images for urge-inducing qualities for use in our dot probe study (images containing eyebrows, eyelashes, and close up hair), our results are reflective of daily triggers for TTM, and not just prototypical images of head hair as in Lee et al. (2012). Further, the use of competitive images flanking both sides of the fixation cross allowed TTM participants to demonstrate a bias towards hair-related cues when competing with neutral images. To fully explore the nature of the attentional bias, future dot probe paradigms should employ a competitive paradigm comparing hair-related images not only with neutral images, but also threat images as in the study by Lee et al. (2012) and positive images competing for attention with TTM images. This will allow us to see if TTMs respond similarly towards threat images when faced with a variety of hair-related images or if a reward bias might be manifested.

Overall, our pattern of results provides evidence for biased attentional processing of hair-related cues in people reporting TTM symptomology, irrespective of hair-pulling severity. Specifically, this attentional bias appears to be characteristic of attentional maintenance. This raises several implications about the role of delayed disengagement in TTM psychopathology and how this may influence one's experience with their hair-pulling condition.

Chapter 5

General discussion

The aims of this research in this thesis were to investigate and contribute to limited existing research on attitudes towards, and attentional biases in, TTM. This final chapter will discuss the results of the research studies throughout this thesis.

5.1 Summary of experimental findings

Before commencing an in depth investigation on lower-level attentional biases in TTM, Chapter 2 began by using a higher-level vignette task that investigated stigmatising attitudes towards protagonists presenting symptoms of hair-loss and skin-lesioning due to different underlying causes (BFRB/ non-BFRB). Depression was included as a control vignette to acquire stigma-ratings towards a condition with no observable physical symptoms. Our results illustrated clear attitudinal differences both between groups (TTM, control) and within groups (perceived controllable: TTM, CSP; and perceived uncontrollable: alopecia, psoriasis). The results of Experiment 1 are indicative of increased public stigma towards people with BFRBs relative to matched visible conditions that are perceived as uncontrollable. These findings are in line with existing literature that perceived controllability drives negative attitudes towards disorders perceived as controllable (Corrigan et al., 2000; Weiner et al., 1988) and more specifically, negative attitudes from the public towards BFRB behaviours (Boudjouk et al., 2000, Marcks et al., 2005; Ricketts et al., 2012).

Further, the role of knowledge, experience, and awareness of TTM (and BFRBs) appears to be important in how people with BFRBs are viewed (Woods et al., 1999). Experiment 1 also investigated how people with TTM rated others with a BFRB (TTM, CSP) and matched conditions (alopecia, psoriasis) when the observable physical symptoms were similar. Our findings showed that our TTM group rated the 4 groups with physical observable symptoms similarly, consistent with our hypothesis. However, contrary to our prediction that all 5 vignettes would receive similar stigmatising attitude ratings, the TTM group rated the depression vignette significantly higher. It is possible that the physical external observable symptoms of the BFRB (TTM, CSP) and non BFRB (alopecia, psoriasis) vignettes were viewed by the TTM group as being very much in common with their daily experience, contrary to depressed mood which is somewhat more internalised and not always a daily experience. In further studies investigating stigma towards TTM and other BFRBs, one can also investigate the role of self-stigma. In order to distinguish public and self-stigma, self-stigma is the internalisation of mental health stereotypes. In internalising these, people with mental illness form negative self-perceptions that can further lead to barriers to treatment, and ultimately, recovery (Corrigan, 1994). This study and its results highlight the importance of increasing the understanding of, and further research into, TTM (and BFRBs). It demonstrates that the impact of BFRB behaviours goes beyond the core disorder symptoms experienced by BFRB individuals.

Chapter 2 proposed that stigma and shame may be functionally related in TTM. In Experiment 2, we focussed specifically on the negative affective correlate of shame using a modified Stroop paradigm to investigate reaction time latencies to shame-related, positive, and neutral words in a self-reported hair-pulling sample versus a control group. While some literature has shown the experience of shame to be present in people with TTM (Casati et al., 2000; du Toit et al., 2001, Nobel, 2012; Penzel, 2003; Singh at al., 2016), our results did not reflect an attentional bias towards shame-related words in our TTM sample. Our reaction time research findings in Experiment 2 revealed neither a main effect of group (TTM, control), word type (shame-related, neutral, positive), nor group by word type interaction. As Casati et al. (2000) and Nobel (2012) suggest, the experience of shame and hair-pulling behaviours may be a bidirectional relationship. Further, it is possible that our shame-related words were not the most appropriate for a TTM sample. Using the

Experience of Shame Scale (Andrews et al., 2002), Nobel's (2012) findings showed that people with TTM don't only experience higher general shame, but higher characterological, behavioural, and body shame. The majority of our shame-related words inspired from Sippel and Marshall's (2011) modified Stroop study into people with PTSD were general and characterological shame-related words, and particularly, socially threatening words pertaining to judgement and failure. While these words may contribute to maladaptive schemata, the inclusion of behavioural and body shame-related words may have made our word-set more representative of words endorsed by a TTM sample. Our TTM sample also demonstrated variability, with hair-pulling severity ranging from 10 to 26 (out of 28) on the MGH-HS. It is prudent to consider that shame in our TTM sample was not high enough to affect shame-related word processing. These suggestions, however, are speculative and it must also be considered that our TTM sample did not experience any bias when presented with shame-related words. A more general discussion of the use of linguistic stimuli is addressed later in this discussion.

Further reaction time studies (Experiments 3 and 4) investigated differences in the processing of hair-related words (matched with positive, negative and neutral words). In Experiment 3 using a Lexical Decision task, our results yielded no group (TTM, control) by word type (anxiety, hair-related, neutral, positive) interaction. Self-reported hair-pullers exhibited no differences in response times to hair-related linguistic stimuli compared with control participants; however, we did find a significant main effect of word type in both experiments where positive words had the quickest response times. Experiment 4's modified Stroop task also found no group (TTM-High, TTM-Low, control) by word type (hair-related, anxiety, neutral, positive) interaction, but there was a main effect of group, where the TTM-High severity group had slower reaction times overall than the control group. Further, similar to Experiment 3, the main effect of word type was significant, providing evidence that our linguistic stimuli were well-controlled and robustly matched.

At first glance, the significant main effects revealed in our tasks using hair-related words seem to offer more interesting results than those of our Stroop task using shame-related words. However, the absence of an interaction rejected our predictions that the TTM group would demonstrate an attentional bias to words considered to be pertaining to their condition, in this case, hair-related words. As mentioned above, our linguistic stimuli were robustly matched, however, were these hair-related words “disorder-related” enough to elicit a bias in people with TTM symptomology? Words possess several emotional properties (see Chapter 3, section 3.1.1) and Bradley and Lang’s (1999) ANEW ratings provide valence and arousal ratings for 1034 words. However, none of the 55 hair-related words that were generated by 2 people with TTM for the purpose our research had an existing valence and arousal rating, as shown in Table 3.2 of this thesis. This led to Experiment 5’s word rating task that allowed us to explore the emotional properties (arousal and valence) of our hair-related words in more depth. Upon removal of the reaction time component, we found differences in arousal ratings of hair-related words where our TTM-High group assigned significantly higher arousal ratings to hair-related words relative to: (1) body image and neutral stimuli; and (2) control participants. Using the top rated arousing hair-related words (with their anxiety, neutral and positive matched counterparts), we were then able to reanalyse the hair-related Lexical Decision and hair-related Stroop data. Again, this smaller, stronger word set yielded no significant group by word type interactions. The theoretical implications of our linguistic studies are discussed in more depth later this discussion section.

The final line of research in this thesis was to migrate from linguistic to pictorial stimuli in the investigation of attentional processing in people with TTM. A vast amount of empirical research has used the dot probe task as a measure of attentional bias in a variety of conditions and disorders. As introduced in Chapter 4, the ecological validity of images is higher than that of words (e.g., seeing an image of a root compared with the word “root”). In Experiment 6, using hair-related images obtained from a pictorial norming task, we used an online competitive dot probe task where participants viewed a hair-related and neutral image competing for their attention on either side of a fixation cross for a duration of either 250 ms or 1000 ms. The time taken (in ms) to identify the location of a probe that replaced one of the images was recorded. Typically, a shorter stimulus presentation duration (i.e., 250 ms) is a measurement of initial facilitated engagement with a stimulus, while a longer stimulus presentation duration (i.e., 1000 ms) is a measurement of disengagement (early or late) from a stimulus. We tested a group of participants who reported TTM symptomology (compared to a non hair-pulling control group) and found a significant SOA (300 ms, 1050 ms) by group (TTM, control) by Target Image (hair-related, neutral) interaction. Our results showed that the time taken to locate the probe at the 1050 ms SOA was significantly longer for the TTM group when it replaced the neutral image. We can explain these findings as being demonstrative of attentional bias in people with TTM towards hair-related images in the form of delayed disengagement. Our results in the context of dot probe research will be addressed in more detail further in this discussion.

Whilst our results from our lexical reaction time studies (Experiments 3 and 4) did not provide evidence supporting an attentional bias towards hair-related stimuli in individuals with TTM symptomology, Experiment 6 utilising pictorial stimuli demonstrated that once attention has been caught by hair-related images, it is difficult for people with TTM to disengage their attention from them. This is in line with research showing that the emotional state of an individual promotes an attentional bias demonstrated by delayed disengagement toward disorder-related cues (Koster, Crombez, Verschuere & De Houwer, 2004; Rudaizky, Basanovic, & MacLeod, 2014; Salemink, van den Hout & Kindt; 2007; Yiend & Mathews, 2001). We will now discuss the results of the language and pictorial attentional bias research studies in this thesis in the context of different theoretical models.

5.2 Theoretical interpretations

5.2.1 Comprehensive Behavioural (ComB) Model of TTM

The ComB model of TTM (Mansueto et al., 1997), as mentioned in Chapters 1 and 4 of this thesis, is a treatment model designed to capture and address several aspects of the hair-pulling experience in individuals with TTM. It proposes that hair-pulling does not have a single explanatory factor, but rather, is explained by a combination of factors and how they interact with each other: sensory; cognitive; affective; motor; and external cues. These are then viewed in an ABC model context: Antecedents (i.e., stimuli prompting urges to pull); Behaviours; and Consequences. Attentional bias to hair-pulling related stimuli would be considered as an antecedent in terms of the ComB model of TTM. Our series of attentional bias studies in this thesis investigated how biased attention to hair-related stimuli may exist in people with TTM. Our dot probe paradigm results using images are consistent with the ComB model (Mansueto et al., 1997) because our results show that when attention is caught by hair-related images, disengagement is delayed. This may be argued to support the ComB model, in that, once a hair-pulling episode has begun, it is difficult to stop (i.e., difficult to disengage from the act of hair-pulling). What is interesting about the ComB model is that while antecedents are identified as being part of TTM, their valence (positive, negative) is not differentiated, but rather, just that such antecedents play a key role. Section 5.2.3 will consider how our results from different experimental paradigms can tease apart the effectiveness of picking up biases to TTM-related stimuli.

As discussed in Chapter 4, our dot probe results are relevant to the ABC component of Mansueto et al.'s (1997) ComB model. One can consider the efficacy of interventions that are capable of retraining individuals with attentional biases towards disorder related stimuli. In a systematic review and meta-analysis of psychological and pharmacological treatments for TTM (Slikboer, Nedeljkovic & Moulding, 2017) it was concluded that although difficult to treat, psychological interventions are more effective for TTM than pharmacological treatments. Falkenstein, Mouton-Odum, Mansueto, Golomb and Haaga (2016) piloted the comprehensive behavioural (ComB) model of TTM (Mansueto et al., 1997) to test the efficacy of this intervention. Sixteen participants with the hair-pulling disorder demonstrated attendance and treatment satisfaction based on this model. Our current, and future attentional bias results can inform therapeutic interventions for TTM in terms of how individuals process external cues related to hair-pulling.

5.2.2 Reward *and* threat

We will now consider how positive (reward) and negative (threat) stimuli might both be salient in TTM. In the context of attentional bias, TTM has clear characteristics differentiating it from conditions such as addictions (characterised by reward detection) and anxiety (characterised by threat detection). Existing literature reviewed in this thesis has been able to tease apart the nature of attentional biases in such conditions; however, when it comes to understanding this with regard to hair-pulling in TTM, it is yet to be understood in its entirety. Sections 4.1.5 and 4.1.7 in Chapter 4 presented the reader with a dual model of TTM where the act of pulling one's hair can be characterised either by reward (e.g., "I enjoy pulling my hair, so hair-related stimuli will grab and keep my attention"), or threat (e.g., "Pulling my hair makes me upset, so hair-related stimuli will grab and keep my attention"), or perhaps a combination of both. Whether the presence of an attentional bias towards stimuli in TTM is understood to be attributed to threat (Lee et al., 2012) or in response to hair-pulling being reported as a pleasurable behaviour (Diefenbach, et al., 2008; Grant et al., 2012; Lochner et al., 2011; Meunier et al., 2009; Roberts et al., 2013; Walther et al., 2014), this bias can have the capacity to maintain one's attention towards disorder-related stimuli, therefore maintaining the hair-pulling behaviour. We shall also discuss our non-significant linguistic results in the context of these theoretical models.

5.2.3 Behavioural addiction/reward attentional bias model

Hair-pulling is typically reported by people with TTM as being a pleasurable experience characterised by immediate pleasure and gratification (Diefenbach et al., 2008; Grant et al., 2012; Lochner et al., 2011; Meunier et al., 2009; Walther et al., 2014). With this in mind, hair-pulling appears to provide positive reinforcement, making the behaviour difficult to stop. Section 2.3.3 in Chapter 2 presented a review of studies using modified versions of the Stroop paradigm that demonstrated that future behaviours can be predicted by current use of substances (e.g., smoking, alcohol). Waters et al. (2003) showed that slower reaction times and more errors on their tobacco Stroop task were predictive of future smoking behaviours in smokers. Field et al. (2009) showed a similar pattern of results in their meta-analysis where attentional biases towards substance abuse stimuli were correlated with cravings to smoke. Our linguistic paradigm findings were not consistent with this model: the processing of words in people with TTM compared with a control group did not differ relative to other word types. One frequently occurring feature of attentional bias models in reward/ addiction research is the argument that classical conditioning drives an initial pairing between addiction-related stimuli, resulting in subsequent reward/ positive reinforcement (e.g., Field & Cox, 2008, Roberts et al., 2013). Thus, the stimulus is taken to cue substance availability and the associated response is the expectation of gratification/ reward. In the context of this argument, our non-significant results in our reaction time paradigms for differential processing of hair-related stimuli can be explained. We must consider that hair on one's body is something that is constantly available, unlike other disorder related stimuli (i.e., cigarettes, alcohol). If this argument were to stand, in experimental settings, people with TTM may not respond in a similar way to hair-related words because they already have their actual and real “addiction”-related stimulus (hair) continually available and immediately accessible. Therefore, TTM-related stimuli in an experimental setting (i.e., hair-related words) should be less likely to cue gratification anticipation in individuals with TTM. This could be because, either, they have become somewhat habituated to hair-related stimuli, or because real world cues (i.e., actual hair) are present in the here and now and already impact in different sensory domains (touch, sight) - essentially minimizing the potential impact of stimulus words. If this is the case, it may be that those in the early stages of TTM onset may respond more strongly to hair related cues because habituation may be a lesser issue. Future research could potentially investigate this through contrasting groups of recent onset with group of long-term TTM.

5.2.4 Threat attentional bias model

Linguistic studies using negatively valenced words typically demonstrate robust effects of word type, that is, delayed response times relative to other word types (e.g., Briesemeister et al., 2011; Estes & Verges, 2008; Kuperman et al., 2014; Larsen et al., 2008). Experiment 5 in this thesis obtained valence ratings for 55 hair-related words that yielded no significant differences in valence ratings from those of 55 matched body image and neutral words. This was in line with our hypothesis, proposed as being due to the heterogeneous nature of hair-related words for people with TTM: words such as “hair”, “root” may receive a positive rating from some hair-pullers due to desirability but negative ratings from others due to negative associations with their hair-pulling behaviour. Therefore, our 55 hair-related words may not hold any particular valence across a larger group of people with TTM, cancelling out any attentional bias characterised by negative valence/ threat.

In terms of images, some research has found speeded engagement with, and speeded disengagement from, threat stimuli that are both characteristic of early threat detection and avoidant coping mechanisms respectively (Dennis & Halberstadt, 2013; Koster, Crombez, Verschuere, Van Damme & Wiersema, 2006; Lee et al. (2012). This was not the pattern of results that emerged from our competitive dot probe task. Rather, our results were in line with the majority of dot probe research using threat-related images that found *delayed* disengagement (e.g, Fox et al., 2006; Koster et al., 2004; Rudaizky et al., 2014; Salemink et al., 2007; Yiend & Mathews, 2001). Our TTM group (compared to a non hair-pulling group) demonstrated no speeded engagement with hair-related images, relative to neutral images. Rather, our results showed delayed, slower, disengagement from hair-related images, in direct contrast with the only other study (Lee et al. 2012) using a dot probe task in people with TTM. Our images were normed by an independent group of hair-pullers as being highly arousing, but not necessarily negative valenced. As we can see, the nature of attentional processing in TTM is still complex and future research is needed.

5.3 Potential limitations of our studies

5.3.1 Online experimental paradigms

All but one (the lexical decision task) of the reaction time experiments in this thesis used an online experimental platform (http://experiments.psy.gla.ac.uk) which is a largely used online interface built and maintained by The institute of Neuroscience and School of Psychology's webmaster. This interface uses Flash which has been shown to be accurate in its detection of reaction time differences (e.g., Reimers & Stewart, 2015) and is as accurate as any other software running on its own (outside the browser). The primary practical driver for using online experimentation was to increase the number of participants with TTM symptomology. For example, our lexical decision task in-lab study had 28 TTM participants with a mean hair-pulling severity score of 12.8 (range 1-24/28). The use of an online interface allowed us to: (1) increase our TTM samples sizes considerably; and (2) have a participant group with a higher hair-pulling severity. Sample sizes and hair-pulling severity were: (1) Shame Stroop (TTM: *N*=44, mean MGH-HS=17.2, range=10-26); (2) Hair Stroop (TTM-Low: *N*=19, mean MGH-HS=5.3, range=1-9; TTM-High: *N*=70, mean MGH-HS=15.3, range=10-28); and (3) Dot probe (TTM: *N*=45, mean MGH-HS=16.3, range=10-27). Upon first glance of the participant information above, one can see that we recruited much larger samples with higher hair-pulling severity scores. The use of these TTM samples and how representative they are of the general TTM population will be discussed further in section 5.3.2. While some concerns exist in relation to the accuracy of using an online interface for timing accuracy, technical and environmental variability of online RT research (see, e.g., Hilbig, 2016), research has demonstrated that web-based replications of lab research generally yield very similar results (e.g., Corley & Scheepers, 2002; Crump, McDonnell, & Gureckis, 2013). Indeed, the same pattern holds when participants are randomly allocated to lab and web conditions (Hilbig, 2016). Moreover, systematic study of the impact of the hardware variability has indicated that response times can be accurately measured across different computer systems (e.g., Brand & Bradley, 2012; Reimers & Stewart, 2015). Given the consistency of experimental effects and timing accuracy in lab and web-based experiments, it is unlikely that the online data collection techniques used in this thesis negatively impacted on the quality of the data acquired.

5.3.2 TTM sampling

Section 5.3.1 has already detailed the samples we recruited throughout this thesis. As this thesis evolved, we noticed that hair-pulling severity varied greatly (MGH-HS ranges from 0-28) in our participant samples. In Experiments 4 (hair Stroop) and 5 (word-rating task), we divided those reporting hair-pulling behaviours into separate TTM-High and TTM-Low groups to allow us to observe any differences that might emerge based on hair-pulling severity. Our hair Stroop paradigm (using a TTM-High and TTM-Low group) did not elicit a group by word type interaction but our word-rating task (using a TTM-High and TTM-Low group) did show hair-pulling severity influenced arousal ratings of hair-related words. In Experiment 5's dot probe study, we also investigated if hair-pulling severity within the TTM group might influence the time taken to identify the location of the probe. This exploratory analysis showed that hair-pulling severity did *not* affect reaction times. As we can see, TTM severity and corresponding results varied throughout this thesis. This could be due to the nature of the experimental paradigms employed (reaction time vs rating task). As raised earlier in section 5.2.3, some paradigms may not be able to facilitate an attentional bias response when the hair-pulling participant already has their "real life" salient cue (hair) immediately accessible on their body. However, in tasks without a reaction time component such as a word-rating task, the participant has time to process the stimulus more deeply and reflect on its emotional significance.

Further, as our knowledge of our TTM samples increased as this thesis developed, our hair-related Stroop task and our dot probe task sampled participants who reported that they had sought support for their hair-pulling condition. This may reduce the generalisability of these research findings, as they are not wholly representative of hair-puling individuals who have not felt the need to seek support, but live with TTM. Overall, the heterogeneity of the TTM population is vast and we found varied results based on TTM severity throughout our experiments.

Nevertheless, overall, we are confident that our sampling methods allowed us to use data from a representative sample of people with TTM. Again, when observing the in-lab versus online experimental samples mentioned above, we were able to recruit people from online platforms in different parts of the Western world, giving us giving us access to those who could not otherwise have participated, due to geographical location. Also some participants reported that the anonymity of completing a task from one's home allowed them to contribute without having to "out" themselves as being a hair-pulling participant in a lab environment.

5.3.3 Hair-pulling subtypes

We did not consider the role of focussed and automatic hair-pulling subtypes in our series of research studies. Research into hair-pulling styles has identified two subtypes of pulling: (1) automatic, where the puller removes hair completely outside of their awareness; and (2) focussed, where the puller removes hair whilst focussing complete attention on the activity (e.g., with the use of a mirror/ tweezers) (Flessner et al., 2008; Flessner et al., 2009). Currently, the triggers and regions of pulling have been identified as being different across automatic and focussed pulling. Eyelash pulling has been shown to be significantly higher in groups of focussed pullers at 43.8%, than in automatic pulling groups at 5.7% (Duke et al., 2010) and we also did not record regions of pulling in our participant samples. It is important to note that focussed and automatic pulling are rarely mutually exclusive as most people with trichotillomania will exhibit both types of pulling at least some of the time. Flessner et al. (2009) suggest that focussed hair-pulling occurs more frequently in response to negative mood states such as anxiety, stress and depression. Consequently, attentional bias research into variations in hair-pulling patterns may shed more light on the nature of attentional biases underlying different hair-pulling styles.

5.4 Future directions

5.4.1 Self-stigma

It can be speculated that if shame is to be investigated further in TTM samples, self-stigma might also merit attention as shame and self-stigma may be functionally related. Like shame, self-stigma is detrimental to one’s self-worth and identity (Corrigan, 2004; Corrigan, et al., 2010; Corrigan et al., 2013). In an investigation of attentional bias to self-stigma related words, Chan and Mak (2015) pre-screened 161 individuals for having a mental illness and then asked them to complete a measure of habitual self-stigma (the STAR). Those in the top and bottom quartile of this habitual self-stigma were selected for inclusion in the study. Participants completed an emotional Stroop task that employed stigma-related words (e.g., failure), positive words (e.g., proud), and non-affective words (e.g., urban). Those in the strong habitual self-stigma group had faster responses to stigma-related words than non-effective words. Those with low habitual self-stigma demonstrated no differences in reaction times across word types. The results indicate that those endorsing stronger habitual self-stigma were more able to ignore the meaning of the stigma-related words, allowing quicker responses to name the colour. While we looked at shame-related words in a modified Stroop task, response time latencies to self-stigma related stimuli would also be potentially informative in a TTM sample. Should attentional biases be detected in response to such stimuli, we can further understand the nature of any cognitive biases in TTM that endorse negative self-perceptions.

5.4.2 Eye-tracking study

Eye movement studies allow the recording of subjects' eye movements as they scan a visual field. Effectively, we can "track" *where* people are looking based on their fixations, and see *for how long* these fixations are. Heat-maps are visual representations of eye gaze. Caldara and Miellet (2011) were able to show "fixation heatmaps" using *i*Map. *i*Map allows one to observe individual fixations (per participant and stimulus) and then create fixation maps. Then, *i*Map allows the averaging of these individual fixation maps together to show "group" fixation maps. These statistical fixation maps are both robust and data-driven.

To provide a little background, we can look at some abnormality research into how people process faces. Individuals on the autism spectrum disorder (ASD) scale scan faces differently relative to control groups. Control groups follow a regular pattern known as holistic processing when looking at faces, typically fixating on major features such as eye, nose and mouth regions. ASD individuals, however, often show different patterns of face processing, attending to different facial features (Pelphrey et al., 2002).

Body Dysmorphic Disorder (BDD) entered the DSM-5 diagnostic category of obsessive compulsive and related disorders (APA, 2013) and is therefore in the same category as TTM. BDD, often nicknamed "the disease of imagined ugliness" is a severe mental health condition where individuals are overly preoccupied with imperfections in their appearance, causing extreme distress, social functioning, and low quality of life. BBD often goes unrecognised due to shame lowering individuals coming forward and practitioners being unfamiliar with the condition (Phillips, 2004). Immediately, we can identify similarities in the psychopathologies of TTM and BDD, where TTMs also carry great deals of shame regarding their "self-inflicted" hair-loss. Similar to BDD, many TTM sufferers enshroud both their hair-pulling behaviours and subsequent hair loss in secrecy to conceal their condition from others (Weingarden & Renshaw, 2015).

A small handful of studies have investigated visual information processing of faces in BDD. Feusner et al. (2010) showed that individuals with BBD (*N*=18) were quicker at identifying inverted faces (faces presented upside down at a 180 degree rotation) compared to the control group (*N*=17) at longer presentation times. There were no differences in accuracy. Further, in a change detection paradigm (Stangier, Adam-Schwebe, Müller & Wolter, 2008) BDDs (*N*=21) demonstrated a significantly higher discrimination of changes between standard and target face images, than groups who had dermatological conditions (*N*=39). Eye and nose changes in particular were detected more accurately by the BDD group who also showed higher vigilance for even subtle changes on the face deviating from the average. These results can be explained in the context of increased detail-oriented face processing in people with BDD (interpreted as being due to a preoccupation with features and imperfections) compared with more holistic face processing in normal controls. Finally, in an eye-tracking study using overweight and thin body images (matched with neutral images) as stimuli, women who were high in body dissatisfaction (*N*=34) showed longer gaze durations towards both overweight and thin images compared to women with low body dissatisfaction (*N*=34) (Gao et al., 2014). The results are explained by sustained attentional maintenance: (1) thin bodies may serve as a reward (i.e. one's attention is maintained by the "ideal body"); and (2) overweight bodies may be perceived as socially comparable with one's own body (those with higher body dissatisfaction often evaluate their own bodies as overweight and have their attention maintained by similarly perceived body flaws).

This brings us up to date with the study that is currently in progress. In TTM, sites most commonly pulled from are scalp, eyebrows, eyelashes, and pubic hair, and hair-pullers generally report pulling from multiple area (Duke et al., 2010; Grant, et al., 2011, Woods et al., 2006). People with TTM also report affective correlates including depression (Tung et al., 2015), social inhibition (Woods, et al., 2006), and shame (Nobel, 2012; Singh et al., 2015; Weingarden & Renshaw, 2015). We are currently running a study with TTM and control participants where faces on screen are scanned whilst eye-movements are recorded by an eye-tracker. As shown in studies on BDD, we are keen to find out if TTMs scan faces differently compared to normal controls. In particular, TTMs may have different scanning patterns of non-feature areas of the face such as eyebrows, hairline, etc. The TTM group may demonstrate differential eye movement patterns and scan non-feature areas of the face (eyebrows, hairline) more so than the control group. Further, we can create an "average face" of the stimuli presented. This will allow us to compare TTM and control group heatmaps of hair-related areas (eyebrows and hairline). Finally, the purpose of the memory task is to maintain the participants' attention. However, it could be interesting to examine if there are any differences in the memory task results and what may be driving these differences (e.g., detail oriented processing of faces). If this is the case, we will have evidence that another high-functioning group show differential scanning patterns of faces. If there are differences, this may indicate detail-oriented processing of faces in TTM, however, the underlying causes of this bias could be attributed to thoughts about oneself or thoughts about the target images being viewed, as shown in Table 5.1.

Table 5.1. *Example illustrative thoughts underlying detailed-oriented processing of faces.*

Illustrative thoughts about themselves	**Illustrative thoughts about others**
"Because I pull out my eyebrows, I always feel people will notice that I have to fill them in" *"I always wear the same hairstyle...it's hard to wear it up with the patches underneath"* *"I have to wear false eyelashes. Although I'm at peace with my TTM (now), I wish it didn't have to be this way"*	*"I always want to pluck her eyebrows – they drive me crazy!"* *"I always notice when someone has had their hair done"* *"My boyfriend has this one ginger eyelash…I have to resist attacking it when he's asleep!"*

Further, it would be interesting to ask TTMs to scan their own face whilst their eye movements are recorded by an eye-tracker. Greenberg et al. (2014) took photographs of participants with BDD (*N*=19) and a control group (*N*=20) and images were then standardised for colour and size. Upon returning to complete the second part of the study, all participants were asked to take part in an eye-tracking study where they scanned their own face on screen for 40 seconds and another face for 40 seconds each (trials were counter-balanced across participants). Participants then: provided a distress score (SUDS); selected and rated the most attractive least attractive regions region of their own face; and selected and rated the most attractive and least attractive regions of their other face. Results showed that the BDD group scanned their own perceived irregularities on their own face more, but scanned what they rated as the attractive features of the other face more. BDDs over-attended to perceived negative attributes pertaining to their own appearance. In replicating this study in TTM, this can illustrate differences in potential detail-oriented processing of one's own and other faces in TTM.

5.5 Closing comments

In conclusion, this thesis has investigated the important area of TTM and has presented studies investigating attitudes towards and attentional biases in TTM. The investigation of stigmatising attitudes towards TTM (and other BFRBs) has indicated that more education surrounding BFRBs is necessary to increase the awareness and understanding of these conditions. Whilst attentional bias results were varied in terms of linguistic paradigms, we have evidence that individuals with TTM attend differentially to pictorial stimuli and in particular, have difficulty disengaging their attention from hair-related images upon viewing them. Our results make an important contribution towards the understanding of the processing of disorder-related stimuli in TTM. Future research should pursue how TTMs attend to different linguistic stimuli (e.g., self-stigma related words) and more varied pictorial stimuli that are reflective of everyday attention allocation. A fuller understanding of these attentional biases can inform therapeutic approaches for TTM.

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Appendix A

MGH-HS (Keuthen et al, 1995)

For each question, pick one statement which best describes your behaviors and/or feelings **over the past week**. If you have been up and down, try to estimate an average for the week. Please read all the statements in each group before making your choice.

For the next three questions, rate only the urges to pull your hair

1. Frequency of urges. On an average day, how often did you feel the urge to pull your hair?

0 This week I felt no urges to pull my hair.
1 This week I felt an **occasional** urge to pull my hair.
2 This week I felt an urge to pull my hair **often.**
3 This week I felt an urge to pull my hair **very often.**
4 This week I felt **near constant** urges to pull my hair.

2. Intensity of urges. On an average day, how intense or "strong" were the urges to pull your hair?

0 This week I did not feel any urges to pull my hair.
1 This week I felt **mild** urges to pull my hair.
2 This week I felt **moderate** urges to pull my hair.
3 This week I felt **severe** urges to pull my hair.
4 This week I felt **extreme** urges to pull my hair.

3. Ability to control the urges. On an average day, how much control do you have over the urges to pull your hair?

0 This week I could **always** control the urges, or I did not feel any urges to pull my hair.
1 This week I was always able to distract myself from the urges to pull my hair **most of the time.**
2 This week I was able to distract myself from the urges to pull my hair **some of the time.**
3 This week I was able to distract myself from the urges to pull my hair **rarely.**
4 This week I was **never** able to distract myself from the urges to pull my hair.

For the next three questions, rate only the actual hair-pulling

4. Frequency of hair-pulling. On an average day, how often did you actually pull your hair?

0 This week I did not pull my hair.
1 This week I pulled my hair **occasionally.**
2 This week I pulled my hair **often.**
3 This week I pulled my hair **very often.**
4 This week I pulled my hair so often it felt like I was **always** doing it.

5. Attempts to resist hair-pulling. On an average day, how often did you make an attempt to stop yourself from actually pulling your hair?

0 This week I felt no urges to pull my hair.
1 This week I tried to resist the urge to pull my hair **almost all of the time.**
2 This week I tried to resist the urge to pull my hair **some of the time.**
3 This week I tried to resist the urge to pull my hair **rarely.**
4 This week I **never** tried to resist the urge to pull my hair.

6. Control over hair-pulling. On an average day, how often were you successful at actually stopping yourself from pulling your hair?

0 This week I did not pull my hair.
1 This week I was able to resist pulling my hair hair **almost all of the time.**
2 This week I was able to resist pulling my hair **most of the time.**
3 This week I was able to resist pulling my hair **some of the time.**
4 This week I was **rarely** able to resist pulling my hair.

For the next question, rate the consequences of your hair-pulling

7. Associated distress. Hair-pulling can make some people feel moody, “on edge,” or sad. During the past week, how uncomfortable did your hair-pulling make you feel?

0 This week I did not feel uncomfortable about my hair-pulling.
1 This week I felt **vaguely uncomfortable** about my hair-pulling.
2 This week I felt **noticeably uncomfortable** about my hair-pulling.
3 This week I felt **significantly uncomfortable** about my hair-pulling.
4 This week I felt **intensely uncomfortable** about my hair-pulling.

Appendix B.

AQ-9 (Corrigan et al., 2003)

Circle the number of the best answer to each question:

1 2 3 4 5 6 7 8 9

None at all **Very much**

1. I would feel pity for VIGNETTE CHARACTER.

1 2 3 4 5 6 7 8 9

None at all Very much

2. How dangerous would you feel VIGNETTE CHARACTER is?

1 2 3 4 5 6 7 8 9

Not at all Very much

3. How scared of VIGNETTE CHARACTER's would you feel?

1 2 3 4 5 6 7 8 9

Not at all Very much

4. I would think that it was VIGNETTE CHARACTER's own fault that she is in the present condition.

1 2 3 4 5 6 7 8 9

Not at all Very much

5. I think it would be best for VIGNETTE CHARACTER community if she were put away in a psychiatric hospital.

1 2 3 4 5 6 7 8 9

None at all Very much

6. How angry would you feel at VIGNETTE CHARACTER?

1 2 3 4 5 6 7 8 9

Not at all Very much

7. How likely is it that you would help VIGNETTE CHARACTER?

1 2 3 4 5 6 7 8 9

Definitely would not help Definitely would help

8. I would try to stay away from VIGNETTE CHARACTER.

1 2 3 4 5 6 7 8 9

Not at all Very much

9. How much do you agree that VIGNETTE CHARACTER should be forced into treatment with her doctor even if she does not want to?

1 2 3 4 5 6 7 8 9

Not at all Very much

Appendix C.

Vignettes used in Experiment 1.

Vignette 1: Trichotillomania (perceived controllable hair-loss)
Olivia is a 25 year old female whose friends are concerned about her thinning hair and eyelashes. A few weeks ago, her friends noticed her continually pulling out her hair whilst watching a movie and they often see her playing with her hair and eyelashes excessively. On examination, Olivia has several bald patches on her scalp and eyelids which require her to engage in fixing her hair and makeup before leaving the house. Olivia reports that she knows she should stop pulling out her hair but when she is pulling her hair, she is often not aware of it and cannot control the urges. Olivia's hair loss causes her to feel a lot of shame about her appearance, and as a result she has started to avoid social situations through fear of people learning of her behaviour. Olivia carries hair products, makeup and a mirror in her bag everywhere she goes in an attempt to conceal her hair loss from others.

Vignette 2: Alopecia (perceived uncontrollable hair-loss)
Fiona is a 26 year old female who is attending a doctor's clinic to have her hair loss assessed. Her family is concerned as her hair has been falling out for several months and on examination, Fiona has bald patches on her scalp and eyelashes. Fiona reports that when washing her hair, it often falls out excessively. She has also reported clumps of hair on her pillow on waking up in the morning. This makes Fiona feel very self-conscious and she often gets very upset. She reports that her job is very stressful and that particularly stressful events seem to prompt her hair falling out. Her hair loss has resulted in her feeling out of control and vulnerable as she feels she can do nothing to curb the stress that prompts her hair to fall out. Fiona feels embarrassed about her hair loss and engages in a daily routine to conceal her bald patches.

Vignette 3: **Compulsive skin-picking (perceived controllable skin lesioning)**
Anna is a 28 year old female. She states that her sister encouraged her to attend counselling when she found out about her skin-picking behaviour. She scratches and picks the skin on her legs and face with a needle when she becomes bored or stressed. Often, she searches for imperfections on her skin to fix. This has occurred for at least one year. She denies any self-harm behaviours and states that this is an irresistible urge which feels rewarding and is pleasurable. However, the physical results of scabs and scars are upsetting to Anna. She avoids many social events because the attire she feels she would need to wear would reveal her skin-picking injuries. Although she wants to stop picking her skin, she reports that the urges to do so are impossible to resist. Anna feels embarrassed and ashamed and attempts to hide the wounds from others. (147 words)

Vignette 4: Psoriasis (perceived uncontrollable skin lesioning)
Angela is a 27 year old female who has recently been encouraged by her friends to visit the doctor. Red, flaky, crusty patches of skin covered with silvery scales have erupted on her neck, chest and arms. Angela says that her job is stressful, and she reports her skin flaring up in response to high stress situations. The red, flaky skin has affected her confidence greatly and she feels distressed and self-conscious about her physical appearance. Angela has started avoiding several social situations as she doesn't want people to see her when her skin has flared up. Sometimes she takes days off work during particularly bad outbreaks. She has tried to conceal the scaly patches on her skin, but feels she is only making it worse. Attempting to conceal it is taking up more and more of Angela's time. She feels embarrassed and vulnerable.

Vignette 5: Depression (control vignette)

Rebecca is a 28 year old female who has been referred by her family physician for evaluation. She reports 3 months of severely low mood that is especially bad early in the mornings, resulting in disturbed sleep patterns. Rebecca also reports decreased energy, an inability to concentrate when she is at work, a decreased appetite with a 10 pound weight loss, and frequent thoughts about ending her own life. She also states that she has lost interest in several activities that she used to find enjoyable. On evaluation, Rebecca is tearful, lacks animation and her mood is very low. She does report two previous periods of very low mood: one in late adolescence and another during her senior year in college. During the latter episode, her symptoms were so severe that she was unable to attend classes and missed deadlines. Rebecca's mood is so low that she feels hopeless about her future. (152 words)

Appendix D.

Norming of shame-related words. Items in bold represent the highest rated words.

Shame Word	Mean rating
agony	2.53
alone	4.65
bashful	4.35
belittlement	**7.12**
blame	**5.94**
blamable	**6.5**
broken	4.59
cast-off	**6.29**
contempt	4.59
criticise	5.24
criticize	5.19
defamation	4.38
degrade	**7.12**
dejected	5.06
depreciation	4.76
despise	4.82
disappear	3.94
discredit	4.53
disgrace	**7.71**
embarrass	**6.88**
expose	4.35
exposure	3.88
failure	**6.47**
fraudulent	**6.18**
hateful	4.53
helpless	3.71
hide	4.06
humiliate	6.47
humiliated[5]	**7.88**
humiliation	7.59
improper	3.82
incompetent	5
inferior	**6.18**
insecure	5.35
insignificant	**6.12**
jilted	4.94
letdown	5.29
loathed	5.29
outcast	**7.76**
pathetic	**6.53**
rejected	**7**

[5] "humiliated" was selected over "humiliate" based on the higher rating it received.

reproach	4.71
resentment	5.53
ridicule	**6.65**
scorn	5.06
selfish	4.24
status	2.53
suffering	4.35
torment	5.53
unaccepted	**5.88**
undesirable	**5.94**
vile	5.12
worthless	**6.94**

Appendix E.

Stimuli used in Experiment 2.

Shame	Neutral	Positive
belittlement	elaboration	trustworthy
blame	bread	bride
blamable	activate	carnival
cast-off	ketchup	playful
degrade	lantern	sparkle
disgrace	mischief	applause
embarrass	vigilance	valentine
failure	feature	freedom
fraudulent	inhabitant	graduation
humiliated	nonchalant	sweetheart
inferior	umbrella	paradise
insignificant	indifferent	millionaire
pathetic	microphone	diamonds
outcast	glacier	blossom
rejected	register	exciting
ridicule	radiator	jubilant
unaccepted	absolution	easygoing
undesirable	fragrance	fireworks
worthless	telescope	honeymoon

Appendix F

Stimuli used in Experiment 3 and 4.

Hair	Anxiety	Positive	Neutral
hair	died	hope	news
pick	hurt	song	lift
pull	weak	keen	item
root	burn	hero	tool
brush	crazy	glory	stiff
extract	despair	liberty	nursery
patch	fatal	eager	slope
urge	ugly	fame	lamp
make-up	scared	velvet	invest
fringe	misery	parade	hammer
highlights	resentment	incredible	disclosure
eyebrows	sickness	treasure	evaluate
beard	agony	bride	elbow
disguise	inferior	paradise	umbrella
extensions	frustrated	passionate	procession
tangled	anguish	ecstasy	connect
coarse	trauma	dancer	melted
moustache	slaughter	honeymoon	telescope
bald	scar	heal	maze
hairdresser	abandonment	millionaire	indifferent
shampoo	execute	festive	garment
stubble	hateful	diploma	whistle
curly	bully	puppy	litre
wiry	stab	nude	knot
pleats	insult	erotic	rattle
scalp	dizzy	witty	crawl
sparse	betray	riches	golfer
eyelids	torment	blossom	dresser
cosmetics	criticise	fireworks	fragrance
follicle	stinging	applause	mischief
dandruff	insecure	gorgeous	scissors
shave	scorn	tasty	tease
perm	vile	ruby	rust
eyelashes	disgraced	evergreen	sentiment
mascara	charred	reunion	lantern
wig	sob	gem	sew
conditioner	bereavement	trustworthy	elaboration
grooming	ridicule	jubilant	radiator
hairstyle	stupidity	valentine	vigilance
camouflage	humiliated	sweetheart	nonchalant
comb	cyst	cute	vest
clippers	suicidal	carnival	mushroom
eyeliner	mutilate	diamonds	activate
bulb	scab	glee	beak
bunches	tearful	radiant	glacier
voluminous	unbearable	graduation	inhabitant
pluck	annoy	flirt	aloof

alopecia	diseased	vacation	windmill
regrowth	embarrass	daffodil	calculus
ingrown	snubbed	sparkle	fielder
tweezers	genocide	serenade	lemonade
matted	detest	tickle	juggle
bandana	unloved	playful	ketchup
pigtails	amputate	calmness	kerchief
hairspray	suffocate	comforter	triathlon

Appendix G

Pseudowords in Experiment 3 lexical decision paradigm

PW_1	PW_2	PW_3	PW_4
clat	nump	yalk	quib
nate	dimp	morm	shan
prad	sush	hust	yond
leem	graw	hity	pite
tisky	avice	hoshy	bloaf
curgeon	thirney	whently	bruddle
natch	exard	penth	chire
woth	yate	folt	velm
tumple	shenty	nugles	remact
durate	tellow	wumble	chunts
harrelling	dentilated	inderbated	redelanted
strawful	caborial	wissener	shrunnel
drazy	ploin	stant	fline
scanther	lunasite	spouthed	limpeous
dispernate	internable	restanable	brugliness
quimity	slinner	croppen	flawned
rondia	staper	fentry	horrow
lampertic	extramous	porpalage	prepented
hain	trab	mesk	felp
strenilised	trebatement	plembiation	strathinger
shefler	trudace	drondle	quaster
umption	rebling	bundour	hethlem
crend	imple	sneck	cheen
dess	ting	lorn	tark
branly	trence	crider	lannel
lanic	nainy	bleth	clane
revace	penace	bowful	wudged
looster	phozzel	brollen	trubbed
plouncher	canchette	blaptious	slamperic
quallegy	whellion	abrinder	impental
uniceive	repation	duncious	trebelia
anter	prain	larse	writh
sart	virp	foda	drit
stromella	glimption	restingle	ashieveate
spreeny	croiler	dristle	gitched
bip	pon	wid	oin
nellaquette	hetrosponic	refringable	ferrimental
thoungle	slandium	recarthy	tempious
improther	refressing	brastenic	timbilate
entrophite	ammolodate	prumptious	romberment
timp	diny	prot	bist
brasmine	accouley	clorious	durledge
varchary	plaction	debentia	conferly
bink	zorn	sote	wope
chalify	perdice	bloncks	stimper
inhunction	innaprator	propiralle	requitious
dunge	slarp	thade	nuggy

requette	plincher	thunning	flambled
impartle	lindermy	naughter	antipoxy
frittel	exabber	nordaly	smockel
spultion	splornet	grastion	ommented
decity	quance	dreaps	mished
plipper	shepter	tabenal	lessity
castened	poothing	thromped	smeathen
endorment	calidemic	strimpled	excemming

Appendix H

Edinburgh Handedness Inventory (Oldfield, 1971)

Read each of the questions below. Decide which hand you use for each activity and then ***circle*** the answer that describes you the best. If you aren't sure, try acting it out to see which hand you are using.

1.	With which hand would you normally write?	Right Either Left
2.	With which hand do you draw?	Right Either Left
3.	Which hand would you use to throw a ball to hit a target?	Right Either Left
4.	In which hand do you use your racquet for tennis, squash, etc.?	Right Either Left
5.	With which hand do you use your toothbrush?	Right Either Left
6.	Which hand holds a knife when you are cutting things?	Right Either Left
7.	Which hand holds the hammer when you are driving a nail?	Right Either Left
8.	When you strike a match, which hand holds the match?	Right Either Left
9.	In which hand would you use an eraser on paper?	Right Either Left
10.	Which hand removes the top card when you are dealing from a deck? (i.e., when you are the dealer of a Blackjack game, which hand to you use to distribute the cards that is placed on the table?)	Right Either Left
11.	Which hand holds the thread when you are threading a needle?	Right Either Left
12.	In which hand would you hold a fly swatter (to kill a fly)?	Right Either Left

Appendix I

Stimuli used in Experiment 5.

Hair	Neutral	Body image
alopecia	activate	anorexia
bald	aloof	appetite
bandana	beak	belly
beard	calculus	bingeing
brush	connect	bloated
bulb	crawl	blubbery
bunches	disclosure	bony
camouflage	dresser	breasts
clippers	elaboration	bulimia
coarse	elbow	bulky
comb	evaluate	bum
conditioner	fielder	buttocks
cosmetics	fragrance	calorie
curly	garment	carbohydrate
dandruff	glacier	chew
disguise	golfer	cleavage
extensions	hammer	consume
extract	indifferent	diet
eyebrows	inhabitant	diuretic
eyelashes	invest	fastfood
eyelids	item	fasting
eyeliner	juggle	flab
follicle	kerchief	flabby
fringe	ketchup	flesh
grooming	knot	food
hair	lamp	hips
hairspray	lantern	hunger
hairdresser	lemonade	kilogram
hairstyle	lift	laxatives
highlights	litre	metabolism
ingrown	maze	nourished
make-up	melted	nutrition
mascara	mischief	obesity
matted	mushroom	oral
moustache	news	overeating
patch	nonchalant	overfed
perm	nursery	overweight
pick	procession	plump
pigtails	radiator	potbelly
pleats	rattle	purge

pluck	rust	restrict
pull	scissors	saturates
regrowth	sentiment	skeletal
root	sew	skinny
scalp	slope	slim
shampoo	stiff	spit
shave	tease	starvation
sparse	telescope	starve
stubble	tool	supper
tangled	triathlon	thighs
tweezers	umbrella	thin
urge	vest	underweight
voluminous	vigilance	voluptuous
wig	whistle	vomit
wiry	windmill	waist

Appendix J

Stimuli used in Chapter 5 pictorial norming task.