WHAT’S SO FUNNY?
AN EVALUATION OF THE RELATIONS AMONG HUMOUR USE, MIRTH, AND DEPRESSIVE SYMPTOMATOLOGY

by

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Abstract

Humour production and showing mirth (i.e., smiling and laughing) confer prosocial advantages. However, there is a paucity of literature evaluating how humour manifests in psychopathology. Humour and mirth may be especially relevant in depression, wherein profound impairments are evident in emotional and social functioning. Chapters 2 and 3 present correlational and predictive relations of depressive, social anxiety, and social anhedonia symptoms with humour styles, and consider the role of motivational systems and expressivity of positive affect as they relate to humour. As expected, symptoms and avoidance-based motivation were positively related to maladaptive humour styles and negatively related to adaptive humour styles. Interestingly, the pattern of relations shifted when considered among individuals in a depressive episode; acutely depressed individuals generally shy away from any humour style rather than gravitating toward specific styles. In a mediation model, the inverse relation between depressive symptoms and affiliative humour was fully mediated by approach-based motivation and expressivity of positive emotions. Chapters 4 and 5 examined subjective and observed mirth responses (facial affect and laughter) demonstrated by depressed and healthy comparison groups. Relative to non-depressed individuals, depressed persons reported less enjoyment, lower ratings of funniness, and fewer instances and shorter durations of positive facial affect and laughter when viewing humourous videos. There was no significant change in retrospective ratings of enjoyment and funniness at a one-week follow-up. The pattern of responsivity by depressed persons shifted when they viewed humourous videos while hearing others laughing. Both groups demonstrated more mirth when hearing others laugh; there were no differences between groups on mirthful behaviours. The one exception was that the total duration of laughter produced by depressed individuals was shorter than that produced by individuals in the healthy comparison group. This research project demonstrates that facets of depressive symptomatology are differentially associated with humour use and depressed individuals show blunted emotional responsivity to humourous stimuli. However, the pattern of reduced affective responsivity is context specific in that it fluctuates in response to hearing others’ laughter. These findings have important implications for the
conceptualization of depression and the subsequent avenues for the treatment of individuals with depression.
Co-Authorship

I. Co-Authorship Declaration

In all instances, the author of this dissertation (Katherine Holshausen) performed the data analysis, interpretation, and manuscript preparation. The co-authors listed were involved in the conception and design (Chris R. Bowie), revisions (Chris R. Bowie), and final approval of the manuscripts (Chris R. Bowie, Garret Cree, Vanessa Montemarano). I certify that I have obtained permission from all co-authors to include the below materials in my thesis.

II. Declaration of Previous Publication

This dissertation includes four original papers, all of which are in preparation for publication. The data presented in Chapters 2, 4, and 5 have been previously presented at conferences noted in the table below. I certify that the below material describes work completed during my registration as a graduate student at Queen’s University.

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List of Abbreviations

ANOVA = Analysis of Variance
BAS = Behavioural Approach Scale
BC = Bias Corrected
BCa = Bias Corrected Accelerated
BEQ = Berkeley Expressivity Questionnaire
BIS = Behavioural (Avoidance) Inhibition Scale
CESD-R = Centre for Epidemiologic Studies Depression Scale - Revised
CI = Confidence Interval
CIS = Chapman Infrequency Scale
DSM = Diagnostic and Statistical Manual for Psychiatric Disorders
ECI theory/hypothesis = Emotion Context Insensitivity theory/hypothesis
ECT = Electroconvulsive Therapy
FACES = Facial Expression Coding System
GAD = Generalized Anxiety Disorder
GED = General Equivalency Diploma
HAM-D = Hamilton Depression Rating Scale (interview)
HIT = Human Intelligence Task
HSQ = Humor Styles Questionnaire
ICC = Internal Consistency Coefficient
MANOVA/MANCOVA = Multiple Analysis of Variance (and/or Covariance)
MDD = Major Depressive Disorder
MDE = Major Depressive Episode
MTurk = Amazon Mechanical Turk
OCD = Obsessive Compulsive Disorder
PoH = Points of Hilarity
PTSD = Post-traumatic Stress Disorder
RCT = Randomized Controlled Trial
RSAS = Revised Social Anhedonia Scale
SD = Standard Deviation
SIAS = Social Interaction Anxiety Scale
SPSS = Statistical Package for the Social Sciences
Chapter 1

General Introduction

1.1 Objectives

Major depressive disorder (MDD) has been identified as the leading cause of disability worldwide, impacting several functional domains, including social functioning. There is substantial evidence evaluating the factors that contribute to social dysfunction and the relative role of depression-related symptoms of social anhedonia and social anxiety. However, we know little about the specific social behaviours that are impaired among individuals with MDD. One promising avenue in need of further investigation is humour. Humour is a relatively ubiquitous social phenomenon that facilitates social interactions by bringing people closer together, and is associated with feelings of reward and enjoyment.

The purpose of this series of studies was to elucidate how individuals with depression use humour (i.e., humour style) and demonstrate humour appreciation (i.e., mirth), and the differential relations of two common but independent symptoms of depression: social anxiety and social anhedonia with mirth. Two different methodologies were employed to address this research question. The first was an online survey study. The survey included self-reported data of depressive symptoms, social anxiety, social anhedonia, humour styles, appetitive motivational drives, and expressivity of positive emotions. The second was an experimental laboratory-based procedure. During this lab task, I examined subjective and observed enjoyment of humourous video clips, how subjective ratings changed after a one-week delay, and how individuals responded to humourous stimuli when they heard others laughing. The online survey was accessible to individuals via Amazon Mechanical Turk (Chapters 2 & 3). The experimental studies recruited healthy controls and individuals with a diagnosis of MDD to partake in a study conducted in our laboratory (Chapters 4 & 5). The results of this thesis have potential implications for our understanding of factors related to social dysfunction in depression, and could inform relevant treatment targets for individual- and group-based interventions.
This dissertation addressed the following specific research questions:

(1) What are the relations among depressive symptoms, social anxiety, social anhedonia, and four types of adaptive and maladaptive humour styles?

(2) After considering symptoms, what is the relation of motivational systems and expression of positive emotions with humour styles?

(3) Compared to controls, how do depressed individuals (a) respond to humourous videos, (b) rate enjoyment and humourousness of videos at a follow-up appointment, and (c) respond to humourous videos when they hear others laughing at the same videos?

1.2 An Overview of Depression, Social Anhedonia, and Social Anxiety

1.2.1 Depression

Major depressive disorder (MDD) is a psychological disorder representing a constellation of symptoms that affects approximately 8% of the population (Bromet et al., 2011). The ratio of female to male afflicted persons is 2:1 (Kessler & Wang, 2008). The cardinal symptoms of MDD include pervasive depressed mood and diminished interest or pleasure in activities. Other symptoms may include weight changes, disrupted sleeping patterns, psychomotor agitation/retardation, fatigue/loss of energy, feelings of worthlessness/guilt, difficulties with concentration/indecisiveness, and recurrent thoughts of suicide. Further, MDD is accompanied by clinically significant distress or impairment in functioning in areas such as scholastic achievement, interpersonal relationships, and vocational success (American Psychiatric Association, 2013). Indeed, the World Health Organization ranks depression as the leading cause of disability worldwide (World Health Organization, 2012).

MDD is characterized as an episodic disorder (American Psychiatric Association, 2013). The typical presentation of symptoms follows a pattern of periods in which the number and severity of presenting symptoms warrant a clinically significant “major depressive episode (MDE))”, followed by periods with fewer or no symptoms where individuals are deemed to be in partial/full remission (i.e., “euthymic”). Approximately 20% of individuals experience ongoing depressive symptoms consistent
with an MDE without a clear cyclical waxing and waning pattern of symptom severity (van Randenborgh et al., 2012). These individuals may fall under the specifier: Chronic. Alternately, some individuals may experience subthreshold clinically significant depressive symptoms for extended periods of time, but never meet the criteria for an MDE. These individuals are classified as experiencing a related depressive illness called dysthymia (American Psychiatric Association, 2013). However, even among those who are in remission, some recalcitrant symptoms are evident throughout the course of depression, including impairments in social functioning (Kennedy, Foy, Sherazi, McDonough, & McKeon, 2007; Rhebergen et al., 2010), neurocognitive functioning (McIntyre et al., 2013), and emotion (Bourke, Douglas, & Porter, 2010).

Symptoms of depression manifest in many psychological disorders. MDEs are a necessary criterion for major depressive disorder, but can occur outside of MDD (e.g., bipolar disorder, schizoaffective disorder; American Psychiatric Association, 2013). Like other mental health disorders, depressive symptoms occur along a continuum and are experienced to varying degrees across the lifespan of most individuals (Sutin et al., 2013). Taken together, the high prevalence rates of depression coupled with the associated impairment across multiple facets of everyday behaviour underscores the need to better understand the ways in which depressive symptomatology interact with functional outcome.

1.2.2 Social Anhedonia

A predominant feature of MDD is anhedonia, defined as diminished interest or pleasure in response to stimuli that were previously perceived as rewarding during a pre-morbid state (American Psychiatric Association, 2013). Recent evidence suggests that anhedonia may be best understood by evaluating two separable components: anticipatory and consummatory anhedonia. Anticipatory anhedonia refers to deficits in the expectation of deriving pleasure from a normally pleasurable activity, while consummatory anhedonia is liking or deriving pleasure from a pleasurable stimulus in the moment (Gard, Gard, Kring, & John, 2006). In line with this, individuals with depression and anhedonia have been shown to demonstrate diminished hedonic responses (i.e., pleasure and interest in response to typically rewarding stimuli). This
is evident in response to pleasant imagery (Allen, Trinder, & Brennan, 1999; Fiorito & Simons, 1994), words (Mathews & Barch, 2006), films (Rottenberg, Kasch, Gross, & Gotlib, 2002), and sensory stimuli (Chentsova-Dutton & Hanley, 2010).

In addition to the general diminishment in pleasure-related experiences, individuals with MDD often experience a specific subtype of anhedonia related to social interactions: social anhedonia. Social anhedonia is defined as a reduction in pleasure experienced from interpersonal interactions and, in turn, the subsequent reduced desire for social affiliation (Germaine, Garrido, Bruce, & Hooker, 2011). It is related to disinterest in social contact, and is conceptually and statistically separable from shyness, introversion, and anxiety in social situations (Silvia & Kwapił, 2011). Social anhedonia is positively associated with symptoms of depression (Rey, Jouvent, & Dubal, 2009) and flattened or incongruous facial affect in non-psychiatric samples (Kadison, Ragsdale, Mitchell, Cassisi, & Bedwell, 2015; Leung, Couture, Blanchard, Lin, & Llerena, 2010). Among individuals with MDD, social anhedonia is related to limited access to strategies for emotion regulation, lack of emotional clarity (Atherton, Nevels, & Moore, 2015), and decreased impulsivity (Amr & Volpe, 2013). Thus, while there appears to be a clear role for social anhedonia as it relates to recovery and functional outcome, there is a paucity of literature documenting the way in which social anhedonia interacts with these variables.

1.2.3 Social Anxiety

Social anxiety is a psychological disorder characterized by intense fear in social situations that causes significant distress and impairment in one’s ability to function (American Psychiatric Association, 2013). Specifically, individuals with a social anxiety disorder experience debilitating fear of what others are thinking about them, which is most pronounced concerning fears of embarrassment, humiliation, criticism, or rejection. Coupled with the cognitively-based feelings of fear and uncertainty, individuals with anxiety also often report physical symptoms such as blushing, heart racing, sweating, shaking, and trembling, which are typically associated with panic attacks (American Psychiatric Association, 2013). The estimated lifetime prevalence rate of social anxiety is 12%, with higher prevalence rates reported in
females (Ruscio et al., 2008). Social anxiety often co-occurs with depression, such that approximately 59% of individuals with depression have a comorbid anxiety disorder (Kessler et al., 2003), wherein 27% have a diagnosis of social anxiety (Fava et al., 2000). The combination of MDD and social anxiety has been linked to greater overall symptom severity (Ledley et al., 2005) and diminished quality of life (Wong, Sarver, & Beidel, 2012).

Socially anxious individuals crave the company of others (Stein & Stein, 2008), but will often avoid social situations or endure them with intense discomfort for fear of being scrutinized and judged (American Psychiatric Association, 2013). Similar to MDD, social anxiety is associated with low self-esteem, high self-criticism (Cox, Fleet, & Stein, 2004), and impairments in social functioning (Alden & Taylor, 2004). Individuals with social anxiety report being at least moderately impaired in relationships with family, romantic partners, and friends (Schneier et al., 1994). Paradoxically, despite desires to connect with others, individuals with social anxiety often behave in ways that promote negative social outcomes. Employing safety behaviours such as continually monitoring what they have said and how others have perceived them, prompts others to label them as distant and uninterested (Clark, 2005). Case in point, Heerey and Kring (2007) found that socially anxious individuals displayed higher rates of fidgeting, self-talk, and reassurance-seeking, and demonstrated poor reciprocity of smiling in social interactions. These behaviours were negatively associated with interaction partners’ ratings of interaction quality and positive affect during the interaction. This cyclical pattern lends credence to the interpersonal model of social anxiety, asserting that unintentionally dysfunctional and non-affiliative behaviours evoke negative social responses (Alden, 2005). Resultantly, socially anxious individuals often report a high degree of social isolation (Davidson, Hughes, George, & Blazer, 1993) and have fewer social relationships than healthy individuals (Alden & Taylor, 2004), which are byproducts of safety-seeking behaviours, rather than diminished social skills per se (Clark, 2005). This pattern incites self-fulfilling prophecies that diminish the subsequent likelihood of approaching others and increases the likelihood of avoidance (Taylor & Alden, 2011).
1.3 Emotion in Depression

1.3.1 Theories of Emotion

An important distinction in evaluating the emotion literature is between what is considered a mood and an emotion (Rottenberg & Gross, 2003). MDD is characterized by alterations in mood (e.g., dysphoria), wherein a mood is effectively a state of mind that is not necessarily related to environmental stimuli (Watson, 2000). Conversely, an emotion is a rapidly occurring response to a salient stimulus (Bylsma, Morris, & Rottenberg, 2008; Ekman, 1992). To this end, it has been proposed that moods facilitate emotions by up-regulating or down-regulating congruous emotional reactions to stimuli (Bylsma et al., 2008; Rottenberg, 2005). There are currently three prominent emotional reactivity theories predicated on this interactional model between mood and emotions. These include negative potentiation, positive attenuation, and emotion context insensitivity. The negative potentiation hypothesis posits that pervasive negative moods in MDD potentiate emotional reactivity to negative stimuli (i.e., increased negative emotion; Beck, 1979). The positive attenuation hypothesis holds that individuals with MDD experience reduced positive responses to positive emotional stimuli because these are incongruous with pervasive negative moods, thus, are down regulated (i.e., decreased positive emotion; Henriques & Davidson, 2000). Finally, the emotion context insensitivity (ECI) hypothesis suggests that depressed individuals will demonstrate diminished emotional reactivity to both positively and negatively valenced emotional stimuli (i.e., pervasive blunted responsivity; Rottenberg, 2005). While there is competing evidence for all three theories, the preponderance of evidence from the past two decades suggests that, at present, the ECI theory best accounts for emotional reactivity deficits in MDD (Rottenberg & Hindash, 2015). The ECI theory also accounts for the finding that diminished global emotional reactivity predicts a poorer clinical course (Peeters, Berkhof, Rottenberg, & Nicolson, 2010), suggesting that emotional reactivity is functionally relevant in MDD.
1.3.2 Blunted Emotional and Expressive Reactivity

Within the framework of the ECI hypothesis, depressed individuals demonstrate attenuated reactivity in response to negatively and positively emotionally salient stimuli. This response pattern is evident when interacting with several types of emotional stimuli including images (Sloan, Strauss, & Wisner, 2001), films (Kaviani et al., 2004), stress tasks (Guinjoan, Bernabó, & Cardinali, 1995), and reward and punishment paradigms (Henriques & Davidson, 2000). According to the ECI hypothesis, insensitivity to emotionally salient stimuli should be evident across the emotionality continuum. At this juncture, evidence most strongly supports attenuated responsivity to sadness and happiness, wherein the blunting of positive emotional reactivity appears to be larger in magnitude than that of negative reactivity. Taken together, there is a large effect for self-reported emotional reactivity deficits (Bylsma et al., 2008).

Emotional deficits manifest both in real-time responsivity (e.g., Sloan et al., 2001) and in the context of retrospective biases. For instance, depressed individuals demonstrate reduced emotional and facial affect responsivity during recollection and imagining of a happy event (Gehricke & Shapiro, 2000). Depressed individuals also show a stronger bias for recollection of negative affect relative to positive affect (Ben-Zeev, Young, & Madsen, 2009) and tend to remember negative information better than positive (Mathews & MacLeod, 2005; Matt, Vázquez, & Campbell, 1992). It may be the case that current mood affects retrieval of memories such that negative mood facilitates retrieval of negative memories (Bower, Gilligan, & Monteiro, 1981) and is associated with less accurate recall of pleasurable events (Gotlib & Neubauer, 2000).

Consistent with the ECI framework, depressed individuals demonstrate diminished expressive responsivity, signifying a medium effect size for deficits in behavioural measures of emotion (Bylsma et al., 2008). Restricted emotional reactivity is evidenced by lower intensity facial expressions (Sloan et al., 2001), less responsivity to reward contingencies (Henriques & Davidson, 2000), reduced cheek and brow activity (Gehricke & Shapiro, 2000), fewer smiles (Girard, Cohn, Mahoor, Mavadati, & Rosenwald, 2013; Reed, Sayette, & Cohn, 2007; Trémeau et al., 2005), and a relative absence of adaptive behaviours.
in response to others emotional expressions (Radke, Güths, André, Müller, & de Bruijn, 2014). These findings are aligned with more specific measures of facial affect using electromyography (EMG) that have demonstrated that individuals rated highly in depressive symptoms failed to show the expected increase in relevant facial activity in response to stimuli intended to elicit positive emotions (Sloan, Bradley, Dimoulas, & Lang, 2002). The same pattern of blunted responsivity manifests in social interactions in which depressed individuals demonstrate fewer affiliative facial expressions (e.g., less smiling; Girard et al., 2013) and behaviours (e.g., lack of eye contact; Ellgring, 2007) and more non-affiliative facial expressions relative to controls (Girard et al., 2014). The motivation for this lack of engagement may be self-protective in nature, whereby withdrawal could protect an individual from anticipated rejection, disappointment, and social exclusion (Allen & Badcock, 2003; Girard et al., 2013). However, given the critical role of demonstrating appropriate affect in interpersonal interactions (Morris, Bylsma, & Rottenberg, 2009; Tooby & Cosmides, 1990), it is likely that these difficulties with experiential and expressed emotionality promote social dysfunction (Hames, Hagan, & Joiner, 2013; Kupferberg, Bicks, & Hasler, 2016; Segrin, 2000). These patterns of emotional dysfunction highlight the need to understand the specific deficits evident in depression, with a view to better understand the transactional nature of emotional reactivity and social functioning.

1.4 Social Functioning in Depression

1.4.1 Scope of Social Dysfunction

MDD presents with a marked lack of pleasurable social contact and subsequent social withdrawal. While this impairment is in part linked to symptoms of social anxiety and social anhedonia (Alden & Taylor, 2004; Germine et al., 2011), depressive symptoms themselves (e.g., dysphoria; Segrin, 2000) are also major contributors to social dysfunction. Individuals with depression report impairments across several domains of social functioning including work, family, and friendship (Hirschfeld et al., 2000; Paykel, Weissman, & Prusoff, 1978). Specifically, people with MDD report less satisfying social lives relative to individuals without depression (Hirschfeld et al., 2000). Individuals with MDD demonstrate maladaptive
interaction patterns with others that generate stressful interpersonal experiences (Davila, Hammen, Burge, Paley, & Daley, 1995). Indeed, they may not necessarily have fewer social interactions than healthy individuals on the whole, but tend to have a smaller number of interaction partners and report lower quality interactions that are less intimate and less rewarding (Nezlek, Hampton, & Shean, 2000). These difficulties are evident across many social relationships, wherein depressed individuals report more negative interactions with strangers (Hale III, Jansen, Bouhuys, Jenner, & van den Hoofdakker, 1997; Segrin, 2000), colleagues (Kennedy et al., 2007), family members (Benazon, 2000), and romantic partners (Daley & Hammen, 2002). These negative interactions, in turn, promote feelings of isolation and loneliness, which may perpetuate depressive symptomatology (Beekman et al., 1995). Psychosocial functioning difficulties also persist upon remission (Coryell et al., 1993; Rhebergen et al., 2010; Simon & Ludman, 2014). Specifically, previously depressed women experience more problematic relationships with their children, extended family, and friends, wherein they report more stressful life events related to conflict in interpersonal relationships (Hammen & Brennan, 2002).

Taken together, the findings in social impairments coupled with emotional processing suggest that individuals with depression experience less pleasurable responses to in-the-moment and retrospectively encountered pleasurable stimuli. This reduction in pleasure is evident across several stimuli and experiences that are typically deemed pleasurable, including social interactions. From a mechanistic perspective, there are several factors that may contribute to social dysfunction and less fulfilling social relationships. One such factor is the role of underlying motivational systems that promote approach and avoidance, as these may illustrate how motivational systems that are specific to different symptom clusters may interact with aspects of social functioning.

1.4.2 Behavioural Inhibition/Activation

Behavioural inhibition and behavioural activation (approach) are motivational systems (BIS and BAS, respectively) that serve important functions in interpersonal behaviour (Gable, Reis, & Elliot, 2000). The BIS/BAS conceptualization of approach and withdrawal related behaviours is predicated by models of
emotion motivational systems (Gray, 1973, 1987). The BIS regulates sensitivity to threat and non-reward cues by inhibiting behaviour, increasing arousal, and assessing for risk. Conversely, the BAS is an approach-related, positively incentivized system that regulates movement toward reward. While initially applied to explain motivations underlying anxiety, the BIS and BAS are increasingly recognized as important factors for general psychopathology (Pinto-Meza et al., 2006). This is especially true of depression, anhedonia, and social anxiety, as these symptoms are closely linked with social functioning deficits wherein approach-avoidance drives are central to dysfunctional social behaviours (American Psychiatric Association, 2013).

BIS/BAS drives have been shown to be aberrant in individuals with MDD who, relative to controls, report higher levels of avoidance and lower levels of approach (Kasch, Rottenberg, Arnow, & Gotlib, 2002). This pattern of BIS/BAS drives manifests in the failure to approach social situations because they are not rewarding while simultaneously actively avoiding social situations to prevent rejection. Levels of BIS and BAS are stable over time and do not appear to fluctuate directly in response to clinical state (Kasch et al., 2002). BAS dysregulation exacerbates the presentation and course of depression (Kasch et al., 2002); specifically, lower BAS is associated with greater concurrent severity of depressive symptoms and predicts a worse outcome at follow-up time points. A hypoactive BAS may be a trait-vulnerability marker for MDD, as dampened BAS drives are evident both during depressive episodes and when individuals are in remission (Pinto-Meza et al., 2006). Relatedly, social anxiety is characterized by a conflict between competing motives to approach (i.e., “belong”) and avoid humiliation or rejection (i.e., “be accepted”), whereas social anhedonia reflects a diminished approach drive (Brown, Silvia, Myin-Germeys, & Kwapi, 2007; Morgan et al., 2009). Taken together, while depressive symptoms generally contribute to interpersonal dysfunction, there may be differential roles of social anxiety and social anhedonia, such that social anxiety pits drives to connect and belong against active avoidance, whereas social anhedonia thwarts one’s attempts to incite socializing (Brown et al., 2007). The use of these motivational systems in the context of socially-relevant behaviours is necessary to better understand
the way approach and avoidance motivational systems are associated with symptomatology and concomitant social dysfunction in depression.

1.4.3 Mirth: An Untapped Domain in Depression

Exposure to enjoyable stimuli (e.g., social contact) is rewarding and facilitates the likelihood of future engagement with such stimuli. However, individuals with depression experience diminished levels of enjoyment in response to a range of typically rewarding stimuli; thus, it may be the case that individuals with depression are less interested in typically rewarding aspects of social relationships. Yet, we know little about how depressed individuals respond to specific aspects of interactions that tend to be enjoyable in non-depressed individuals. One such aspect is that of humour, or, more specifically, mirth. Mirth is the emotion and subsequent expression of this enjoyment via smiling, laughing, or other non-verbal displays. Mirth facilitates social relationships (Shiota, Campos, Keltner, & Hertenstein, 2004), such that exposure to humour produces an increase in positive affect, mood (Szabo, 2003), and social connectedness (Gervais & Wilson, 2005; Martin, 2007). This suggests that the use of humour and experience of mirth contribute to the aspects of socializing that are rewarding, and are promising avenues of research in understanding the maintenance of depressive symptomatology and the associated impairments in social functioning.

1.5 Humour and Mirth

1.5.1 Theories of Humour and Laughter

Humour and laughter are universal aspects of human experience. They occur across all cultures and among individuals of all ages (Apte, 1985; Lefcourt, 2001). While the specific subject matter of humour is somewhat culturally specific, the sound of laughter is easily recognized and indistinguishable from culture to culture (Provine & Yong, 1991). From a developmental perspective, laughter is typically first demonstrated in infants at four months of age (Sroufe & Wunsch, 1972). In fact, laughter is considered to be an innate human trait as even children who are born deaf and blind engage in laughter in the absence of
being exposed to the laughter of others (Provine, 2001). In essence, “laughter is essentially a way of expressing or communicating to others the fact that one is experiencing the emotion of mirth” (Martin, 2007). Thus, humour is largely considered a social phenomenon (Martin & Kuiper, 1999).

While there are several theories of humour, the most predominant view is that humour involves an idea, image, text, or event that is incongruous, odd, unusual, unexpected, surprising, or out of the ordinary. Further, the stimulus must be appraised as non-threatening, non-serious, or unimportant (i.e., ‘playful’; Martin, 2010). This manifests in safe surprises (e.g., peek-a-boo games) among infants, tickling and physical play in children, and incongruity-based humour in adults. Thus, the key elements of humour are considered to be incongruity, unexpectedness, and playfulness, also referred to as “nonserious social incongruity” (Gervais & Wilson, 2005). A demonstrative example is this pun:

*Bob said to the Gym Instructor: “Can you teach me how to do the splits?”*
*Gym Instructor said: “How flexible are you?”*
*Bob said: “I can’t make Tuesdays.”*

There are three stages of processing involved in the subjective enjoyment of this pun. First, the observer encounters an incongruity (e.g., Bob responds to the question about flexibility referencing his schedule). Second, the observer engages in problem-solving to resolve the incongruity – that prompted the feeling of surprise – between the joke and the initial expectation based on the beginning of the joke (e.g., the conversation is set up to be about physical flexibility, but shifts to schedule availability; a second later we realize that Bob’s response is based on a different meaning of flexibility). Finally, the appreciation stage, which entails the emotional, physiological, and physical response (e.g., derisive chuckle, playful eye-roll; Suls, 1972; Taber, Redden, & Hurley, 2007).

However, some aspects of humour are not captured by the incongruity theory. For instance, hostile or aggressive humour does not pertain to a non-serious blunder or joke. In hostile humour, targets of ‘jokes’ or mishaps are most often embarrassed or hurt. Appreciation of hostile humour is considered to be a means to express aggression indirectly while protecting one’s image because it allows the viewer to remain outwardly non-hostile (Weinstein, Hodgins, & Ostvik-White, 2011). Evidence of this type of
humour is still in need of further investigation, but it can be concluded that the appreciation of aggressive humour appears to be a relevant construct in the study of humour (Gignac, Karatamoglou, Wee, & Palacios, 2014).

The perception of humour typically induces a pleasant emotional response, wherein exposure to humourous stimuli produces an increase in positive affect and mood (Szabo, 2003). Positive emotions (such as mirth) play a role in the facilitation of social relationships (Shiota et al., 2004). The enjoyable emotional state following shared humourous experiences provides a strong incentive to seek out opportunities for humour and laughter, which fulfill important social functions. For instance, humour is often used as an affect-regulation strategy in the context of interpersonal relationships (Besser, Luyten, & Mayes, 2012; Martin, 2007; Miczo, Averbeck, & Mariani, 2009; Taber et al., 2007). Laughter is considered both a behavioural response (by the person laughing) and a signal (received by the other member(s) in the interaction). Laughter appears to be inherently contagious (Provine, 1992) and benefits both the sender and receiver by generating positive emotions that strengthen group identity and cohesion, promote stability, and moderate stress (Gervais & Wilson, 2005). An important distinction in considering the effects of smiling and laughter is that which is spontaneous and humour-evoked (i.e., Duchenne; e.g., laughing at the punch line of a joke you find funny) relative to non-Duchenne that is deliberately generated (e.g., smiling at a stranger to appear friendly; Taber et al., 2007). Not only do these two types of responses share different neurological underpinnings (Iwase et al., 2002; Wild et al., 2006), they are relatively easily distinguished as ‘fake’ or ‘real’ by observers (Miles & Johnston, 2007; Reysen, 2006). Duchenne smiles also induce more positive affect than non-Duchenne smiles in observers (Surakka & Hietanen, 1998).

Taken together, the psychological functions of humour are classified into three general categories: (1) cognitive and social benefits of the positive emotion of mirth, (2) uses of humour for social communication and influences, and (3) tension relief and coping (Martin, 2007). Given the broad
implications of humour it stands to reason that the use, sharing, and enjoyment of humour serves an adaptive social advantage (Martin, 2007).

1.5.2 Humour Styles

Humour style refers to the way in which individuals use humour in their everyday lives. Measurements of humour style have typically emerged as a means to evaluate the relation between ‘sense of humour’ and physical and psychological wellbeing. From this perspective humour style may be conceptualized as a behaviour that serves a functional role. However, the majority of extant scales fail to assess the way people actually use and express humour in their everyday lives (Martin, 2007). Specifically, the role of humour style intrapsychically and interpersonally has often been overlooked. This is particularly surprising in light of the large social aspect of humour, wherein much of the use and expression of humour occurs in social interactions.

In response to this shortfall, Martin and colleagues (2003) developed the Humor Styles Questionnaire (HSQ). The HSQ features a two-dimensional framework that includes a strong focus on both the intrapersonal and interpersonal nature and consequences of humour. The framework suggests that two underlying dimensions reflect both the interpersonal nature of humour (i.e., injurious or benign) and the target of enhancement (i.e., the self or relationships with others). The combination of these two dimensions yields four distinct humour styles, two that are adaptive (i.e., affiliative and self-enhancing) and two that are maladaptive (i.e., aggressive and self-defeating). On the adaptive dimension, affiliative humour is benign humour that is used to enhance relationships with others, such as friendly banter, whereas self-enhancing humour refers to benign humour that is used to enhance the self, for example, to maintain a positive outlook during times of adversity. Adaptive humour styles have been demonstrated to be associated with positive interpersonal relationships (e.g., social support, interpersonal competence, and intimacy; Dozois, Martin, & Bieling, 2009; for a review see Martin, 2007) and feelings of well-being (Butzer & Kuiper, 2008; Cann, Norman, Welbourne, & Calhoun, 2008). Conversely, the maladaptive humour style of aggressive humour refers to injurious humour that is used to enhance the self, such as
ridiculing others, while self-defeating refers to injurious humour that is used to enhance relationships with others through actions such as belittling oneself. Maladaptive humour styles have been shown to be associated with distress (Martin et al., 2003), loneliness (Fitts, Sebby, & Zlokovich, 2009), lower levels of relationships satisfaction (Cann et al., 2008), and general dislike by other people (Kuiper & Leite, 2010).

To date, the literature suggests that both affiliative and self-enhancing styles of humour are negatively related to depression whereas the opposite pattern has been observed for self-defeating humour (Martin, 2007). Many of these studies have evaluated the relation between humour styles and other interpersonally relevant factors (e.g., self-esteem; Stieger, Formann, & Burger, 2011) using dysphoria as the measure of depression in large undergraduate samples. Thus, they fall short in their generalizability as they do not capture the heterogeneity of the general population, nor do they consider how humour styles manifest among individuals who meet a clinically relevant cutoff of a current major depressive episode.

1.6 Humour, Smiling, and Mirth in Depression

1.6.1 Processing of Humour

Studies of emotional processing demonstrate that depressed individuals show attenuated responses to amusing and humourous stimuli (e.g., Rottenberg & Hindash, 2015). Further, while depressed individuals are often poor at using humour as an effective coping strategy (Falkenberg, Jarmuzek, Bartels, & Wild, 2010), individuals do attempt to use humour to offset depressive symptomatology (Proudfoot et al., 2015). Yet, the specific way that depressed individuals process and appreciate humour has received very little attention in the literature. From a processing perspective, it may be the case that people with depression struggle to understand and quickly process humourous information because of associated executive functioning deficits (Uekermann et al., 2008). However, Falkenberg and colleagues (2010) found that depressed individuals do not differ from controls in their subjective reports of how funny they found humourous stimuli. These findings suggest that the processing and problem solving aspects may still be intact. Thus, difficulties with emotional processing may be implicated in apparent deficits in
humour appreciation, whereas the specific way in which depressed individuals use humour on a daily basis (i.e., humour style) is related to the self-generation of humour strategies to connect with others.

### 1.6.2 Humour Styles

As aforementioned, there are several studies documenting the relations between depressive symptoms and humour styles. Findings demonstrate that depressive symptoms are positively related to the maladaptive humour style of self-defeating humour and inversely related to positive humour styles of affiliative and self-enhancing humour (Frewen, Brinker, Martin, & Dozois, 2008; Martin, 2007). The relation of depressive symptoms and self-defeating humour is aligned with clinical conceptualizations of depression whereby depressed individuals often have low self-worth and are inclined to put themselves down (Crocker, 2002; Roberts & Monroe, 1994). A self-defeating style captures humour used in social settings in which individuals attempt to relate to others by means of self-denigration. Alternatively, affiliative and self-enhancing humour styles encompass aspects that run contrary to depressive symptoms. For instance, both adaptive humour styles are correlated with extraversion (Galloway, 2010), cheerfulness, and social intimacy (Martin et al., 2003), whereas depressive symptoms are inversely related to each of these constructs (Falkenberg et al., 2010; Hakulinen et al., 2015; Nezlek et al., 2000). Furthermore, self-enhancing humour is effectively an emotion regulation strategy used to see the humourous side of a negatively valenced event. Studies evaluating the relation of depression and emotion regulation suggest that the two share a negative relation, which is true both when depression is evaluated continuously (Garnefski, Teerds, Kraaij, Legerstee, & van den Kommer, 2004) and as a categorical variable (Joormann & Gotlib, 2010).

### 1.6.3 Smiling, Laughter, and Mirth

It is well documented that individuals with depression demonstrate attenuated or blunted emotional expression in response to positive stimuli or typically-positive experiences (e.g., viewing happy film clips, mother-infant interactions, social interactions; Rottenberg & Vaughan, 2008). This responsivity
captures diminished frequency of smiling (Sloan et al., 2002; Trémeau et al., 2005) as well as instances of laughter (Schelde, 1998). However, we know less about the way in which the demonstration of smiling and laughter interact with depression. Research among individuals with neuromuscular facial disorders demonstrates that the inability to smile, but not global impairment of facial motion, predicts both depression and anxiety severity (VanSwearingen, Cohn, & Bajaj-Luthra, 1999). Thus, reduced smiling unto itself is related to depression severity. There is also evidence that the laughter of depressed individuals may be qualitatively different from healthy controls. Recently, Navarro and colleagues (2014) demonstrated the use of laughter as a diagnostic feature of depression. They found that specific prosodic features of Duchenne laughter expressed in a laboratory task while viewing humorous stimuli correctly categorized 75% of a sample of healthy controls and depressed individuals. Some have even suggested that increased frequency of smiling and laughter may be behavioural markers of remission and indicative of recovery from depression, as individuals with remitted depression demonstrate more smiling and laughter than their depressed counterparts (Sakamoto, Nameta, Kawasaki, Yamashita, & Shimizu, 1997; Schelde, 1998). Given the paucity of literature on these topics, more evidence is needed to substantiate these findings, but they raise the question of a possible bidirectional relation between smiling and/or laughter and depression.

To this end, there is a small, but growing literature that demonstrates the somewhat efficacious use of manualized training of humour abilities (Falkenberg, Buchkremer, Bartels, & Wild, 2011), humour therapy (Brodaty et al., 2014; Goodenough et al., 2012; Ko & Youn, 2011; Quintero, Henao, Villamil, & León, 2015), and laughter yoga (Shahidi et al., 2011) in reducing depressive symptoms. The manualized training of humour abilities involves eight group-therapy sessions in which therapists lead discussions and exercises designed to help individuals discuss the use and importance of humour, as well as putting humour into practice (e.g., creating punchlines for jokes, planning how to respond with a witty remark when embarrassed). Participants completing this therapy have reported reduced depressive symptoms and improvements in competency using humour (Falkenberg, Buchkremer, Bartels, & Wild, 2011). Other
humour therapy interventions have focused primarily on elderly individuals with depressive symptoms and have included eight sessions of comical singing (Houston, 1998), watching humourous videos three times a week for twelve weeks (Boyd & McGuire, 1996), and, more recently, a single-blind randomized controlled trial (RCT) in Australia. The Australian RCT is entitled the Sydney Multisite Intervention of LaughterBosses and ElderClowns (SMILE), wherein LaughterBosses (trained facility staff) and ElderClowns (professional performers) work with elderly individuals on a weekly basis for twelve weeks. Sessions focus on developing techniques for enhancing communication and positive diversion, and working on strategies to incorporate humour and play into daily life routines. The trial found no significant effects on primary outcomes of depression, but improvements in quality of life and social engagement (Brodaty et al., 2014). Finally, laughter yoga involves provoked laughter interspersed with deep breathing, and has been demonstrated to decrease depressive symptoms on par with exercise therapy in depressed older women (Shahidi et al., 2011). Thus, taken together, there is some evidence to suggest that humour and laughter-based therapies may incite decreases in depressive symptoms such that further investigation is warranted (Braniecka, Parnowska, & Radomska, 2011).

These studies highlight that expression of positive emotions and prosodic qualities of laughter are different in depression, and that the training of mirthful behaviours may subsequently incite reductions in depressive symptoms. However, it does not inform our understanding of how the expression of mirth and laughter are related to use of humour in everyday life and social functioning. Given the prosocial aspects to the demonstration of humour appreciation, it is necessary to understand the conditions under which it may be elicited. This may prove especially important among individuals with depression who may not only have different humour styles than non-depressed individuals, but may also fail to experience and visibly express enjoyment in response to humour at socially appropriate time points.

1.7 Addressing Gaps in Our Understanding of Humour and Mirth in Depression

The purpose of these studies is to better understand the relation between humour styles, humour appreciation, and depressive symptomatology, using both self-report and experimental manipulation in a
laboratory setting. While there are several competing theories of emotion and numerous factors that affect
and maintain social dysfunction, there is still a very limited understanding of the role of humour in
depression. Given the poignancy of humour and mirth as socially relevant strategies to produce bonding
and belonging, there is a need to more comprehensively evaluate these variables as they relate to
depression. This dissertation addressed some of the important unanswered questions, thereby taking steps
to bridge this gap in our understanding.
Chapter 2

What’s Cramping Your Style?

Differential Relations Among Humour Styles, Depressive Symptoms, Social Anxiety, and Social Anhedonia

2.1 Introduction

Major depressive disorder (MDD) is characterized by numerous related symptoms and affects approximately 8% of the population (Bromet et al., 2011). Primary symptoms include pervasive depressed mood and anhedonia (American Psychiatric Association, 2013), in which social anhedonia, defined as reduced pleasure from interpersonal interactions and subsequent dampened desire for social affiliation (Germine et al., 2011), has been shown to be an important indicator of depressive episodes (Blanchard, Horan, & Brown, 2001). Social anxiety is an often co-morbid clinically relevant symptom cluster (Ohayon & Schatzberg, 2010); 59% of individuals with depression have a comorbid anxiety disorder (Kessler et al., 2003), and 27% meet criteria for social anxiety disorder (Fava et al., 2000). Moreover, the combination of MDD and social anxiety has been linked to greater overall symptom severity (Ledley et al., 2005) and diminished quality of life (Wong et al., 2012). Thus, it is important to consider the roles of social anxiety and social anhedonia when attempting to understand MDD symptomatology.

Individuals with MDD experience significant impairments in functioning across several social environments, including work, family, and friendships (Bosc, 2000; Paykel et al., 1978). MDD is associated with a less satisfying social life (Hirschfeld et al., 2000), wherein individuals with MDD may not have fewer social interactions than healthy individuals, but tend to have fewer interaction partners and report lower quality interactions that are less intimate and less rewarding (Nezlek et al., 2000; Nezlek, Imbrie, & Shean, 1994). Indeed, relative to individuals without MDD, depressed individuals report more negative interactions with strangers (Gotlib & Robinson, 1982), roommates (Hokanson, Hummer, &
Butler, 1991), and family members (Benazon, 2000). Thus, individuals with MDD struggle to experience pleasure across several interpersonal contexts, and have less positive and fulfilling social relationships.

In the context of interpersonal relationships, belongingness and acceptance are considered the most fundamental needs (Leary, 2007). This suggests that examining mechanisms underlying failure to achieve these needs is critical to understanding social dysfunction. One mechanistic line of research implicates the functionality of motivational systems underlying behaviour (i.e., approach/avoidance systems). These have been shown to be aberrant in individuals with MDD who, relative to controls, report higher levels of avoidance and lower levels of approach (Kasch et al., 2002). This permutation of motivational systems manifests in the failure to approach social situations because they are not rewarding while simultaneously actively avoiding social situations to prevent rejection. Social anxiety is characterized by a conflict between competing motives to approach (i.e., “belong”) and avoid humiliation or rejection (i.e., “be accepted”), whereas social anhedonia reflects a diminished approach drive (Brown, Silvia, Myin-Germeys, & Kwapił, 2007; Morgan et al., 2009). While social anxiety and social anhedonia are moderately correlated with one another (Mattick & Clarke, 1998), the shared variance is thought to be related to the mutual experience of discomfort in social situations (Silvia & Kwapił, 2011). Furthermore, the two constructs have been shown to be separable, such that social anhedonia does not reflect shyness or introversion, but rather a genuine disinterest borne out of lack of pleasure (Silvia & Kwapił, 2011). By contrast, social anxiety is postulated to be due to viewing others as potentially critical, hostile, or rejecting (Leary & Kowalski, 1995). Thus, while depressive symptoms generally contribute to interpersonal dysfunction, there may be differential roles of social anxiety and social anhedonia, such that social anxiety pits drives to connect and belong against active avoidance, whereas social anhedonia thwarts one’s attempts to incite socializing (Brown et al., 2007).

### 2.1.1 Humour styles and psychopathology

One promising avenue in understanding the maintenance of depressive symptomatology and concomitant impairments in social functioning is that of humour style. Humour and laughter serve important social-
emotional functions, including inciting experiences of enjoyment and facilitating social connectedness, wherein the enjoyment and use of humour proffer an adaptive social advantage (Martin, 2007). As such, a better understanding of the interpersonal behaviour patterns of humour style may provide some insight into how depressive symptoms, social anxiety, and social anhedonia exert differential effects on social functioning. Recent research evaluating relations between psychological wellbeing and humour styles has employed a four dimension humour style questionnaire (HSQ; Martin, Puhlik-Doris, Larsen, Gray, & Weir, 2003). The HSQ describes two styles as adaptive (positive) and two as maladaptive (negative).

Affiliative humour is a positive style used to strengthen social bonds, wherein one might joke around and laugh with or amuse others. Self-enhancing humour is the tendency to maintain a humourous outlook and to use humour as an emotion regulation and coping strategy, to enhance positivity. Aggressive humour is a negative style related to the use of sarcasm, teasing, and using humour to criticize others in attempt to bolster the self. Self-defeating humour is the tendency to use humour in an excessively self-disparaging or ingratiating way, for the purposes of being perceived favourably.

Affiliative and self-enhancing humour are negatively related to depressive symptoms, general anxiety (Martin et al., 2003), social anxiety (Tucker, Judah, et al., 2013), and suicidal ideation (Tucker, Wingate, et al., 2013). By way of enhancing social relationships, these styles have been demonstrated to be associated with positive aspects of interpersonal relationships (e.g., social support, interpersonal competence, and intimacy) and feelings of wellbeing and self-esteem (Martin, 2010). Furthermore, it may be the case that affiliative and self-enhancing styles exert protective effects against interpersonally-relevant predictors of depressive symptoms, such as loneliness (Hampes, 2005), shyness (Hampes, 2006), and a lack of belongingness (Tucker, Wingate, et al., 2013). It has been hypothesized that individuals who employ affiliative and self-enhancing humour styles may be more likely to reach out and solicit support from others and be buffered against concerns about rejection (Tucker, Judah, et al., 2013), thereby mitigating deleterious effects of depression and social anxiety. In light of the diminished drive to approach (“belong”) experienced by socially anhedonic individuals, it may be the case that social
anhedonia would be more negatively associated with affiliative humour than both depressive symptoms and social anxiety. Indeed, it has been observed that individuals with social anhedonia demonstrate markedly deficient affiliative behaviours in social interactions (Llerena, Park, Couture, & Blanchard, 2012). Furthermore, this diminished drive to approach, coupled with social anhedonia’s association with higher overall negative affect (Blanchard et al., 2001) and inverse relation to positive emotions (Silvia & Kwapil, 2011), suggests that it would share a negative association with self-enhancing humour similar to that of depression and social anxiety.

Aggressive humour does not have meaningful correlations with either depressive or social anxiety symptoms (Martin et al., 2003; Tucker, Judah, et al., 2013), but is positively related to measures of aggression and hostility (Martin et al., 2003). Dissimilarly, self-defeating humour has consistently been positively associated with depressive symptoms, general anxiety (Martin et al., 2003; Martin, 2007), and social anxiety (Tucker, Judah, et al., 2013), and is inversely correlated with self-esteem (Stieger et al., 2011). Both maladaptive humour styles have been shown to be associated with distress (Martin, 2007), loneliness (Fitts et al., 2009), lower levels of relationship satisfaction (Cann et al., 2008), and dislike by other people (Kuiper & Leite, 2010). Taken together, it seems that while the mechanisms of aggressive and self-defeating humour may be different, they are alike in alienating others and promoting interpersonal dysfunction. Concerning social anhedonia, wherein the crux is a lack of need to belong that is unrelated to the perception that others do not want to be with them (Kwapil et al., 2009), it stands to reason that social anhedonia would not be significantly associated with either a propensity to deride others (aggressive humour) or oneself (self-defeating humour).

2.1.2 Aim of the current study

Given the differential relations of depressive symptoms, social anxiety, and social anhedonia with salient aspects of social dysfunction, it is important to extend this work to the domain of humour styles where the association with social anhedonia is currently unknown. Furthermore, past research has typically evaluated depressive symptoms as a continuous variable in relation to humour styles, often tapping
dysphoria rather than examining the magnitude of these relations in individuals who meet diagnostic criteria for a major depressive episode (MDE). To our knowledge, the current study addresses these gaps in understanding by being the first to evaluate the relation of social anhedonia to humour styles, and to contrast this relation with those between depressive symptoms and social anxiety. Furthermore, this study is also novel in that it directly compares individuals who meet diagnostic criteria to individuals who do not demonstrate this level of clinical severity.

It was hypothesized that social anhedonia would be negatively correlated with affiliative humour. This relationship would be significantly more negative than the correlations between affiliative humour and both depressive and social anxiety symptoms. Self-enhancing humour would also be negatively correlated with social anhedonia with a magnitude similar to those observed for social anxiety and depression. Concerning maladaptive humour styles, it was hypothesized that the relation of social anhedonia with self-defeating humour would be significantly different from the relations of both depressive symptoms and social anxiety with self-defeating humour. These correlations were only tested in the non-MDE group. When comparing the strength of correlations between individuals who did and did not endorse symptoms consistent with an MDE, it was hypothesized that correlations would be in the same direction but with a stronger magnitude than previous research on the relation of humour styles to depressive and social anxiety symptoms. Specifically, in the MDE group: depressive and social anxiety symptoms would be significantly more strongly negatively correlated with adaptive humour styles, and more strongly positively correlated with maladaptive humour styles. Social anhedonia would be more strongly negatively correlated with all four adaptive and maladaptive humour styles.

2.2 Method

2.2.1 Participants

Participants were recruited via crowdsourcing through an advertisement posted on MTurk. MTurk is an Amazon.com owned internet-based crowdsourcing service that allows “requesters” (study investigators) to recruit “workers” (other users, i.e., potential participants) to complete online tasks and surveys for
relatively minimal costs. On MTurk, workers browse Human Intelligence Tasks (HITs; e.g., surveys) and complete HITs of interest. Upon successful completion of tasks requesters pay workers. Data ascertained on MTurk has been demonstrated to be reliable in both healthy populations and clinical samples (Buhrmester, Kwang, & Gosling, 2011; Shapiro, Chandler, & Mueller, 2013). A link to a survey was posted to MTurk. Participant data is anonymous and Amazon.com retains all identifying information. The advertisement posted on MTurk is presented in Appendix A. This study was conducted in compliance with the Queen’s University Research Ethics Board (approval letter in Appendix B).

Eligible participants met the following criteria: (i) between the ages of 18-60; (ii) able to read and write English fluently; (iii) normal or corrected vision; (iv) a previous HIT approval rate for all requesters’ HITs as greater than or equal to 90% rating and a total number of past HITs approved greater than or equal to 500 on Amazon Mechanical Turk (MTurk; https://www.mturk.com/mturk/welcome); and (v) reside in North America. Participants were excluded if they missed more than 5% of the total items, completed the survey in under 19 minutes (minimal completion time computed by determining a cutoff of 2 standard deviations above the average reading rate of 184 words per minute; Trauzettel-Klosinski & Dietz, 2012), and for random responding as measured by a score of 3 or more on the Chapman Infrequency Scale (Chapman & Chapman, 1983). Using algorithms aligned with DSM-IV diagnoses, individuals scoring above the clinical cutoff for a probable major depressive episode on the Center for Epidemiologic Studies Depression Scale-Revised (CESD-R; Eaton, Smith, Ybarra, Muntaner, & Tien, 2004) were assigned to the MDE group and all others were assigned to the non-MDE group.

2.2.2 Measures

2.2.2.1 Survey software

The online survey was created using Fluid Surveys, a survey application that is provided for Queen’s University faculty and students at no cost. Letter of information and consent presented in Appendix C. The survey took approximately 45 minutes to complete. After completion, participants were compensated $3 via MTurk (rate of pay aligned with conventions on MTurk; Horton & Chilton, 2010). All participants
were also provided with a debriefing form with contact information for North American mental health services (presented in Appendix D). The following questionnaires were included in the survey.

2.2.2.2 Demographic questionnaire

Participants provided information about their age, gender, ethnicity, educational background, and marital status.

2.2.2.3 The Center for Epidemiologic Studies Depression Scale-Revised (CESD-R)

The CESD-R (Eaton et al., 2004) is a 20-item checklist designed for use in the general population that measures depressive symptomatology from the DSM-IV (American Psychiatric Association, 1994). Symptom domains include: sadness, anhedonia, appetite, sleep, thinking/concentration, guilt, fatigue, psychomotor agitation, and suicidal ideation. Participants rate how often they have experienced items in the past week. Response options range from 0 (not at all or less than 1 day) to 4 (nearly every day for 2 weeks). Total scores range from 0 to 60, wherein one can use the total score or an algorithmic classification procedure to determine clinical depression cutoffs. For this study, individuals in the MDE group met the following criteria for a probable MDE: anhedonia or dysphoria nearly every day for the past two weeks, plus symptoms in an additional three DSM symptom groups reported as occurring either nearly everyday day for the past two weeks, or 5-7 days in the past week. The internal consistency of the scale in the present study was excellent (α = .95).

2.2.2.4 The Revised Social Anhedonia Scale (RSAS)

The RSAS (Eckblad, Chapman, Chapman, & Mishlove, 1982) is a 40-item, true-false, self-report questionnaire that measures decreased pleasure derived from interpersonal interactions. High scores on the RSAS are associated with interview-based reports of current social withdrawal and isolation (but not loneliness) and reports of less enjoyment from and the need for social contact (Mishlove & Chapman, 1985; Edell, 1995). Consistent with prior research, questions from the 17-item Chapman Infrequency Scale (Chapman & Chapman, 1983) were interspersed in the RSAS to examine the extent to which
participants’ responses were valid. As in other studies, individuals who endorsed three or more infrequency items were excluded from analyses (Cohen, Leung, Saperstein, & Blanchard, 2006). The internal consistency of the RSAS in the present study was excellent ($\alpha = .93$).

2.2.2.5 The Social Interaction Anxiety Scale (SIAS)

The SIAS (Mattick & Clarke, 1998) is designed to assess social interactional anxiety, which is defined as extreme distress when initiating and maintaining conversations with others. The SIAS is a 20-item scale that is rated on a scale from 0 (*not at all characteristic or true of me*) to 4 (*extremely characteristic or true of me*). The internal consistency in the present study was excellent ($\alpha = .97$).

2.2.2.6 The Humour Styles Questionnaire (HSQ)

The HSQ (Martin et al., 2003) is a 32-item self-report measure assessing four dimensions related to individual differences in uses of humour in everyday life. Respondents rated each item using a 7-point Likert-type scale ranging from 1 (*totally disagree*) to 7 (*totally agree*). The HSQ contains 8-item subscales measuring each of the four dimensions of humour: affiliative, self-enhancing, aggressive, and self-defeating. The resulting scores are four subscale scores ranging from 8-56, thus humour styles are amenable to being used as continuous variables. The internal consistencies of the subscales in the present study were good (ranging from $\alpha = .81$ to .89).

2.3 Results

2.3.1 Sample Characteristics

A total of 419 participants completed the online survey, of which 51 were excluded for reasons including: missing more than 5% of the total questions ($n = 25$), completing the survey in under 19 minutes ($n = 16$), and for random responding (3+ on Chapman Infrequency Scale; $n = 10$; see Appendix E for differences between included versus excluded participants). Using the CESD-R algorithm for determination of a probable major depressive episode (Eaton et al., 2004), individuals were assigned to either the MDE
group (n = 24) or non-MDE group (n = 344). Demographics for all 368 participants are reported in Table 2.1. All participants included in the final sample reported living in the United States of America.

### Table 2.1 Descriptive Characteristics of the Overall Sample and by Depression Group

<table>
<thead>
<tr>
<th></th>
<th>MDE (n = 24)</th>
<th>Non-MDE (n = 344)</th>
<th>Total (N = 368)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age M (SD)</strong></td>
<td>32.42 (10.85)</td>
<td>35.17 (9.75)</td>
<td>34.99 (9.83)</td>
<td>.186</td>
</tr>
<tr>
<td><strong>Gender n (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>12 (50)</td>
<td>168 (48.84)</td>
<td>180 (48.91)</td>
<td>.930</td>
</tr>
<tr>
<td>Male</td>
<td>12 (50)</td>
<td>174 (50.58)</td>
<td>186 (50.54)</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity n (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td>.785</td>
</tr>
<tr>
<td>Caucasian</td>
<td>16 (66.67)</td>
<td>265 (77.03)</td>
<td>281 (76.36)</td>
<td></td>
</tr>
<tr>
<td>Latino/Hispanic</td>
<td>1 (4.17)</td>
<td>20 (5.81)</td>
<td>21 (5.71)</td>
<td></td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>0</td>
<td>2 (.58)</td>
<td>2 (.54)</td>
<td></td>
</tr>
<tr>
<td>African</td>
<td>3 (12.50)</td>
<td>22 (6.40)</td>
<td>25 (6.79)</td>
<td></td>
</tr>
<tr>
<td>Caribbean</td>
<td>0</td>
<td>3 (.87)</td>
<td>3 (.82)</td>
<td></td>
</tr>
<tr>
<td>South Asia</td>
<td>0</td>
<td>5 (1.45)</td>
<td>5 (1.4)</td>
<td></td>
</tr>
<tr>
<td>East Asia</td>
<td>1 (4.17)</td>
<td>12 (3.49)</td>
<td>13 (3.5)</td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td>2 (8.33)</td>
<td>10 (2.91)</td>
<td>12 (3.3)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>3 (.87)</td>
<td>3 (.82)</td>
<td></td>
</tr>
<tr>
<td><strong>Education n (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td>.444</td>
</tr>
<tr>
<td>Some high school</td>
<td>0</td>
<td>1 (.03)</td>
<td>1 (.03)</td>
<td></td>
</tr>
<tr>
<td>High school diploma/GED</td>
<td>3 (12.50)</td>
<td>39 (11.34)</td>
<td>42 (11.41)</td>
<td></td>
</tr>
<tr>
<td>Some college/university</td>
<td>10 (41.67)</td>
<td>114 (33.14)</td>
<td>124 (33.70)</td>
<td></td>
</tr>
<tr>
<td>College diploma</td>
<td>8 (33.33)</td>
<td>80 (23.26)</td>
<td>88 (23.91)</td>
<td></td>
</tr>
<tr>
<td>University degree</td>
<td>3 (12.50)</td>
<td>73 (21.22)</td>
<td>76 (20.65)</td>
<td></td>
</tr>
<tr>
<td>Post graduate degree</td>
<td>0</td>
<td>35 (10.17)</td>
<td>35 (9.51)</td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status n (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Single</td>
<td>13 (54.17)</td>
<td>134 (38.95)</td>
<td>147 (39.95)</td>
<td></td>
</tr>
<tr>
<td>Single, but in a relationship</td>
<td>3 (12.50)</td>
<td>66 (19.19)</td>
<td>69 (17.88)</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>2 (8.33)</td>
<td>121 (35.17)</td>
<td>123 (33.42)</td>
<td></td>
</tr>
<tr>
<td>Separated/divorced</td>
<td>3 (12.50)</td>
<td>21 (6.10)</td>
<td>24 (6.52)</td>
<td></td>
</tr>
<tr>
<td>Widowed</td>
<td>3 (12.50)</td>
<td>1 (.29)</td>
<td>4 (1.09)</td>
<td></td>
</tr>
</tbody>
</table>

*Note. Values may not add up to 100% due to missing data*

### 2.3.2 Analyses

Two sets of Pearson correlations were conducted to test the hypotheses concerning the relations of each humour style to depressive symptoms, social anxiety, and social anhedonia. The first set of correlations evaluated the strength of these relations among the non-MDE sample; the second set only included participants in the MDE group (Table 2.2). Steiger’s z-test (Steiger, 1980) tested the hypotheses that social anhedonia would be differentially correlated with humour styles, relative to those with depressive symptoms and social anxiety. Further, Fisher’s R-to-z transformations (Cohen & Cohen, 1983) tested the
hypotheses that the relation of humour styles to psychopathological traits would be different in the MDE group relative to the non-MDE group.

2.3.3 Correlations

Pearson correlations and descriptive statistics are presented in Table 2.2. Consistent with hypotheses, social anhedonia was significantly negatively correlated with both affiliative and self-enhancing humour styles, \( r(344) = -.45, p < .001 \) and \( r(344) = -.32, p < .001 \), respectively. Social anhedonia was significantly positively correlated with an aggressive humour style, \( r(344) = .15, p = .004 \), but was not significantly correlated with self-defeating humour style, \( r(344) = .03, p = .577 \).

Table 2.2 Correlations, Means, and Standard Deviations by Depression Group

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Affiliative humour</td>
<td>-</td>
<td>.64**</td>
<td>.43*</td>
<td>.63**</td>
<td>-.30</td>
<td>-.55**</td>
<td>-.56**</td>
</tr>
<tr>
<td>2. Self-enhancing humour</td>
<td>.67**</td>
<td>-</td>
<td>.48*</td>
<td>.65**</td>
<td>-.50*</td>
<td>-.26</td>
<td>-.37</td>
</tr>
<tr>
<td>3. Aggressive humour</td>
<td>.11</td>
<td>.03</td>
<td>-</td>
<td>.47*</td>
<td>-.34</td>
<td>-.39</td>
<td>-.04</td>
</tr>
<tr>
<td>4. Self-defeating humour</td>
<td>.14**</td>
<td>.10</td>
<td>.46**</td>
<td>-</td>
<td>-.07</td>
<td>-.30</td>
<td>-.21</td>
</tr>
<tr>
<td>5. Depressive symptoms</td>
<td>-.20**</td>
<td>-.31**</td>
<td>.16**</td>
<td>.18**</td>
<td>-</td>
<td>-.08</td>
<td>.18</td>
</tr>
<tr>
<td>6. Social anxiety</td>
<td>-.40**</td>
<td>-.40**</td>
<td>.07</td>
<td>.19**</td>
<td>.54**</td>
<td>-</td>
<td>.39</td>
</tr>
<tr>
<td>7. Social anhedonia</td>
<td>-.45**</td>
<td>-.32**</td>
<td>.15**</td>
<td>.03</td>
<td>.33**</td>
<td>.49**</td>
<td>-</td>
</tr>
</tbody>
</table>

Non-MDE Group

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>43.58</td>
<td>9.22</td>
</tr>
<tr>
<td>SD</td>
<td>39.21</td>
<td>8.94</td>
</tr>
</tbody>
</table>

MDE Group

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>39.21</td>
<td>13.49</td>
</tr>
<tr>
<td>SD</td>
<td>33.04</td>
<td>12.76</td>
</tr>
</tbody>
</table>

Note. Non-MDE group below diagonal, MDE group above.

Note. Directionality and strength of correlations remained the same when computing partial correlations to account for any potential role of marital status.

Note. Bolded coefficients survived family-wise Bonferroni corrections (\( p < .013 \) for HSQ, \( p < .017 \) for symptoms)

\*\( p < .05 \)

\**\( p < .01 \)

2.3.4 Strength of Relations Between Correlations

Stieger’s \( z \)-test results supported both hypotheses concerning the significance in strength of correlations between adaptive humour styles and social anhedonia, relative to its correlations with depressive symptoms and social anxiety. Specifically, social anhedonia was significantly more negatively correlated with an affiliative humour style than depressive symptoms, \( z = -4.49, p < .001 \), but, unexpectedly, not
different than social anxiety, $z = -1.06, p = .290$. Further, social anhedonia was not significantly differently negatively correlated with self-enhancing humour than depressive symptoms, $z = 1.65, p = .099$, or social anxiety, $z = -.02, p = .986$. Relative to depressive symptoms and social anxiety, social anhedonia was not more positively correlated with aggressive humour, $z = -.13, p = .896$ and $z = 1.47, p = .142$, respectively. Lastly, social anhedonia was not significantly correlated with a self-defeating humour style, which was different than depressive symptoms and social anxiety, $z = -2.44, p = .015$ and $z = -2.89, p = .004$, respectively. Only the $z$-tests of correlations between (i) social anhedonia and depressive symptoms with affiliative humour and (ii) social anhedonia and social anxiety symptoms with self-defeating humour survived family-wise Bonferroni corrections.

Fisher’s R-to-z transformations revealed that while depressive symptoms in the MDE group were more strongly negatively correlated with both affiliative and self-enhancing humour, these were not significantly different from the non-MDE group ($z = .48, p = .635; z = 1.02, p = .309$, respectively). Further, inconsistent with hypotheses, depressive symptoms were not more strongly positively correlated with maladaptive humour styles in the MDE group. Indeed, where depressive symptoms had been positively correlated with aggressive humour in the non-MDE group, they were negatively correlated with aggressive humour in the MDE group; this change in correlation was statistically significant, $z = 2.32, p = .020$. This difference did not survive a family-wise Bonferroni correction. Depressive symptoms were also not more strongly positively correlated with self-defeating humour; the difference in correlations was not statically significant between groups, $z = 1.12, p = .262$.

Social anxiety in the MDE group was negatively correlated with affiliative and self-enhancing humour styles, wherein the correlation was more negative with affiliative humour, but less negative with self-enhancing humour than in the non-MDE group. However, neither difference was statistically significant ($z = .87, p = .384; z = -.70, p = .483$, respectively). Furthermore, contrary to hypotheses, the correlations between social anxiety and both aggressive and self-defeating humour styles were negative, such that the magnitude of change in strength and directionality was significantly different from the non-
MDE group; aggressive: z = 2.15, \( p = .032 \), self-defeating: z = 2.21, \( p = .027 \). Neither of these differences survived a family-wise Bonferroni correction.

In the MDE group relative to the non-MDE group, social anhedonia was more negatively correlated with affiliative, self-enhancing, aggressive, and self-defeating humour styles. However, none of these group differences were statistically significant (z’s range from .25 to 1.09, ps range from .279 to .801).

2.4 Discussion

The current study examined the relations between humour styles and symptoms of depression, social anxiety, and social anhedonia. Results replicated past research demonstrating that depressive symptoms and social anxiety are negatively associated with affiliative and self-enhancing humour styles, minimally related to aggressive humour, and positively related to self-defeating humour (Martin et al., 2003; Tucker, Judah, et al., 2013). Moreover, findings supported hypotheses that social anhedonia would be negatively correlated with affiliative and self-enhancing humour styles. The inverse relation with affiliative humour is consistent with research evaluating social interactions wherein individuals with social anhedonia demonstrate diminished instances of affiliative behaviour (Llerena et al., 2012) and coalesces with predictions predicated on deficient approach/belongingness drives inherent in social anhedonia (Brown et al., 2007).

It was surprising that the magnitude of the relation of affiliative humour with social anhedonia was significantly different from depressive symptoms but not from social anxiety. Past research suggests that the magnitude of correlations of depressive symptoms and social anxiety with affiliative humour are similar (Tucker, Judah, et al., 2013). However, individuals who completed the present study were more anxious than those in the study by Tucker and colleagues. Further, Tucker and colleagues also found that the correlation of social anxiety symptoms to depression was lower at high levels of affiliative humour, suggesting that the overall higher anxiety level of this sample may have resulted in divergent relations of affiliative humour to these symptoms. Concerning self-enhancing humour, research by Atherton and
colleagues (2015) demonstrated that social anhedonia is related to emotion regulation difficulties and is inversely related to positive emotions (Silvia & Kwapił, 2011). Thus, it was aligned with expectations that social anhedonia would be negatively associated with self-enhancing humour, as self-enhancing humour is effectively a humour-based coping strategy relying on emotion regulation skills to see the humourous side of a negative event.

In contrast to depression and social anxiety, both in this study and others, social anhedonia was not significantly related to self-defeating humour. One explanation is that socially anhedonic individuals lack the drive to approach and join in with others (Brown et al., 2007), and when they do, it seems unlikely that this would be at the cost of self-deprecation, as social anhedonia is not significantly correlated with self-esteem (Fawcett, Clark, Scheftner, & Gibbons, 1983), whereas depression (Orth & Robins, 2013), anxiety (Watson, Suls, & Haig, 2002), and self-defeating humour (Stieger et al., 2011) are negatively associated with self-esteem. Social anhedonia was also positively correlated with aggressive humour. However, the small magnitude of this correlation and its similarity to the correlation between both depressive symptoms and social anxiety with aggressive humour suggests that its’ statistical significance may be a function of the sample size, rather than a meaningful association between social anhedonia and aggressive humour. Future research is needed to further examine these relations.

This study extends past research by comparing the strength of correlational relations in a group of individuals who meet criteria for an MDE to a group who do not meet this severity threshold. In general, hypotheses were predicated on the assumption that correlations of depressive and social anxiety symptoms with humour styles would be in the same direction but to a stronger magnitude in the MDE group relative to the non-MDE group. It was predicted that social anhedonia would be negatively related to all humour styles because social anhedonia is defined by a preference to be alone (Brown et al., 2007). Therefore, as social anhedonia increases so too should the desire to avoid social interactions through any means, wherein the propensity to engage in any type of humour for the purposes of inciting social bonding would decline. Consistent with hypotheses, each of depressive symptoms, social anxiety, and
social anhedonia remained negatively or were more negatively related to affiliative and self-enhancing humour styles. However, the magnitude of differential correlations of the non-MDE versus the MDE group was not statistically significantly different.

Contrary to expectations, depressive symptoms and social anxiety were negatively correlated with aggressive humour, while social anhedonia remained non-significantly related to aggressive humour in the MDE group. Indeed, the difference in directionality and magnitude of the difference for depression and social anxiety were statistically significant between the MDE and non-MDE groups. There are several potential explanations for these unanticipated results. First, at high levels of depression and anxiety, it may be the case that any approach-based drive is overpowered by a heightened inhibition drive. This may account for the relative similarity of the negative correlations of both depression and social anxiety with aggressive humour, despite the non-existent relation between depression and social anxiety in the MDE group. Another social anxiety-specific interpretation is that social anxiety is related to anger suppression (Breen & Kashdan, 2011), but does not increase propensity for aggressive behaviour toward others (DeWall, Buckner, Lambert, Cohen, & Fincham, 2010); this is possibly because expressions of aggression have the potential to generate conflict (Averill, 1983), wherein there is an increased likelihood of scrutiny and rejection. Thus, individuals with high social anxiety may be especially inclined to avoid any behaviours that may invite rejection and judgment. It is important that future research further investigate the relation of depressive symptomatology with aggressive humour.

Also inconsistent with hypotheses, the relation of self-defeating humour to social anxiety demonstrated a significant difference in directionality from a positive association (in the non-MDE group) to a negative association (in the MDE group). Self-defeating humour was not significantly related to depression, but, expectedly, was more negatively related to social anhedonia. Only the change in social anxiety’s relation with self-defeating humour was statistically different between groups. These inverse relations are most notable as they are in direct contrast to the majority of the literature base suggesting that self-defeating humour is related to depression and social anxiety. As such, it is important to note that
the MDE sample in this study is primarily characterized by severe anxiety. Specifically, the SIAS cutoff for differentiating presence of social phobia from those without social phobia is 34 (Heimberg, Mueller, Holt, Hope, & Liebowitz, 1992), whereas a score of 50 characterized individuals with social phobia and generalized anxiety disorder (Mennin, Heimberg, & Jack, 2000). The SIAS mean of the present MDE sample is 52.62. Thus, this highly anxious sample of individuals with an MDE may present a unique opportunity to illustrate the potency of the inhibition drive when not counter-balanced by an approach drive. One possible explanation in need of further study is that individuals with acutely high social anxiety may struggle to successfully employ any humour style. Indeed, it has been shown that highly socially anxious individuals fail to react to rejection in a positive or prosocial manner (Mallott, Maner, DeWall, & Schmidt, 2009), which, in the context of self-defeating humour, would suggest that attempts to denigrate oneself to incite connectedness may backfire. Furthermore, cognitive behavioural theories postulate that individuals with social anxiety limit information shared with others to reduce the likelihood of negative evaluation (Rapee & Heimberg, 1997). Therefore, at acutely high levels of anxiety, the potential payoff of putting oneself down and revealing a deficit or weakness, even for the purpose of bonding, is too aversive. Taken together, for these reasons, individuals with high social anxiety may actively avoid any attempts to engage with peers, as opposed to opting to use some humour styles over others. It is important that future studies examine these relations to better understand how symptom severity interacts with humour styles.

In all, results from this study demonstrate that depressive symptoms, social anxiety, and social anhedonia are differentially related to facets of adaptive and maladaptive humour styles. The nature of these relations is nuanced and complex, such that these symptoms may not share a strictly linear relationship with humour styles, particularly when levels of psychopathology are acutely high. Data from this study show that social anhedonia, like depressive and social anxiety symptoms, is negatively associated with affiliative and self-enhancing humour styles, but is only minimally to moderately related to self-defeating and aggressive humour styles, respectively. This study also demonstrated that the
magnitude and directionality of these relations are different when considered in the context of a major depressive episode. This suggests that these symptom clusters may exert differential effects on social dysfunction associated with depressive disorders, particularly when psychopathology is more acute. Future research should continue to explore the relations between depressogenic symptomatology and interpersonal variables to better understand the role of different factors in predicting and maintaining impairment in social functioning.

2.4.1 Limitations and Future Directions

The results in this study should be considered in light of several limitations. First, the study was conducted with individuals online, and may be subject to spurious findings resulting from participants rushing through questions to receive compensation simply for completing the questionnaire. Further, these findings may not generalize to other samples, particularly one in which individuals come into a lab environment and interact with lab staff. It has been documented that people with social anxiety have a greater online presence than people without social anxiety (Shepherd & Edelmann, 2005; Weidman et al., 2012), thus the proportion of individuals reporting high social anxiety may not mirror prevalence rates in offline contexts. However, it is important to note that multiple studies have confirmed that data procured via MTurk is just as, if not more, reliable than data collected through more traditional sample pools (see Shapiro et al., 2013 for a review). Specifically, individuals with psychopathology report being more comfortable disclosing information online than they would be in an in-person visit. Furthermore, several precautions were taken in this study to ensure responders had a strong reputation as a reliable worker (≥ 90% HIT approval rate) and were well versed in how to complete surveys via MTurk (≥500 HITS completed). Another potential limitation is the small sample size of individuals meeting criteria for a possible MDE, based on self-report responses to the CESD-R. While the proportion of 6.5% of individuals meeting criteria for a probable MDE is generally consistent with annual prevalence rates (Hasin, Goodwin, Stinson, & Grant, 2005), and the CESD-R has been demonstrated to be a reliable indicator of depression severity (Van Dam & Earleywine, 2011), these findings should be replicated in a
sample assessed by a trained clinical interviewer. This would allow for confirmation of diagnoses and to assess for a history of depression rather than only current self-reported symptomatology. A larger sample size encompassing a broader age range would also assuage possible concerns about potential power-related issues in detecting reliable correlations in the MDE sample and allow for considerations related to humour style changes across the lifespan.

Despite the aforementioned limitations, the current study contributes novel details to our understanding of the differential roles of depression, social anxiety, and social anhedonia as they relate to social functioning via humour styles. Given that these symptom variables seem to interact with critical needs of belongingness and acceptance in social interactions, it stands to reason that targeting humour style may be a possible avenue for focus in psychotherapy. Indeed, cognitive behavioural therapy may be especially amenable to work around humour styles, wherein individuals could challenge and reframe beliefs about acceptance and belongingness using humour to incite social rapport-building.
Chapter 3

Nuanced Relations of Depressive Symptomatology, Approach/Avoidance Motivational Systems, and Positive Expressivity with Humour Styles

3.1 Introduction

Impairment in social functioning is one of the most clinically significant features of depression. Interpersonal difficulties are evident across several contexts of social relationships, including work, family, and friendships (Benazon, 2000; Bosc, 2000; Kennedy et al., 2007; Paykel et al., 1978; Segrin, 2000). From a quantitative perspective, depressed persons have fewer social contacts and less integrated social networks compared to their non-depressed counterparts (Gotlib & Lee, 1989; Nezlek et al., 2000). Qualitatively, individuals with depression have less satisfying social lives (Hirschfeld et al., 2000), characterized by being less rewarding and having less intimacy (Nezlek et al., 2000, 1994), with a higher frequency of negative interactions (Benazon, 2000; Gotlib & Robinson, 1982; Hokanson et al., 1991).

This pattern of interpersonal dysfunction is postulated to promote isolation and loneliness, subsequently contributing to the maintenance of depressive symptoms (Beekman et al., 1995). The pervasive nature of these impairments highlights the need to better understand the specific mechanisms that are associated with social difficulties. Doing so would allow for a more comprehensive conceptualization of the interaction of depressive symptoms with social functioning and, ideally, aid in the identification of relevant treatment targets.

Affiliative behaviour refers to actions that are performed with the intention of supporting or improving one’s connection with another person, for which the overarching goal is to generate positive social interactions. Indeed, the need to establish and sustain social relationships is characterized as a universal fundamental need (Baumeister & Leary, 1995). One common interpersonally-based strategy to connect with others is the use of humour (Martin & Kuiper, 1999). Humour is often used as an affect-regulation strategy in the context of interpersonal relationships (Besser et al., 2012; Martin, 2007; Miczo
et al., 2009; Taber et al., 2007). Moreover, humour incites laughter, and laughter incites feelings of cohesion (Gervais & Wilson, 2005), liking, and closeness among interaction partners (Treger, Sprecher, & Erber, 2013). The propensity to engage in such behaviours is dampened among individuals who are depressed. Depressed individuals demonstrate fewer prosocial and affiliative facial expressions and more non-affiliative facial expressions (Girard et al., 2014). Depressed persons are also more prone to use humour styles that disrupt interpersonal rapport (Martin et al., 2003; Martin, 2007), rather than generating reciprocal enjoyment and liking. Thus, individuals with depression inadvertently contribute to their own patterns of social difficulties and subsequently fail to fulfill innate needs to establish and sustain social relationships. While numerous factors have been identified as playing a role in affecting social functioning, it is those factors that either promote or thwart prosocial behaviours that warrant special attention. To this end, symptoms of social anhedonia and social anxiety, motivation, and displays of interpersonal attempts at bonding play central roles in the attainment of successful interpersonal relationships.

### 3.1.1 Social anxiety and social anhedonia

Social anhedonia and social anxiety are two clusters of symptoms that frequently co-occur with depressive symptoms (Fava et al., 2000; Kessler et al., 2003). Anhedonia is a primary feature of depression (American Psychiatric Association, 2013). Social anhedonia refers to the aspects of anhedonia pertaining to reductions in pleasure from interpersonal interactions and dampened desire for future social affiliation (Germine et al., 2011). By contrast, social anxiety is characterized by intense fear in social situations, causing significant distress and impairment in one’s ability to function in social situations (American Psychiatric Association, 2013). However, both symptoms have been linked to a poorer course of illness (Blanchard et al., 2001; Ledley et al., 2005; Wong et al., 2012). Individuals experiencing both of these symptom clusters report impairments in social functioning (Alden & Taylor, 2004; Davidson et al., 1993; Silvia & Kwapił, 2011), and demonstrate reduced affiliative behaviours (e.g., reciprocal smiling, flattened affect; Heerey & Kring, 2007; Silvia & Kwapił, 2011). Despite their inherent overlap, the two
constructs are demonstrably separable, both theoretically and statistically. Social anxiety is postulated to be due to viewing others as potentially critical, hostile, or rejecting (Leary & Kowalski, 1995), which is coupled with a strong desire to avoid rejection (Morgan et al., 2009) and intense shyness (Henderson, Gilbert, & Zimbardo, 2014). Alternatively, social anhedonia does not appear to reflect shyness or introversion, rather a disinterest in socializing related to the lack of pleasure associated with interpersonal contact (Silvia & Kwapis, 2011). Statistically, these symptoms are moderately correlated with one another (Mattick & Clarke, 1998); however, the shared variance is best attributed to the joint experience of discomfort in social situations (Silvia & Kwapis, 2011). Taken together, social anxiety and social anhedonia represent important avenues in understanding the link between relevant aspects of specific symptoms and social behaviour.

3.1.2 Motivational systems

Behavioural inhibition and behavioural activation (approach) are motivational systems (BIS and BAS, respectively; Gray, 1973, 1987) that serve important functions in interpersonal behaviour (Gable et al., 2000). The BIS is responsible for regulation of sensitivity to threatening and non-reward cues. It promotes behavioural inhibition, increased arousal, and assessment for risk. Conversely, the BAS is an approach-related, positively incentivized system that regulates movement toward reward. The BIS and BAS are increasingly recognized as important factors for psychopathology (Pinto-Meza et al., 2006). Indeed, depression is associated with higher avoidance (BIS) and lower approach (BAS; Bijttebier, Beck, Claes, & Vandereycken, 2009; Kasch et al., 2002). Social anxiety is characterized by high approach and high avoidance, such that the BIS and BAS are in competition (Morgan et al., 2009). This manifests in a strong desire to approach social situations because of their rewarding properties, which is thwarted by the drive to avoid rejection and humiliation. Social anhedonia is primarily defined by a reduced approach drive, resulting in active avoidance of social situations because of disinterest rather than fear of rejection (Brown et al., 2007). BIS/BAS systems have been shown to be related to a number of socially-relevant variables, including, but not limited to, positive affect (Gable et al., 2000) and humour use in everyday
life (Ford, McCrighth, & Richardson, 2014), and feelings of connectedness in relationships (Carver, Avivi, & Laurenceau, 2013). Taken together, findings on the roles of the BIS/BAS drives suggest they serve important roles in daily activities, particularly those relevant to social behaviours.

3.1.3 Humour styles

Humour style refers to the way in which individuals use humour in their everyday lives. The primary emotion experienced in response to the comprehension and appreciation of a funny occurrence is amusement (Herring, Burleson, Roberts, & Devine, 2011). The feeling of amusement and subsequent expression of this emotion is referred to as mirth (Martin, 2007). Thus, one’s humour style is a behaviour that serves a functional role in promoting healthy affect regulation and inciting social connectedness (Martin, 2007) via mirth. Most recent conceptualizations of humour style suggest that there are two general dimensions of humour style: adaptive and maladaptive (Martin et al., 2003; Martin, 2007). These dimensions capture the intrapersonal and interpersonal nature (i.e., benign or injurious) and consequences of humour, which depends on the target (i.e., the self or relationships with others). Adaptive humour styles are associated with better self-reported well-being (Butzer & Kuiper, 2008; Cann et al., 2008; Guenter, Schreurs, Van Emmerik, Gijsbers, & Van Iterson, 2013) and happiness (Liu, 2012), positive interpersonal relationships (Martin, 2007), and perceived social desirability (Cann & Matson, 2014; Kuiper & Leite, 2010). Conversely, maladaptive humour styles are associated with self-reported distress (Martin et al., 2003), loneliness (Fitts et al., 2009), and less satisfaction in social relationships (Cann et al., 2008).

Specifically, adaptive humour is comprised of two humour styles: affiliative and self-enhancing (Martin et al., 2003). Affiliative humour is a positive style used to strengthen social bonds, wherein one might joke around and laugh with or amuse others. Affiliative humour is characterized as being benign and targets relationships with others. Individuals who employ an affiliative humour style are perceived as being more open and outgoing (Zeigler-Hill, Besser, & Jett, 2013). Affiliative humour is also associated with trait cheerfulness, social warmth (Mitrache, Esser, Proyer, & Ruch, 2011), intimacy, social support,
and competence in social situations (Dozois et al., 2009). It has also been postulated that successful use of affiliative humour requires coordinated use of prosody, facial expressivity, and gestures (Plenty, Bejerot, & Eriksson, 2014). By comparison, self-enhancing humour refers to a benign, self-directed humour style that is used to enhance one’s perspective. For instance, maintaining a positive outlook during times of adversity. Like affiliative humour, self-enhancing humour is positively associated with self-esteem (Stieger et al., 2011), cheerfulness (Mitrache et al., 2011), BAS (Ford et al., 2014), and being perceived by others as friendly (Kuiper & Leite, 2010). Dissimilar to affiliative humour, self-enhancing humour is more closely aligned with one’s ability to cope and maintain optimism (Cann & Etzel, 2008; Kuiper, 2012; Kuiper, Martin, & Olinger, 1993; Martin et al., 2003). Concerning their relations to psychopathology variables, affiliative humour and self-enhancing humour styles have been shown to be inversely associated with depression, social anxiety, and social anhedonia (Dozois et al., 2009; Frewen et al., 2008; Martin, 2010; Tucker, Judah, et al., 2013; see Chapter 2).

Maladaptive humour includes self-defeating and aggressive humour styles (Martin et al., 2003). Both styles are injurious in nature; though, self-defeating is self-directed, and aggressive is directed at others. Self-defeating humour refers to attempts at humour that are used to enhance relationships with others through actions such as belittling oneself (e.g., making a joke about one’s own inadequacies). Aggressive humour refers to a style that entails the ridiculing of others using sarcasm and caustic remarks. Self-defeating humour is negatively associated with self-esteem, and positively associated with depression, anxiety, social anhedonia (Chapter 2; Dozois et al., 2009; Martin et al., 2003), and BIS (Ford et al., 2014). Aggressive humour is inversely related to interpersonal competence (Dozois et al., 2009), and is positively related to aggression, hostility (Martin et al., 2003), and social anhedonia (Chapter 2). The relation of depression with aggressive humour has mixed findings (Chapter 2; Frewen et al., 2008; Martin et al., 2003; Tucker, Judah, et al., 2013). Thus, while extant literature has begun to examine the way humour styles interact with depression, we know little about the specific mechanisms that predict use of specific styles. Moreover, there is ample evidence to suggest that depression is inversely associated
with positive affiliative behaviours, but we have limited insight into how this relationship may be offset by protective factors such as approach-based motivation and expressions of mirth. Identification of protective factors that could be cultivated through therapeutic intervention is an important step in mitigating the negative impact of depression on social functioning.

3.1.4 Aim of the current study

The present study examined predictive relations of symptom variables (depression, social anxiety, social anhedonia), BIS and BAS, and positive facial expressivity, with humour styles. In hierarchical regressions, symptoms were entered first, followed by BIS and BAS, and then positive facial expressivity. It was hypothesized that depression, social anxiety, and social anhedonia (via inverse relationships), followed by BAS, and positive expressivity would predict affiliative and self-enhancing humour; BIS would also enter for self-enhancing humour, but not affiliative humour. These hypotheses were aligned with previous literature suggesting that each of depression, social anxiety, and social anhedonia are inversely related to both adaptive humour styles (Martin, 2010; Tucker, Judah, et al., 2013; Chapter 2). Further, where BAS has been shown to be associated with both adaptive humour styles, BIS was only associated (negatively) with self-enhancing humour (Ford et al., 2014). Finally, it was expected that positive expressivity would enter for both adaptive styles because affiliative humour is for targeted use in social situations where prosocial expressions would be warranted, and even though self-enhancing humour is considered an internally directed style, it is associated with optimism and perceptions by others as friendly.

It was hypothesized that aggressive humour would be predicted by BAS and positive expressivity (via an inverse relationship), whereas depression, social anxiety, and BIS would predict self-defeating humour. BAS has been demonstrated to be positively correlated with aggressive humour, whereas depression, social anxiety, and BIS have been shown to have strong relationships with self-defeating humour; these results were expected to be replicated in this study.
Given the important role of affiliative behaviours in the development and maintenance of social relationships, the last hypothesis was specific to affiliative humour. First, consistent with prior research, it was predicted that depressive symptoms would be negatively associated with affiliative humour. Second, because BAS and prosocial displays of facial expressivity are diminished in depression, it was predicted that depression would be negatively associated with BAS and facial expressivity. Third, given that past research has shown that BAS is associated with affiliative humour and positive facial expressivity has been implicated as playing an important role in affiliative behaviours, it was predicted that the relationship between depressive symptoms and affiliative humour would be mediated by BAS and positive expressivity. That is, employing approach behaviours and demonstrating more prosocial affect may decouple the negative relation between depressive symptoms and affiliative humour.

3.2 Method

3.2.1 Participants

See page 24 from Chapter 2 for specific details on inclusion and exclusion criteria for participants.

3.2.2 Materials

3.2.2.1 Survey software

See page 25 in Chapter 2 for details on survey software. The following questionnaires were included in the survey.

3.2.2.2 Demographic questionnaire

Participants provided information about their age, gender, ethnicity, educational background, and marital status.

3.2.2.3 The Center for Epidemiologic Studies Depression Scale-Revised (CESD-R)

See page 26 in Chapter 2 for CESD-R description.
3.2.2.4 The Revised Social Anhedonia Scale (RSAS)

See page 26 in Chapter 2 for RSAS description.

3.2.2.5 The Social Interaction Anxiety Scale (SIAS)

See page 27 in Chapter 2 for SIAS description.

3.2.2.6 The Humour Styles Questionnaire (HSQ)

See page 27 in Chapter 2 for HSQ description.

3.2.2.7 The Behavioural Avoidance (Inhibition) and Approach System (BIS/BAS)

The behavioural avoidance (or inhibition) and behavioural approach system (BIS/BAS; Carver & White, 1994) is a 20-item self-report questionnaire designed to assess two general motivational systems that underlie behaviour. The BIS regulates aversive motives such as moving away from or avoiding unpleasant goals or stimuli. Conversely, the BAS regulates appetitive motives for which the goal is to move toward a desired goal or stimulus. The BIS/BAS requires participants to indicate their level of agreement with each statement using a 4-point likert scale from 1 (very true for me) to 4 (very false for me). The total BIS score reflects the sum of 7 items mapping onto reactions or anticipation of punishment cues. The BAS score is composed of three dimensions: drive, fun, and reward responsiveness. The BAS-drive scale consists of 4 items related to the persistent pursuit of desired goals. BAS-fun-seeking (BAS-fun) scale includes 4 items that reflect a desire for new rewards and a willingness to approach a potentially rewarding event on the spur of the moment. Finally, BAS-reward consists of 5 items related to responses speaking to the occurrence or anticipation of reward. Consistent with previous research, BAS subscales were combined to reflect an aggregate measure of BAS (Ford et al., 2014). Higher scores on BIS and the BAS subscales indicate greater sensitivity to aversive and appetitive stimuli, respectively. The internal consistencies of the BIS and BAS scales in the present study were good (α = .79 and .86, respectively).
3.2.2.8 The Berkeley Expressivity Questionnaire (BEQ)

The Berkeley Expressivity Questionnaire (BEQ; Gross & John, 1995) is a 16-item scale designed to assess differences in willingness to accept and openly express emotion experiences. The BEQ consists of three subscales: (1) tendency to express positive emotions (BEQ-positive), (2) tendency to express negative emotions (BEQ-negative), and (3) the intensity of impulses to express emotions (BEQ-impulse strength). Items are rated on a 7-point Likert scale, from 1 (strongly agree) to 7 (strongly disagree). In this study, only the BEQ-positive subscale was employed for analyses. The internal consistency of the BEQ-positive subscale in the present study was good (α = .77).

3.3 Results

3.3.1 Sample Characteristics

Participants included in this study were the same subset of individuals who completed the study described in Chapter 2. See page 27 in Chapter 2 for description of sample characteristics. Demographics for all 368 participants are reported in Table 3.1.
Table 3.1 Descriptive Characteristics of the Overall Sample

<table>
<thead>
<tr>
<th></th>
<th>Total (N = 368)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age M (SD)</td>
<td>34.99 (9.83)</td>
</tr>
<tr>
<td>Gender n (%)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>180 (48.91)</td>
</tr>
<tr>
<td>Male</td>
<td>186 (50.54)</td>
</tr>
<tr>
<td>Other</td>
<td>2 (.54)</td>
</tr>
<tr>
<td>Ethnicity n (%)</td>
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<tr>
<td>Caucasian</td>
<td>281 (76.36)</td>
</tr>
<tr>
<td>Latino/Hispanic</td>
<td>21 (5.71)</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>2 (.54)</td>
</tr>
<tr>
<td>African</td>
<td>25 (6.79)</td>
</tr>
<tr>
<td>Caribbean</td>
<td>3 (.82)</td>
</tr>
<tr>
<td>South Asia</td>
<td>5 (1.4)</td>
</tr>
<tr>
<td>East Asia</td>
<td>13 (3.5)</td>
</tr>
<tr>
<td>Mixed</td>
<td>12 (3.3)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (.82)</td>
</tr>
<tr>
<td>Education n (%)</td>
<td></td>
</tr>
<tr>
<td>Some high school</td>
<td>1 (.03)</td>
</tr>
<tr>
<td>High school diploma/GED</td>
<td>42 (11.41)</td>
</tr>
<tr>
<td>Some college/university</td>
<td>124 (33.70)</td>
</tr>
<tr>
<td>College diploma</td>
<td>88 (23.91)</td>
</tr>
<tr>
<td>University degree</td>
<td>76 (20.65)</td>
</tr>
<tr>
<td>Post graduate degree</td>
<td>35 (9.51)</td>
</tr>
<tr>
<td>Marital Status n (%)</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>147 (39.95)</td>
</tr>
<tr>
<td>Single, but in a relationship</td>
<td>69 (17.88)</td>
</tr>
<tr>
<td>Married</td>
<td>123 (33.42)</td>
</tr>
<tr>
<td>Separated/divorced</td>
<td>24 (6.52)</td>
</tr>
<tr>
<td>Widowed</td>
<td>4 (1.09)</td>
</tr>
</tbody>
</table>

Note. Values may not add up to 100% due to missing data

3.3.2 Analyses

Pearson’s correlation analyses were conducted to investigate the relations between variables. Four hierarchical stepwise linear regressions were conducted to test the hypotheses concerning the role of psychopathology symptoms, motivational systems, and positive expressivity in predicting each of: affiliative, self-enhancing, aggressive, and self-defeating humour styles. One multiple mediation analysis tested the hypothesis that the relation between depressive symptoms and affiliative humour would be mediated by behavioural approach (BAS) and positive expressivity (BEQ-Positive). The multiple
mediation analysis was conducted using the Preacher and Hayes (2012) macro for SPSS. To test for mediation indirect effects, the macro employs a bootstrapping resampling procedure to correct for bias in determining estimates of 95% confidence intervals. Indirect effects are calculated as the product of the unstandardized regression weight for the path from the predictor to the mediator to the outcome variable. In this study, the bootstrap sample was set to 5,000 samples, with replacement. If zero was not within the 95% bias-corrected confidence interval, it was concluded that the indirect effect was significantly different from zero at $p < .05$, two-tailed (Preacher & Hayes, 2004).

3.3.3 Correlations

Correlation analyses were used to determine the differential relations between psychopathology variables (depression, social anxiety, and social anhedonia), humour styles (affiliative, self-enhancing, aggressive, and self-defeating), motivational systems (behavioural approach and behavioural avoidance), and positive emotional expressivity. As demonstrated in Table 3.2, psychopathology variables were generally negatively correlated with adaptive humour styles and positively correlated with maladaptive humour styles. Consistent with previous research (Ford et al., 2014), BAS was positively correlated with adaptive humour styles, whereas the BIS was inversely correlated with adaptive humour styles and positively correlated with self-defeating humour. Consistent with hypotheses, the BEQ-Positive was positively correlated with adaptive humour styles and BAS, but negatively correlated with maladaptive humour styles and all psychopathology variables.
### Table 3.2 Correlations Between Psychopathology, Humour, Motivational Systems, and Positive Expressivity

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Affiliative</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Self-enhancing</td>
<td>.64**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Aggressive</td>
<td>.13*</td>
<td>.07</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Self-defeating</td>
<td>.17*</td>
<td>.12*</td>
<td>.46**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Depression</td>
<td>-.23**</td>
<td>-.37**</td>
<td>.12*</td>
<td>.24**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Social anxiety</td>
<td>-.42**</td>
<td>-.41**</td>
<td>.05</td>
<td>.20**</td>
<td>.58**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Social anhedonia</td>
<td>-.47**</td>
<td>-.34**</td>
<td>.14**</td>
<td>.04</td>
<td>.37**</td>
<td>.51**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. BAS</td>
<td>.40**</td>
<td>.34**</td>
<td>.15**</td>
<td>.03</td>
<td>-.28**</td>
<td>-.36**</td>
<td>-.28**</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. BIS</td>
<td>-.15**</td>
<td>-.31**</td>
<td>-.09</td>
<td>.16**</td>
<td>.36**</td>
<td>.59**</td>
<td>.07</td>
<td>-.13**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>10. BEQ-positive</td>
<td>.51**</td>
<td>.37**</td>
<td>-.12*</td>
<td>-.03</td>
<td>-.26**</td>
<td>-.33**</td>
<td>-.45**</td>
<td>.37**</td>
<td>.06</td>
<td>-</td>
</tr>
</tbody>
</table>

**Note.** BAS = Behavioural Avoidance System and Behavioural Approach System – sum of Reward, Fun, and Drive Subscales; BIS = Behavioural Avoidance System and Behavioural Approach System – Inhibition Subscale; BEQ-positive = Berkeley Expressivity Questionnaire – Positive Expression Subscale.

**Note.** Bolded coefficients survived family-wise Bonferroni corrections (p < .013 for HSQ, p < .017 for symptoms, and p < .017 for BIS/BAS variables)

*p < .05
**p < .01

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>43.30</td>
<td>39.29</td>
<td>27.45</td>
<td>27.71</td>
<td>13.42</td>
<td>29.08</td>
<td>14.08</td>
<td>16.58</td>
<td>20.45</td>
<td>20.33</td>
</tr>
</tbody>
</table>
3.3.4 Stepwise Hierarchical Linear Regression Analysis

Four separate stepwise hierarchical linear regression models were constructed to examine whether motivational systems (Block 2) and positive expressivity (Block 3) predicted each humour style after considering the roles of psychopathology symptoms (depressive symptoms, social anxiety, social anhedonia; Block 1). Descriptive details of these regressions are presented below and in Table 3.3.

3.3.4.1 Affiliative humour

The regression was significant with social anhedonia in the first step $F(1,366) = 105.97, p < .001, R^2 \Delta = .23$, followed by social anxiety in the second step of the first block, $F(2,365) = 67.38, p < .001, R^2 \Delta = .05$. The regression remained significant with BAS in the second block $F(3,364) = 58.24, p < .001, R^2 \Delta = .06$, and BEQ-positive in the third block, $F(4,363) = 58.51, p < .001, R^2 \Delta = .07$.

3.3.4.2 Self-enhancing humour

The regression was significant with social anxiety in the first step $F(1,366) = 75.68, p < .001, R^2 \Delta = .17$, social anhedonia in the second step $F(2,365) = 44.37, p < .001, R^2 \Delta = .02$, and depression in the third step of the first block, $F(3,364) = 33.13, p < .001, R^2 \Delta = .02$. The regression remained significant with BAS in the first step $F(4,363) = 29.85, p < .001, R^2 \Delta = .03$, and BIS as the second step in the second block, $F(5,362) = 26.71, p < .001, R^2 \Delta = .02$. The final model was significant with BEQ-positive in the third block, $F(6,361) = 27.03, p < .001, R^2 \Delta = .04$.

3.3.4.3 Aggressive humour

The regression was significant with social anhedonia in the first block $F(1,366) = 7.46, p < .001, R^2 \Delta = .02$, followed by BAS in the second block, $F(2,365) = 10.99, p < .001, R^2 \Delta = .04$, and BEQ-positive in the third block, $F(3,364) = 9.33, p < .001, R^2 \Delta = .02$. 
3.3.4.4 Self-defeating humour

The regression was significant with depression in the first block, $F(1,366) = 21.61, p < .001, R^2 \Delta = .06$.

No other variables entered as significant predictors of self-defeating humour.
Table 3.3 Descriptive Statistics for Humour Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Social anhedonia</th>
<th>Social anxiety</th>
<th>Behavioural approach</th>
<th>Positive expressivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-.48 (.05)</td>
<td>-.47 (.05)</td>
<td>-10.29 (.001)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>-.35 (.05)</td>
<td>-.35 (.05)</td>
<td>-6.73 (.001)</td>
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<tr>
<td>3</td>
<td>-.12 (.03)</td>
<td>-.25 (.03)</td>
<td>-4.75 (.001)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>-.32 (.05)</td>
<td>-.32 (.05)</td>
<td>-6.29 (.001)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>-.08 (.03)</td>
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<td>6</td>
<td>.37 (.07)</td>
<td>.25 (.07)</td>
<td>5.40 (.001)</td>
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</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Social anxiety</th>
<th>Social anxiety</th>
<th>Behavioural approach</th>
<th>Positive expressivity</th>
</tr>
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<tr>
<td>1</td>
<td>-.22 (.05)</td>
<td>-.21 (.05)</td>
<td>-4.21 (.001)</td>
<td></td>
</tr>
<tr>
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Note. Bolded p-values survived Bonferroni corrections (p < .013)
3.3.5 Mediation Analyses

The mediation analysis was performed using the Preacher & Hayes (2004) SPSS macro to examine whether the relation between depressive symptoms and affiliative humour were mediated by BAS and/or BEQ-positive. The estimates of the 95% CIs and summary of mediation analysis is presented in Table 3.4 and Figure 3.1.

Table 3.4 Bootstrapped Indirect Effects of Depressive Symptoms on Affiliative Humour Through Expressivity and Behavioural Approach as Mediators

<table>
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<th>Point estimate</th>
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</table>

Note. BC = bias corrected; BCa = bias corrected and accelerated; 5000 bootstrap samples; BAS = Behavioural Avoidance System and Behavioural Approach System – sum of Reward, Fun, and Drive Subscales; BEQ-positive = Berkeley Expressivity Questionnaire – Positive Expression Subscale.

The total and direct effects of depression on affiliative humour were $\beta = -.15, p < .0001$, and $\beta = -.04, p = .178$, respectively. The difference between the total and direct effect was the total indirect effect through the two mediators, with a point estimate of -.1129 and a 95% bootstrap CI of -.1594 to -.0683. Therefore, the indirect effect of depression on affiliative humour was significantly different from zero. An examination of the specific indirect effects suggests that the indirect effects of depression on affiliative humour through both positive expressivity (BEQ-Positive) and behavioural approach (BAS) were significant. Thus, both positive expressivity and behavioural approach are full mediators, as neither of their 95% CIs contained zeros.
Figure 3.1 Behavioural Approach (BAS) and Positive Expressivity (BEQ-Positive) as Mediators between Depressive Symptoms and Affiliative Humour

**Note.** BAS = Behavioural Avoidance System and Behavioural Approach System – sum of Reward, Fun, and Drive Subscales; BEQ-positive = Berkeley Expressivity Questionnaire – Positive Expression Subscale.

**3.4 Discussion**

This study examined the predictive role of depressive symptomatology, approach/avoidance motivational systems, and positive facial expressivity as they related to different types of adaptive and maladaptive humour styles. Results replicated previously established correlational relations of depression and social anxiety with humour styles, such that depression and social anxiety were positively related to self-defeating humour and inversely related to affiliative and self-enhancing humour (Martin et al., 2003; Tucker, Judah, et al., 2013). Depression, social anxiety, and social anhedonia symptoms have each been shown to be associated with impairments in social functioning (Alden & Taylor, 2004; Davidson et al., 1993; Nezlek et al., 2000; Silvia & Kwapis, 2011), such that their presence is coupled with lack of intimacy and disconnectedness (Kwapil et al., 2009; Nezlek et al., 2000, 1994; Wenzel, 2002). Thus, this research demonstrates that these relationships extend to another social function: the use of humour. The correlational findings from these data also coalesce with those from Ford and colleagues (2014) demonstrating that the behavioural approach (BAS) drive is positively associated with adaptive humour styles and minimally associated with maladaptive humour styles. Alternately, the authors also found...
negative associations of BIS with adaptive humour styles and positive associations with self-defeating humour; these were replicated in this study.

A novel variable of interest in this study was the self-reported measure of positive facial expressivity (BEQ-positive), on which higher scores reflect greater likelihood to let one’s feelings show when happy and laugh aloud at jokes. The correlation between positive expressivity and affiliative humour coincides with theory from the emotion literature suggesting that displays of positive affect serve the functional role of encouraging social affiliation (Fredrickson, 1998; Keltner & Bonanno, 1997). Thus, positive expressivity overlaps with affiliative humour in their shared goal of promoting social connectedness. Positive expressivity was also correlated with self-enhancing humour. This was an expected finding. Self-enhancing humour is positively associated with cheerfulness (Dozois et al., 2009; Mitrache et al., 2011), happiness (Cann, Stilwell, & Taku, 2010), social warmth and gregariousness (Markey, Suzuki, & Marino, 2014), and the BEQ-positive is positively correlated with peer-rated expressivity (Gross, John, & Richards, 2000). Thus, their overlap was anticipated due to their shared outcome of expressing happiness. Furthermore, as expected, positive expressivity was minimally negatively related to maladaptive humour styles. This aligns with theoretical underpinnings of maladaptive styles as having deleterious effects on social relationships (Martin et al., 2003) and quantitative data demonstrating negative relationships of maladaptive humour styles with interpersonal competence (Dozois et al., 2009) and social warmth (Markey et al., 2014).

Consistent with the aforementioned correlational designs (e.g., Ford et al., 2014; Martin et al., 2003; Tucker, Judah, et al., 2013) and aligned with hypotheses specific to this study, social anhedonia, social anxiety, BAS, and positive expressivity emerged as predictors of affiliative humour. Given that affiliative humour is a more narrowly defined manifestation of affiliative behaviour in the context of everyday use of humour, the strong predictive power of social anhedonia and social anxiety is consistent with research evaluating prosocial behaviour in social interactions. Specifically, individuals with social anxiety and social anhedonia demonstrate diminished instances of affiliative behaviour (Heerey & Kring,
In light of these findings, it is to be expected that social anhedonia would account for a significant portion of the variance in affiliative humour. The very nature of BAS is predicated on its functionality as an approach-based drive that incites movement toward reward (Gray, 1973, 1987), thereby fostering the pursuit of positive social goals such as sharing fun and meaningful experiences with friends (Elliot, Gable, & Mapes, 2006; Gable & Strachman, 2008). Thus, coupled with previous studies demonstrating a positive relationship between BAS and adaptive humour styles (Ford et al., 2014), it was expected that BAS would be a significant predictor of affiliative humour. It also naturally follows that positive expressivity would contribute additional predictive power to the affiliative humour model because expression of positive affect facilitates affiliation (for a review, see: van Kleef, 2016) and elicits positive emotional reactions in others (for a review, see: Hatfield, Bensman, Thornton, & Rapson, 2014).

Consistent with hypotheses, self-enhancing humour was predicted by social anxiety, social anhedonia, and depressive symptoms, as well as behavioural approach and behavioural inhibition motivational drives, and positive expressivity. However, the predictive value of social anxiety failed to reach statistical significance in the final model, as it was trumped by behavioural inhibition. This may be due to their statistical and theoretical overlap (Dennis, 2007; Kimbrel, Mitchell, & Nelson-Gray, 2010). Self-enhancing humour is essentially an emotion regulation strategy in which the mechanism of flexible thinking is humour-based. This flexibility is a likely candidate facilitating the relation of self-enhancing humour to higher optimism, more hopefulness, and lower perceived life stress (Cann et al., 2010). To this end, the predictive roles of depression and social anhedonia are aligned both with previous research demonstrating their inverse relationships with self-enhancing humour (Chapter 2; Martin et al., 2003; Tucker, Judah, et al., 2013), and, moreover, their negative associations with general emotion regulation skills (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Joormann & Gotlib, 2010; Mennin, McLaughlin, & Flanagan, 2009; Silvia & Kwapil, 2011). The emergence of higher BAS and lower BIS as predictors coalesces with data from Ford and colleagues (2014) demonstrating that individuals with approach-
oriented motivation have beneficial, adaptive humour strategies, whereas those with an avoidance based motivational style tend to underuse adaptive humour strategies. Previous literature has also demonstrated that BAS is related to higher presence of positive affect, while BIS is related to greater negative affect (Gable et al., 2000; Gray, 1990; Updegraff, Gable, & Taylor, 2004). It has also been shown repeatedly that positive affect facilitates thinking and promotes a flexible approach to problem solving, such that these benefits extend to social behaviour (Isen, 2004; Labroo & Patrick, 2009). As such, the positive affect inherent in BAS lends itself to the facilitation of a positive outlook that accompanies use of self-enhancing humour, whereas the opposite is true of the negative affect associated with BIS. Similarly, positive expressivity is associated with both self-reported positive affect and peer ratings of happiness (Gross & John, 1997), thus it stands to reason it would enter into the self-enhancing humour model. Interestingly, positive expressivity (specifically, the BEQ-positive) is only minimally related to emotional regulation skills involving emotion reappraisal as the mechanism of flexibility (English & John, 2013). For this reason, one might anticipate that it would not predict self-enhancing humour. Future research is required to better understand this seemingly nuanced relationship.

The aggressive humour model included social anhedonia, behavioural approach, and positive expressivity as predictors. The emergence of social anhedonia was unanticipated as a predictor because the very core of social anhedonia is a lack of interest in belonging and affiliation (Kwapil et al., 2009), whereby the attempt to connect with others would be generally dampened, especially if this was at the cost of deriding others. Given the small, albeit significant, magnitude of the correlation between aggressive humour and social anhedonia, it may be the case that its emergence as a significant predictor is a function of a large sample size rather than a meaningful contributor to propensity to use aggressive humour. That said, Fanning and colleagues (2012) found a positive association between social anhedonia and both general aggression and, more specifically, hostility. As such, it may be that socially anhedonic individuals are more inclined to demonstrate aggressive behaviour, which extends to the specific use of humour-based strategies used in social interactions. Additional research is needed to further delineate the
relations between these two constructs. The association between behavioural approach and aggressive humour replicates previous research (Ford et al., 2014), highlighting the role of approach-based behaviour in this other-oriented humour style. Finally, the contribution of positive expressivity (via an inverse relation) to the aggressive humour model is aligned with findings demonstrating negative associations between positive facial affect (e.g., smiling) and hostility displayed during social tasks (Prkachin & Silverman, 2002).

Somewhat inconsistent with hypotheses, only depression, but not social anxiety or behavioural inhibition, entered as a predictor of self-defeating humour. The inverse relation of depression with self-defeating humour is based in a strong literature wherein this relation is repeatedly replicated (see Martin et al., 2003). Their shared overlap with low self-esteem (Stieger et al., 2011), alongside the common depressogenic experience of low self-worth and inclination to put oneself down (Crocker, 2002; Roberts & Monroe, 1994), underscores the candidacy of depressive symptoms in predicting use of self-defeating humour. Similar to the findings in this study, previous research suggests that social anxiety tends to have a similar relationship with self-defeating humour (Tucker, Judah, et al., 2013). However, depressive and social anxiety symptoms are highly correlated in the current study. Thus, it may be the case that the higher concordance of symptoms in this sample prevented social anxiety from emerging as a unique predictor in addition to depression in the current model. Future research to more clearly evaluate the role of social anxiety in self-defeating humour is needed. It was expected that behavioural inhibition would predict self-defeating humour because past research has demonstrated a positive correlation between the two variables (Ford et al., 2014). Moreover, individuals who report high behavioural inhibition also tend to have lower self-esteem (Erdle & Rushton, 2010) and tend to reach out and share their problems with others in the hopes of soliciting emotional support (High & Solomon, 2014). However, the overall low predictive power of the model suggests that there are other critical variables that were not measured in this study. Further research is needed to establish a more comprehensive understanding of factors that predict the use of self-defeating humour.
Finally, the present study contributes to our understanding of the processes that mediate the relation between depressive symptoms and affiliative behaviour in the specific context of humour style. Consistent with hypotheses, the negative association between depressive symptoms was fully mediated by behavioural approach and positive expressivity. Previous research has shown that depressed individuals underutilize socially-facilitative humour styles such as affiliative humour (Martin, 2007) and tend to engage in behavioural patterns that perpetuate social difficulties (Beekman et al., 1995; Liu & Alloy, 2010; Ulaszek et al., 2012). These findings demonstrate that the deleterious effects of depressive symptoms on the use of affiliative humour are offset by the use of approach-based strategies and expression of positive facial affect. Accordingly, treatments in which the improvement of affiliative behaviours is a primary outcome may benefit from targeting these two domains.

Depressed individuals tend to set fewer approach-based goals and more avoidance-based goals and plans (Campbell-Sills, Liverant, & Brown, 2004; Kasch et al., 2002). People with depression are also likely to opt for less rewarding activities because lower reward activities tend to promote less anxiety and are less prone to provoke feelings of disappointment (Dickson & MacLeod, 2004; Hopko, Armento, Cantu, Chambers, & Lejuez, 2003). Evidence for the malleability of these behaviours is evident in the success of behavioural activation treatments, demonstrating large effects in the reduction of depressive symptomatology (see Cuijpers, Van Straten, & Warmerdam (2007) and Sturmey (2009) for reviews) and, critically, improvements in functional approach behaviours (e.g., Hopko, Lejuez, Ruggiero, & Eifert, 2003; Martell, Addis, & Jacobson, 2001). There is limited evidence at this juncture concerning statistically significant change in approach behaviours following a course of behavioural activation therapy (Dichter et al., 2009) as measured according to the specific measure of BIS/BAS employed in this study (i.e., Carver & White, 1994). Recently, however, it has been argued that more specific measurement of BIS/BAS systems is important for behavioural activation treatments and that BIS/BAS related impairments can and should be specifically targeted through the framework of a behavioural activation treatment modality (Bowins, 2012).
These findings also suggest that positive facial affect plays an important role in the use of affiliative humour. Flattened facial expressivity is a core feature of depression (American Psychiatric Association, 2013; Bylsma et al., 2008; Rottenberg & Vaughan, 2008). Depressed individuals demonstrate fewer instances of positive expressivity, including fewer smiles (Reed et al., 2007; Trémeau et al., 2005), less laughter (Schelde, 1998), and a general blunting of facial responsivity (Bylsma et al., 2008). To this end, future research may benefit from evaluating whether extant paradigms training depressed individuals to upregulate their emotions (e.g., Linden, 2014; Linden et al., 2012) may be coupled with facial expressivity training to bolster the overall improvements in positive affect, thereby improving overall social engagement.

3.4.1 Limitations and Future Directions

The findings of this study should be considered in the context of several limitations. First, as with study presented in Chapter 2, these data were collected online and may be subject to shortcomings associated with participants quickly answering all questions in order to attain compensation for completion. Moreover, the results presented in this study may not generalize to samples collected via a different modality of data collection; the most notable of which is in person in a laboratory setting. That said, several studies have demonstrated that data collected via MTurk is comparably reliable to those data collected through more traditional sample pools (see Shapiro et al., 2013 for a review). Also, again, as discussed in Chapter 2, several precautions were taken in this study to ensure responders had a strong reputation as a reliable worker (≥ 90% HIT approval rate) and were well versed in how to complete surveys via MTurk (≥500 HITS completed). Another related limitation is the exclusive use of self-reported questionnaires. However, past research has demonstrated no differences in performance on self-reported questionnaires across different methods of data collection. Similar responses are provided in-person, relative to phone interviews, and self-reported questionnaires (Rosenbaum, Rabenhorst, Reddy, Fleming, & Howells, 2006), wherein presence of experimenters, length of questionnaires, and likelihood of disclosing sensitive material was either superior in the unsupervised self-report condition or consistent.
across reporting methods (Wood, Nosko, Desmarais, Ross, & Irvine, 2006). An important future step will be an investigation of these relations in the context of individuals who have diagnosed clinical pathology by a trained interviewer, rather than self-reported continuum-based measures of psychopathology.

This study only evaluated general approach and avoidance motivational systems, however, future studies may benefit from employment of the BIS/BAS measure that was designed specifically for social interactions (Elliot et al., 2006). To the extent that BIS and BAS variables may be considered specific treatment targets, future research may consider that BIS/BAS systems may be considered trait markers, rather than state markers, in which case, consideration as a moderator of treatment outcomes may be more appropriate (Manos, Kanter, & Busch, 2010). Moreover, it has been suggested that targeting both BIS and BAS systems will promote the greatest improvement in outcome among individuals with depression (Trew, 2011). This coincides with literature from positive psychology suggesting that it is not only the eradication of negative affect that should be targeted, but also the improvement of positive affect (Donaldson, Csikszentmihalyi, & Nakamura, 2011; Lee Duckworth, Steen, & Seligman, 2005).

Taken together, findings from this study contribute new information to our understanding of how psychopathology interacts with motivation and humour styles, and the way in which motivation and expression of emotions affects the relation of depression with affiliative humour. This is especially relevant in the context of clinical interventions in which the treatment targets are social in nature. Indeed, behavioural activation therapy and upregulation of positive emotions may be especially relevant in the context of prosocial behaviours such as adaptive humour.
Chapter 4

Express Yourself: Differences in Subjective and Behavioural Responses to Humourous Stimuli Among Individuals with and without Depression

4.1 Introduction

Major depressive disorder (MDD) is a psychiatric disorder characterized by a syndrome of symptoms including low mood, reduced pleasure and enjoyment (i.e., anhedonia), and disruptions in and withdrawal from normative activities (e.g., socializing, scholastic/vocational endeavors). Despite the inherent heterogeneity in MDD, depressed individuals are united in their experience of disturbances in emotion and mood (American Psychiatric Association, 2013). Individuals with depression show a relative insensitivity to positive stimuli compared to negative stimuli (Levens & Gotlib, 2009). This manifests in real-time preferential attentional biases toward negative information and away from positive stimuli (Duque & Vázquez, 2015; Gotlib & Joormann, 2010). A similar pattern is evident in retrospective studies where depressed individuals tend to remember negative information better than positive information (Mathews & MacLeod, 2005; Matt et al., 1992) and demonstrate a stronger bias for recollection of negative affect relative to positive affect (Ben-Zeev et al., 2009). Even when positive emotions are felt, people with MDD have difficulty maintaining these emotions (Horner et al., 2014; McMakin, Santiago, & Shirk, 2009). Interestingly, while the magnitude of the lack of responsivity to positive stimuli is more pronounced than that of negative stimuli, MDD appears to be associated with dampened emotional reactivity across both positively and negatively affectively valenced stimuli (Bylsma et al., 2008).

Mounting literature suggests that this blunted pattern of emotional reactivity can be understood in the theoretical framework of emotion context insensitivity (ECI; for a review, see: Rottenberg & Hindash, 2015). The ECI view of emotion reactivity posits that depressed individuals demonstrate reduced reactivity to both negatively and positively emotional stimuli (Rottenberg, 2007). ECI difficulties are most pronounced in the major emotion response systems of self-reported experiences and expressive
behaviour. Bylsma and colleagues (2008) found a large effect for self-report and a medium effect for behavioural measures of positive emotional reactivity. Specifically, individuals with MDD report lower levels of happiness and arousal in response to pleasant imagery (Dunn et al., 2004; Fiorito & Simons, 1994), decreased amusement in response to funny films (Rottenberg et al., 2002), and report less enjoyment to sensory stimuli (e.g., eating chocolate; Chentsova-Dutton & Hanley, 2010). Behaviourally, restricted emotional reactivity is evidenced by lower intensity facial expressions (Sloan et al., 2001), less change in appetitive behaviour in response to reward contingencies (Henriques & Davidson, 2000), reduced cheek and brow activity (Gehricke & Shapiro, 2000), and fewer smiles (Reed et al., 2007; Trémeau et al., 2005). Taken together, these findings demonstrate that depressed individuals exhibit attenuated emotional reactions to affectively valenced stimuli. This pattern of responding coincides with diagnostic symptoms of anhedonia, blunted affect, and psychomotor retardation, which, in turn, correspond to evolutionary theories related to social disengagement.

While ECI deficits clearly affect the emotional processing of the affected individual, they also have important implications for social functioning. In a dynamic social interaction it is important to consider both the intrapersonal experience of the depressed individual as well as the interpersonal factors that contribute to dysfunction. Relevant to the intrapersonal factors, depressed individuals report less satisfying social lives (Hirschfeld et al., 2000), wherein interactions are characterized as lacking in intimacy, reward, and enjoyment (Larson, Raffaelli, Richards, Ham, & Jewell, 1990; Nezlek et al., 2000, 1994). Thus, depressed persons’ experience of socializing does not promote the normative sensations of reward and enjoyment experienced by healthy individuals (Burgess & Huston, 2013). Furthermore, there is evidence to suggest that depressed individuals engage in behaviours that may promote social difficulties, such as demonstrating fewer affiliative facial expressions and more non-affiliative facial expressions (Girard et al., 2014). These may be some of the reasons that research repeatedly demonstrates that depressed persons are more likely to be socially rejected than non-depressed individuals (Sacco & Vaughan, 2006). Given the number of factors working against depressed individuals’ experience of
satisfying social relationships, it is important to consider the way in which these individuals use and appreciate prosocial aspects of relationships.

In healthy individuals, social relationships are typically highly rewarding (Burgess & Huston, 2013). One specific set of behaviours that are intrinsically rewarding and function as a means for social bonding are mirthful behaviours (e.g., smiling, laughter; Martin, 2010; Provine, 2004; Thonus, 2008). The act of shared laughter promotes greater positivity and intimacy in social relationships (Kashdan, Yarbro, McKnight, & Nezlek, 2014). Thus, it stands to reason that enjoyment of humour serves as an adaptive social advantage (Martin, 2007). To this end, deficits in shared emotions and blunted responses to humour that would thwart mirthful behaviours (i.e., smiling and shared laughter) would exert particularly negative effects on interpersonal relationships.

Past studies of responsivity to humourous stimuli in depressed samples have often utilized static images or cartoons (Falkenberg et al., 2010), or depict contrived clips from well-known movies or comedic routines (e.g., slapstick antics; Rottenberg et al., 2002). These may be limited in their generalizability as they do not capture everyday situations that one often encounters. Furthermore, past studies have also been limited in their scope of evaluating responsivity, as no studies have considered subjective ratings alongside objective observations characterizing mirth in terms of facial affect and laughter. The present study aimed to address this gap in the emotion reactivity literature by presenting depressed individuals with humourous videos and collecting self-reported enjoyment and funniness ratings, as well as both coding facial affect and laughter in response to the clips. Furthermore, to evaluate the stability of these ratings over time, individuals came back into the lab one week later and provided retrospective ratings of enjoyment and funniness of clips viewed the previous week. Across all participants, it was expected that subjective ratings of enjoyment and funniness would be positively correlated with objective measures of facial affect and laughter. Relative to a healthy comparison group, it was hypothesized that depressed individuals would report lower levels of enjoyment and funniness, and demonstrate less mirth, defined as facial affective responsivity and laughter while watching humourous
videos. It was also hypothesized that there would be a significant interaction at the follow-up time point, such that depressed individuals, but not healthy individuals, would demonstrate significantly lower subjective ratings of enjoyment and funniness after the delay.

4.2 Method

4.2.1 Participants

Participants were 44 never-depressed (i.e., no history of major depressive episodes) healthy adults and 37 outpatients diagnosed with major depressive disorder (MDD) residing in the community of Kingston, Ontario. MDD participants were recruited via several avenues including: (1) referred from two local mental health clinics and hospitals (Maple Family Healthcare, Providence Care Mental Health hospital; \( n = 3 \)), (2) recruitment posters in the community (see Appendix F; \( n = 13 \)), and (3) were drawn from an internal list of participants who had completed previous studies in the cognitive and psychotic disorders laboratory (\( n = 21 \)). Healthy comparison participants were recruited via an advertisement posted on Kijiji (see Appendix F). Inclusion criteria for all participants were: (i) aged between 18-60, (ii) self-reported normal or corrected vision, (iii) fluent in English, and (iv) self-reported normal or corrected hearing. Exclusion criteria included: (i) current or history of substance abuse, psychosis, or mania, (ii) medical conditions that could affect performance (e.g., multiple sclerosis, history of traumatic brain injury, or dementia), and (iii) currently in a course of electroconvulsive therapy (ECT) or completed a course of ECT within the past four weeks, and individuals in the healthy comparison group were excluded if they endorsed symptoms consistent with major depressive disorder. Before being admitted to the study, all participants were required to complete a phone screen to ensure they met inclusion criteria. Both healthy comparison and depressed participants also completed an in-person screen of psychiatric illnesses at the outset of starting the study in the laboratory. This is described in more detail below under Materials. This study was conducted in compliance with the Queen’s University Research Ethics Board (approval letter in Appendix G). Letter of information and consent and debriefing forms presented in Appendices H-K.
4.2.2 Materials

4.2.2.1 Demographic questionnaire

Participants provided information about their age, gender, ethnicity, and educational background.

4.2.2.2 Mini International Neuropsychiatric Interview (MINI)

The MINI (Sheehan et al., 1998) is a 30-minute structured diagnostic screening interview. The MINI provides diagnoses according to the DSM-IV and ICD-10 criteria. The MINI evaluates 17 diagnoses including: major depressive disorder, dysthymic disorder, bipolar disorder, panic disorder, agoraphobia, social phobia, specific phobia, obsessive-compulsive disorder, generalized anxiety disorder, post-traumatic stress disorder, alcohol dependence and abuse, drug dependence and abuse, psychotic disorders, anorexia nervosa, and bulimia) and a suicide module and antisocial personality disorder module. Each module contains a series of yes/no questions that follow diagnostic criteria for each disorder. The interview allows for the use of follow-up questions to take into account the necessary dimensions of the criteria, such as frequency, severity, and chronological order. Each module begins with one or more screening question(s) and if provided answer(s) to questions are negative, the interviewer moves to the next module. If the participant endorsed the screening question(s), then the interviewer proceeded to the remaining questions in that module. The inter-rater reliability and test-retest reliability for the MINI are good, with inter-rater reliabilities above 0.75, and high test-retest reliabilities for most diagnostic modules (Sheehan et al., 1997). The MINI was administered by trained doctoral level Queen’s University clinical psychology students.

4.2.2.3 Hamilton Depression Rating Scale (HAM-D)

The 21-item HAM-D (Hamilton, 1967) is a semi-structured interview designed to assess depressive symptom severity. Doctoral level graduate students in the Queen’s University clinical psychology program conducted HAM-D interviews. Individual item ratings range from 0 to 6 (half points permitted). The HAM-D item ratings range from 0 to 2 or from 0 to 4 based on severity, with a total score from 0 to
50 for the 17 items. Higher scores indicate presence of more severe depressive symptoms. The reliability of the HAM-D is acceptable and comparable to the reliability of other clinician rated depressions scales. The internal consistency of the scale in the present study was good ($\alpha = .86$).

4.2.2.4 Experimental Stimuli

The 42 video clips used in this study were downloaded from youtube.com. Videos were collected over a period of 8 weeks from February to April 2015. Search terms included: “funny video”, “funny compilation”, “fail videos”, and “fail compilation.” Similar to the approach employed by Gignac, Karatamoglu, Wee, & Palacios (2014), humorous video clips were selected from several categories of humour (e.g., aggressive, animal, children, news casting). Three to five undergraduate and graduate students in psychology viewed each selected video. Videos were retained if all students verbally agreed that the video was at least somewhat funny. Of the initial 250 videos, 110 were retained for the next stage of pilotig. In the final piloting stage, 20 individuals from the community watched all 110 videos and provided a rating of how much each video made them laugh on a scale of 1 (“I didn’t laugh at all”) to 7 (“I laughed a lot”). Advertisement posted on Kijiji for final piloting of videos is presented in Appendix L. Videos that met the following criteria were retained: (i) less than 20% of individuals indicated having seen the video in the past, AND (ii) at least 50% of participants rated the video at a 3 or above, AND/OR (iii) at least 20% of people rated the video at 5 or above. See Appendix M for more specific characteristics of all videos used in the final piloting stage. Of the remaining 72 videos, 36 were used for this study (36 for a separate study). Videos (humourous = 36, neutral = 6) were presented in a fixed pseudorandom order; no more than two videos from the same category were presented in a row. Two presentation orders were created to offset the likelihood that responses to videos would be a function of the order in which they were presented. Participants were randomly assigned to Version 1 or Version 2. Neutral videos depicted contexts similar to that of humourous videos, but without any humour (e.g., people talking amongst themselves, a person ordering a cake). Audio across all videos was equalized to
ensure that videos were presented at the same volume. Videos ranged in duration from 6 seconds to 44 seconds in length (mean = 15, SD = 8).

4.2.2.5 Coding and Measurement of Facial Expressions

Videotapes of participants watching videos were coded using a modified version of the Facial Expression Coding System (FACES: Kring & Sloan, 2007) which codes negative and positive dimensions (valence, intensity, and duration) of emotion using a four-point scale (1 = low to 4 = very high; e.g., 1 = a smile with slightly raised mouth corners and very little movement around the eyes, whereas 4 = intense laughing with the mouth). An elaborated demonstration of a decisional chart used for coding training is presented in Appendix N. Hypotheses for this study were predicated on how each group demonstrated mirth and degree of positivity expressed. Thus, only expressions coded as positive were included in the present study. Three undergraduate coders blind to the study hypotheses and diagnoses scored the videos. Outside of training videos, a single coder coded each video. For this reason, single-measures ICC were computed, as this approach is advisable when coded variables do not reflect averages collapsed across multiple coders (Hallgren, 2012). Coders were extensively trained before beginning coding. Specifically, each coder reviewed and coded five training videos and met with the first author and one other coder at least 5 times for consensus meetings in order to meet a criterion of at least 80% agreement (ICC=.83). Two subsequent agreement checks were also completed during the 5 month period of coding (ICC=.89 and ICC=.86, respectively).

4.2.2.6 Laughter Coding

Audio recordings of participants watching videos were coded by a single coder trained to recognize both unvoiced and voiced instances of laughter. Unvoiced laughter characterizes laughs that are grunt-like, including breathy parts or harsher cackles (e.g., “hah”, Bachorowski, Smoski, & Owren, 2001), whereas voiced laughs are repeated vocalic sound segments separated by brief pauses, where each segment typically contains a vowel sound following an aspirated “h” sound (e.g., “hahaha”; Bachorowski &
Owren, 2001; Bachorowski et al., 2001; Ruch & Ekman, 2001; Szameitat, Wildgruber, & Alter, 2013).

The coder was trained by coding three audio files of participants viewing the same video clips employed in this study and working with the first author to achieve an agreement of at 80% (single measures ICC = .92), with a subsequent agreement check half way through coding audio files coded for this study (single measures ICC = .87). The coder was blind to the study hypotheses and diagnoses.

4.2.3 Procedure

The study involved two phases: baseline and follow-up. During the baseline appointment participants completed the symptom interview, self-report questionnaires, and viewed all 42 video clips. Participants sat in a room alone, wearing headphones, with a white noise maker in the hallway to offset any noise from lab staff. Videos were presented in four blocks of 10 or 11 clips. Participants were informed that they were going to see a series of video clips, some of which would be neutral. Participants were also reminded that they would be video and audio recorded. After viewing each video, participants rated their enjoyment and perceived funniness of clip on a scale of 1 (Not at all; Not at all funny, respectively) to 7 (A lot; Very funny, respectively). Participants were told there would be a slight delay between clips and to attend to the screen as they would receive instructions on when to click to begin the next clip. Experimenters manipulated the delay time such that all participants experienced a 10-second delay between the time the participant answered the last question to the screen instructing participants to click to begin the next video. Between blocks of videos participants were given a 30-second break. Upon completion, participants received compensation for participation and follow-up appointments were booked for the following week. At the follow-up appointment participants viewed a screenshot of each of the humourous videos seen at baseline. The screenshot depicted the main characters/people in the video and was accompanied by a brief description of the video (see Appendix O for an example). Participants were asked to rate how much they enjoyed watching the video and how funny they found the video to be upon viewing it at the baseline session. Upon completion, participants viewed a second set of videos for a
study separate from the present study and then were debriefed on the overarching goals of the study and given an opportunity to ask questions of the experimenter.

4.3 Results

4.3.1 Sample Characteristics

A total of 37 participants with a diagnosis of MDD and 44 healthy comparisons (HC) completed the study in full. Participants ranged in age from 18 to 60 years old ($M = 40.77$, $SD = 13.60$), with a total of 17 males and 64 females. The average number of years of education was 16.02 years ($SD = 2.91$). The majority of participants identified themselves as being Caucasian ($n = 66$, 81%), however a subset of other ethnicities were also reported: Middle Eastern ($n = 2$, 3%), Caribbean ($n = 1$, 1%), South Asian ($n = 4$, 5%), East Asian ($n = 2$, 3%), and Mixed/Other ($n = 6$, 7%). While the aim was for the baseline and follow-up appointment to be separated by 7 days, this timeline was not feasible for all participants due to scheduling conflicts. The average time between appointments was 8.12 ($SD = 2.93$). Participants unable to return to for the follow-up within 14 days were excluded from follow-up analyses ($n = 4$; 2 MDD, 2 HC). Descriptive characteristics of the sample, by depressive group are presented in Table 4.1.
### Table 4.1 Descriptive Characteristics of the Sample by Depression Group

<table>
<thead>
<tr>
<th></th>
<th>Depressed $(n = 37)$</th>
<th>Healthy Comparison $(n = 44)$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age $M (SD)$</strong></td>
<td>41.19 (14.05)</td>
<td>38.91 (13.03)</td>
<td>.451</td>
</tr>
<tr>
<td><strong>Sex $n$ (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>30 (81.08)</td>
<td>34 (77.27)</td>
<td>.675</td>
</tr>
<tr>
<td>Male</td>
<td>7 (18.92)</td>
<td>10 (22.73)</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity $n$ (%)</strong></td>
<td></td>
<td></td>
<td>.848</td>
</tr>
<tr>
<td>Caucasian</td>
<td>32 (86.49)</td>
<td>34 (77.27)</td>
<td></td>
</tr>
<tr>
<td>Latino/Hispanic</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>1 (2.70)</td>
<td>1 (2.27)</td>
<td></td>
</tr>
<tr>
<td>Caribbean</td>
<td>0</td>
<td>1 (2.27)</td>
<td></td>
</tr>
<tr>
<td>South Asia</td>
<td>1 (2.70)</td>
<td>3 (6.82)</td>
<td></td>
</tr>
<tr>
<td>East Asia</td>
<td>1 (2.70)</td>
<td>1 (2.27)</td>
<td></td>
</tr>
<tr>
<td>Mixed/Other</td>
<td>2 (5.41)</td>
<td>4 (9.09)</td>
<td></td>
</tr>
<tr>
<td><strong>Years of Education $M (SD)$</strong></td>
<td>15.54 (2.72)</td>
<td>16.55 (3.10)</td>
<td>.129</td>
</tr>
<tr>
<td><strong>HAM-D Total $M (SD)$</strong></td>
<td>17.54 (8.35)</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Diagnoses $n$ (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major depressive episode (current/recurrent)</td>
<td>26 (70.27)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Dysthymia</td>
<td>28 (75.68)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Panic disorder</td>
<td>13 (35.14)</td>
<td>1 (2.27)</td>
<td></td>
</tr>
<tr>
<td>Social phobia</td>
<td>18 (48.65)</td>
<td>2 (4.54)</td>
<td></td>
</tr>
<tr>
<td>GAD</td>
<td>25 (67.57)</td>
<td>1 (2.27)</td>
<td></td>
</tr>
<tr>
<td>Agoraphobia</td>
<td>5 (13.51)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>PTSD</td>
<td>5 (13.51)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>OCD</td>
<td>1 (2.70)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Days between baseline and follow-up $M (SD)$</strong></td>
<td>8.51 (3.36)</td>
<td>7.78 (2.49)</td>
<td>.289</td>
</tr>
</tbody>
</table>

*Note.* Percentages of psychiatric diagnoses do not add up to 100% due to comorbid diagnoses.

*Note.* GAD = Generalized Anxiety Disorder; PTSD = Post-traumatic Stress Disorder; OCD = Obsessive Compulsive Disorder.

*Note.* Medications for participants are presented in Appendix P.

#### 4.3.2 Data Screening

Prior to commencement of data analyses, t-tests were conducted to assess for differences in dependent variables based on the presentation order version to which participants were assigned randomly. None of the t-test results reached statistical significance ($p$s ranged from .076 to .489). As such, version was not included as a covariate in any analyses.

#### 4.3.3 Correlations

Pearson correlations are presented in Table 4.2. Consistent with hypotheses, participants’ subjective ratings of enjoyment and funniness were significantly positively correlated with observed response
variables of frequency and duration of facial expressivity ($rs$ range from .42 to .60, $p < .05$) as well as frequency and duration of laughter ($rs$ range from .31 to .46, $p < .05$). Dissimilar to hypotheses, this pattern did not extend to intensity of facial expressivity, where the correlation was not statistically significant ($rs$ range from .03 to .17, $p > .28$).

### Table 4.2 Correlations of Self-report and Observed Responses to Videos by Group

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Enjoyment</td>
<td>-</td>
<td>.83**</td>
<td>.03</td>
<td>.53**</td>
<td>.46**</td>
<td>.39*</td>
<td>.31*</td>
</tr>
<tr>
<td>2. Funniness</td>
<td>.93**</td>
<td>-</td>
<td>.04</td>
<td>.60**</td>
<td>.64**</td>
<td>.46*</td>
<td>.40*</td>
</tr>
<tr>
<td>3. Average intensity</td>
<td>.12</td>
<td>.17</td>
<td>-</td>
<td>.34*</td>
<td>.38*</td>
<td>.35*</td>
<td>.46**</td>
</tr>
<tr>
<td>4. Frequency</td>
<td>.47**</td>
<td>.55**</td>
<td>.48**</td>
<td>-</td>
<td>.78**</td>
<td>.64**</td>
<td>.47**</td>
</tr>
<tr>
<td>5. Duration</td>
<td>.42*</td>
<td>.47**</td>
<td>.68**</td>
<td>.70**</td>
<td>-</td>
<td>.46**</td>
<td>.43**</td>
</tr>
<tr>
<td>6. Frequency</td>
<td>.36*</td>
<td>.42**</td>
<td>.59**</td>
<td>.53**</td>
<td>.61**</td>
<td>-</td>
<td>.84**</td>
</tr>
<tr>
<td>7. Duration</td>
<td>.40**</td>
<td>.45**</td>
<td>.63**</td>
<td>.49**</td>
<td>.67**</td>
<td>.94**</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note. Healthy comparison group below diagonal, depressed group above.*

*Bolded coefficients survived family-wise Bonferroni corrections (.05/21 = .002 for MDD; .05/21 = .002 for healthy comparison group)*

*p < .05

**p < .01

4.3.4 Multivariate Analysis of Variance

A multivariate analysis of variance (MANOVA) was conducted to determine whether there were differences between the HC and MDD groups on several variables measured in response to watching the videos: subjective enjoyment and funniness ratings, average FACES intensity, duration, frequency of positive expressions, and average duration and frequency of verbalized laughs. The main effect of group was significant, Wilk’s $\Lambda = .81$, $F (7,73) = 2.42$, $p = .028$, $\eta^2 = .19$. Specific pairwise descriptives are presented in Table 4.3. There were significant differences between groups across subjective (enjoyment and funniness) and frequency and duration of expressions and laughter. Groups did not differ on the average intensity of expressions.
Table 4.3 Descriptive Statistics for Self-report and Observed Responses to Videos by Group

<table>
<thead>
<tr>
<th></th>
<th>Depressed Group (n = 37)</th>
<th>Healthy Comparison (n = 44)</th>
<th>F</th>
<th>p</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enjoyment (SD)</td>
<td>3.48 (.88)</td>
<td>3.92 (1.01)</td>
<td>4.18</td>
<td>.044</td>
<td>.05</td>
</tr>
<tr>
<td>Funniness (SD)</td>
<td>3.26 (.91)</td>
<td>3.77 (.96)</td>
<td>5.88</td>
<td>.018*</td>
<td>.07</td>
</tr>
<tr>
<td>Average intensity of positive expressions (SD)</td>
<td>1.79 (.48)</td>
<td>1.90 (.43)</td>
<td>1.09</td>
<td>.299</td>
<td>.02</td>
</tr>
<tr>
<td>Frequency of positive expressions (SD)</td>
<td>28.11 (11.34)</td>
<td>37.89 (12.19)</td>
<td>13.79</td>
<td>&lt;.001*</td>
<td>.15</td>
</tr>
<tr>
<td>Duration of positive expressions (seconds; SD)</td>
<td>212.46 (116.11)</td>
<td>268.68 (132.10)</td>
<td>4.06</td>
<td>.047</td>
<td>.05</td>
</tr>
<tr>
<td>Frequency of laughs (SD)</td>
<td>22.78 (16.52)</td>
<td>37.55 (23.62)</td>
<td>13.79</td>
<td>&lt;.001*</td>
<td>.15</td>
</tr>
<tr>
<td>Duration of laughs (seconds; SD)</td>
<td>48.38 (40.41)</td>
<td>78.84 (57.79)</td>
<td>7.28</td>
<td>.002*</td>
<td>.12</td>
</tr>
</tbody>
</table>

*Survived family-wise Bonferroni corrections (.05/2 = .025 for self-ratings; .05/3 = .017 for facial expressivity; .05/2 = .025 for laughter)

Note. Given that only 70% of the MDD group met current criteria for an MDE, post-hoc exploratory t-tests were conducted to examine intra-group differences based on the median severity cutoff of the HAM-D. The pattern of results remained the same, suggesting that current severity of depressive symptoms was not driving the group-based differences presented in the table above.

Note. The pattern of results is similar when only evaluating responses to videos the participant deemed funniest, suggesting that these findings are not driven by healthy comparison individuals demonstrating an exaggerated response to videos they find especially humourous, rather a heightened global response to humourous stimuli relative to depressed individuals.

4.3.5 Repeated Measures Analyses of Variance

A repeated measures ANOVA was conducted to evaluate main effects of group and enjoyment/funniness over time (i.e., enjoyment and funniness ratings at baseline and follow-up), and an interaction between group and enjoyment over time. The main effect of group was significant ($F(1, 75) = 8.90, p = .004, \eta^2 = .11$), such that healthy individuals reported higher levels of enjoyment ($M = 4.00, SD = 1.25$) relative to depressed individuals ($M = 3.38, SD = 1.30$). The main effect of enjoyment over time was not significant (Wilk’s $\Lambda = .95, F(1,75) = 3.86, p = .053, \eta^2 = .05$), wherein reported levels of enjoyment at baseline ($M = 3.77, SD = .94$) were not significantly different from follow-up ratings ($M = 3.64, SD = .95$). Moreover, contrary to hypotheses, the interaction was not significant (Wilk’s $\Lambda = 1.00, F(1,75) = .06, p = .809, \eta^2 < .01$). Concerning funniness, the main effect of group was significant $F(1, 75) = 12.22, p = .001, \eta^2 = .14$, such that healthy individuals reported higher levels of funniness ($M = 3.87, SD = 1.21$) than depressed individuals ($M = 3.15, SD = 1.26$). Neither the main effect of funniness over time (Wilk’s $\Lambda = .99, F(1,75) = .85, p = .359, \eta^2 = .01$) nor the interaction (Wilk’s $\Lambda = .99, F(1,75) = .52, p = .473, \eta^2 = .01$) were significant. These findings suggest that while healthy individuals reported higher levels of
enjoyment than depressed individuals, there was no difference in the degree to which enjoyment changed over baseline to follow-up either overall or as a function of group status. Furthermore, healthy comparison participants endorsed higher ratings of funniness than depressed individuals, but there was not a significant change from baseline to follow-up, and no interaction between change in funniness and group status. These results are presented in Figure 4.1.

Figure 4.1 Ratings of Self-reported Enjoyment and Funniness at Follow-up by Group

4.4 Discussion

The current study examined the relations between self-reported and observed emotional reactivity to humourous videos, both in real-time and using a retrospective design to solicit self-reported ratings at a follow-up time point among individuals with and without major depressive disorder. Individuals in both groups demonstrated consistent responses across self-reported reactions and facial affective responsivity and produced laughter, such that relations among responsivity variables were significantly positively correlated with each other. However, inconsistent with hypotheses, this pattern of responding did not extend to the average intensity of positive expressions as measured by the FACES coding system (Kring & Sloan, 2007). This suggests that overall enjoyment, reported funniness, and frequency and duration of
expressions and laughter did not coincide with the average magnitude of facial expressions captured by coders. Gehricke & Shapiro (2000) found a similar pattern of discordance in response to an emotion induction task, such that depressed individuals demonstrated discrepancies between facial muscle activity and self-reported emotion. Importantly, their measure of facial expression was an average change over the course of the task, just as the average intensity of expressions measured in this study. It may be that changes in intensity of expression are not best captured by an averaged variable of intensity changes. Additional research is needed to further examine this finding.

Consistent with hypotheses, and aligned with the ECI theory of emotional responsivity (Rottenberg & Hindash, 2015; Rottenberg & Vaughan, 2008), depressed individuals reported lower levels of enjoyment and funniness, and demonstrated fewer instances of positive facial expressions and laughter. The finding that depressed individuals reported lower levels of enjoyment in response to videos coincides with studies demonstrating that people with MDD report lower levels of happiness in response to pleasant stimuli (Dunn et al., 2004; Fiorito & Simons, 1994) and decreased amusement while watching funny films (Rottenberg et al., 2002). Of note are the small effect size differences for self-reported enjoyment and funniness ratings ($\eta^2_p = .06$) and the medium effect size differences ($\eta^2_p = .10$) for behavioural measures (excluding intensity). By comparison, a meta-analysis of emotional reactivity in depression found a large effect for self-report and a medium effect for behavioural measures of positive emotional reactivity (Bylsma et al., 2008). It would seem that the self-reported responsivity to humourous stimuli are less impaired than behavioural responses in depression. This is supported by a similar finding of a small to medium effect size in self-reported amusement in response to humourous films (Rottenberg et al., 2002) and coalesces with data from Falkenberg and colleagues (2010) suggesting that depressed individuals still appreciate humourous stimuli in that they ascribe funny videos as being funny, but display blunted responsivity to these stimuli. Taken together, data from this study and extant literature suggests that that depressed individuals struggle to show appreciation of humour, demonstrated by lower reactivity across multiple modalities of behavioural expression.
Not aligned with hypotheses was the finding of no group difference in average intensity of facial expressions. Similar to the correlations among variables discussed above, this variable may be less associated with changes in emotional experience and frequency and duration-based variables of mirth. However, other studies using the FACES coding system demonstrated medium to large effect sizes in average intensity of positive expressions in response to static pleasant stimuli among depressed women (Sloan et al., 2001) and during affiliative social interactions among individuals with social anhedonia (Llerena et al., 2012). Thus, it may be that this finding is specific to humourous stimuli or because individuals watched videos in isolation, where there is no immediate need to be expressive because of the lack of interaction partners.

One particularly novel aspect of this study was the inclusion of coded laughter. As predicted, depressed individuals produced significantly fewer instances of laughter, and spent a significantly lower proportion of the time laughing than healthy individuals. Fewer instances of mirthful behaviour are congruous with expected results based on the ECI theory of emotional reactivity (Rottenberg & Vaughan, 2008). This finding is also in line with previous studies demonstrating diminished instances of smiling (Sloan et al., 2002; Trémeau et al., 2005), laughter (Schelde, 1998), and general expressivity (Davies et al., 2016) among depressed persons. These data also coalesce with research on affiliative behaviours, wherein a study by Girard and colleagues (2014) found that depressed individuals demonstrate reduced affiliative behaviours in social interactions. Reductions in mirth and demonstration of enjoyment have important implications for social bonding. Indeed, affiliative behaviours such as smiling and shared laughter incite feelings of reward and connectedness, and mitigate the effects of stress and conflict in interpersonal relationships (for a review, see: Martin, 2007). Thus, results from this study highlight the need for both additional research and the importance of addressing impairments in expressivity in therapy.

The hypotheses concerning an interaction in self-reported differences of enjoyment and funniness ratings from baseline to follow-up were not supported. The main effect of group demonstrated that
healthy individuals reported significantly higher levels of enjoyment and funniness ratings both at baseline and at follow-up, but there were no significant differences between the time points, nor was there an interaction. These findings suggest that depressed individuals experienced lower enjoyment and reported less funniness at baseline, which were retained at follow-up, approximately eight days later. Past research has found that depressed individuals tend to recall negatively-valenced information better than positively valenced information (Mathews & MacLeod, 2005), suggesting a retrospective bias wherein current depressive symptoms are associated with less accurate recall of pleasurable events (Gotlib & Neubauer, 2000). Conversely, others have found that depressed individuals tend to engage in intensifications of retrospective accounts of both positive and negative affect in everyday life situations, though intensifications are relatively greater for negatively-valenced events (Ben-Zeev et al., 2009). However, neither of these views of affect recall were supported. It is possible that these biases do not extend to humourous stimuli, or that the design of the current study obscured the manifestation of latent retrospective biases. For instance, on average, both the MDD and HC groups rated videos as being moderately enjoyable and funny both in the moment and retrospectively. It may be the case that stimuli were not salient enough to induce specific memories, such that responses reflect intact memories of most videos being moderately enjoyable with little room for biased perceptions of videos that were particularly enjoyable/funny at the initial visit. Future research is needed to more comprehensively examine retrospective accounts of emotionally salient experiences.

Taken together, results from this study replicate and extend findings from the emotion literature demonstrating that depressed individuals emotional reactivity in response to humourous videos is diminished relative to healthy individuals. This is evident both in self-reported experiences and behavioural expressions of mirth, including instances of facial affect and laughter. These differences do not appear to extend to intensity of facial expressions, nor do they coincide with retrospective biases of affect recollection that predict impairments in recall or intensifications of affectively valenced memories. Given the evident difference in responding between depressed individuals and healthy individuals it is
important that future studies continue to examine emotion reactivity in response to humourous stimuli. These types of studies may be especially important because the literature suggests that mirth-related emotional responsivity may serve as diagnostic markers of depression (Cohn et al., 2009; Navarro et al., 2014) and concurrent impairment (Rottenberg et al., 2002), that may be indicative of recovery (Sakamoto et al., 1997; Schelde, 1998), and predict subsequent relapse (Rottenberg et al., 2002).

4.4.1 Limitations and Future Directions

The results of this study should be considered in light of several limitations. Not all individuals in the MDD group were currently in a depressive episode at the time of the study (70% current MDE; 78% current MDE and/or dysthymia). Indeed, while the median Hamilton Depression (HAM-D) rating score was 18 (indicating at least severe depression in half of the MDD sample), five individuals scored below 7, in the normal range. Further, for those who were not currently depressed, inclusion in the MDD group was based on a self-report of being diagnosed with major depressive disorder in the past. These were not confirmed via clinical chart reviews. Past studies have shown that emotional reactivity deficits may be different in magnitude in remitted individuals relative to those who are currently depressed (Schelde, 1998). However, post-hoc exploratory t-tests revealed no differences on any of the self-report, facial affect, or laughter variables between individuals above and below the median HAM-D score in the MDD group. Comparisons across the spectrum of symptom severity were not a primary focus for this study. As such, future studies should endeavor to recruit a larger sample that would permit stratification across currently depressed and remitted patients. A larger sample would also allow for considerations concerning length of illness, as processing of emotional information has been shown to be different in first episode relative to recurrent MDD (Nandrino, Dodin, Martin, & Henniaux, 2004).

Another important limitation concerns the generalizability of these findings because they were ascertained in a contrived lab environment where individuals viewed clips in isolation. A growing number of studies using ecological momentary assessment demonstrate the utility of collecting emotional reactivity data in response to everyday real-life situations. An especially important observation gained
from using experience-sampling methods is that there are notable fluctuations in negative affect throughout the day (Thompson et al., 2012). Specifically, depressed individuals demonstrate a paradoxical mood brightening effect in response to real life events; relative to a healthy comparison group, people with depression exhibit larger decreases in negative affect after a positively appraised life event (Bylsma, Taylor-Clift, & Rottenberg, 2011; Peeters, Nicolson, Berkhof, Delespaual, & deVries, 2003). For instance, after a positive event (e.g., playing with a pet), depressed individuals report larger reductions in overall current negative affect compared to a healthy comparison group. The change in positive affect has been found to be similar in magnitude between groups. These findings have not been found in laboratory studies, but have important implications for the framework in which emotion reactivity is evaluated. Furthermore, several studies document that depressed persons struggle to modulate their affect based on the presence or absence of other individuals (Gehricke & Shapiro, 2000). An important next step will be to evaluate changes in positive/negative affect and emotional reactivity demonstrated by depressed individuals in responding to humourous real-world events, both when they are alone and with other persons.

Finally, while the data from this study demonstrate significantly different patterns in emotional reactivity in depressed individuals relative to healthy individuals, we are limited in the extent to which we can understand the reasons for group differences. From a mechanistic point of view, it may be that the MDD group was more prone to shift their attention away from positive (humourous) stimuli (Joormann & Gotlib, 2007). Or, alternatively, depressed individuals may have been distracted by negative aspects of some of the videos (e.g., a person getting hurt in an aggressive clip), as past research suggests that people with depression demonstrate attentional biases for negative information in interpersonal stimuli (Gotlib, Krasnoperova, Yue, & Joormann, 2004). It may also be the case that the content of some videos were subtler than others, for instance a clip depicting a person who is initially shocked but then smiles when they recognize that the source of their distress is actually a joke. Due to deficits in facial affect perception and theory of mind (for a review, see: Cusi, Nazarov, Holshausen, MacQueen, & McKinnon, 2012)
depressed individuals may have struggled to identify changes in characters’ facial expressions and state of mind, thereby missing the punch line. Humour cues may also have been missed due to attentional and memory deficits often present in MDD (e.g., Bora, Harrison, Yücel, & Pantelis, 2013; Rose & Ebmeier, 2006). Thus, where a healthy individual processed this information in a positive humour framework, a depressed individual may have failed to encode the clip as being ‘enjoyable’ or ‘funny.’ To this end, future studies may benefit from employing eye-tracking technology, facial affect perception tasks, theory of mind tasks, and tests of attention and discourse memory tasks to address these limitations.

Despite the aforementioned limitations, the current study contributes novel details to our understanding of emotional reactivity to humourous stimuli across both self-reported and behavioural dimensions of reactivity. Given the critical role of prosocial mirth-related behaviours in social functioning, it is important that additional research be conducted to better understand the way in which depressed individuals experience and respond to humourous stimuli with the aim of augmenting existing and creating novel treatment protocols to improve social connectivity and interpersonal relationships.
Chapter 5

Socially Facilitative Mirth In Major Depressive Disorder

5.1 Introduction

Major depressive disorder (MDD) is a psychiatric condition primarily characterized by disturbances in emotion and mood (American Psychiatric Association, 2013). Emotions tend to occur in the context of social interactions and relationships (Boiger & Mesquita, 2012; Parkinson, Fischer, & Manstead, 2004). Thus, it stands to reason that an important corollary of these disturbances in emotion is social functioning. Indeed, most notable of the functional deficits that accompany MDD is the concomitant impairment in social functioning (for reviews, see: Hames et al., 2013; Kessler et al., 2003). Individuals with MDD report impairments across several types of social relationships (e.g., friends, coworkers, family; Fink & Shapiro, 2013; Hirschfeld et al., 2000), wherein interactions are experienced as being less intimate (Nezlek et al., 2000), less enjoyable (Brown, Strauman, Barrantes-Vidal, Silvia, & Kwapil, 2011), and more negative (Benazon, 2000; Kennedy et al., 2007; Segrin, 2000). Moreover, aligned with the interpersonal model of depression (Coyne, 1976a), depressed persons tend to engage in behaviours that incite annoyance and subsequently elicit rejection by interaction partners (Hames et al., 2013; Starr & Davila, 2008). Depressed individuals are also highly sensitive to interpersonal rejection (Starr & Davila, 2008); this creates a vicious cycle of heightened negative affect that promotes withdrawal behaviours (Slavich, O'Donovan, Epel, & Kemeny, 2010), emotion suppression (Gross & John, 2003), and maintenance of loneliness (Leary, 2001). These patterns of experiences suggest dysfunctional intra- and interpersonal aspects of social interactions. To this end, it is important to identify the specific symptoms in MDD that are detrimental to social functioning. Two particularly relevant clusters are social anhedonia and social anxiety. Social anhedonia refers to the reduction in the normative experience of pleasure in the context of interpersonal interactions and reduced desire for social affiliation (Germine et al., 2011). By comparison, social anxiety refers to a syndrome of co-occurring physical and psychological symptoms.
that emerge in response to fears about what other people think about them (American Psychiatric Association, 2013). Both clusters are highly prevalent in depression (Fava et al., 2000; Kessler et al., 2003; Pelizza & Ferrari, 2009; Rey et al., 2009). Depression, social anxiety, and social anhedonia have all been shown to exert deleterious effects on social behaviour (Alden & Taylor, 2004; Blanchard, Collins, Aghevli, Leung, & Cohen, 2011; Germine et al., 2011; Segrin, 2000, 2001), thereby underscoring the importance of considering these symptom clusters in understanding impairments in socially relevant behaviour.

Among individuals with MDD, emotion difficulties manifest in understanding and recognizing emotions in others (i.e., facial processing and theory of mind; for a review, see Cusi et al., 2012) and in attenuated responsivity to affectively-salient stimuli (for a review, see: Bylsma et al., 2008). A growing body of literature suggests that the blunted emotional reactivity evident in depressed persons is captured by the theory of emotion context insensitivity (ECI; for a review, see: Rottenberg & Hindash, 2015). The ECI theory posits that people with depression will fail to show typical emotional reactions in response to positively and negatively valenced stimuli (both social and non-social in nature; Rottenberg, 2005). Indeed, associated affective blunting is evident across responsivity modalities of subjective experience (Bylsma et al., 2008), facial expression (e.g., smiling; Rehman, Gollan, & Mortimer, 2008; Sloan et al., 2002; Trémeau et al., 2005), gesticulation (Segrin & Abramson, 1994; Segrin, 2000), and laughter (Navarro, del Moral, Cuesta-Alvaro, Lahoz-Beltra, & Marijuán, 2016; Schelde, 1998). Importantly, these findings hold true both when individuals encounter stimuli in isolation (e.g., Rottenberg et al., 2002) and in the context of social interactions (Kupferberg et al., 2016; Segrin, 2000; Trémeau et al., 2005). Thus, depressed persons’ reactions to normatively rewarding social stimuli are dampened for the depressed individual due to reduced hedonic experiences, whereby the relative lack of affiliative behaviours (e.g., facial expressions, gestures) may signal lack of engagement or interest to dyadic partners (Kupferberg et al., 2016; Segrin, 2000).
Healthy individuals typically experience social interactions and relationships as being highly rewarding (for a review, see Krach, Paulus, Bodden, & Kircher, 2010). In fact, the desire to form and maintain interpersonal relationships is considered a fundamental need (Baumeister & Leary, 1995). In order to meet this need it is highly adaptive to develop and exhibit socially facilitative behaviours that promote social engagement and connectedness. One such socially relevant variable is the experience and expression of mirth. Mirth refers to the positive emotion and subsequent expression via smiling and laughter that occur in response to encountering humourous stimuli that incite enjoyment. Mirth facilitates social relationships (Shiota et al., 2004) by generating shared feelings of positive emotions that strengthen group identity and cohesion (Gervais & Wilson, 2005). Moreover, the act of shared laughter fosters positivity and intimacy in relationships (Kashdan et al., 2014), thereby underscoring its utility as a socially advantageous behaviour (Martin, 2007). Interestingly, the presence of any laughter unto itself does not confer an appreciative gain in the propensity to engage and connect with others. Nuanced differences in type of laughter matter; voiced (i.e., “hahaha”) but not unvoiced (e.g., “grunt-like” laughs, which include “breathy pants”; Bachorowski et al., 2001; Grammer & Eibl-Eibesfeldt, 1990; Ruch & Ekman, 2001) laughter elicit positive affect in the listener (Bachorowski & Owren, 2001). Thus, voiced laughter proffers the greatest prosocial advantage in interpersonal interactions.

Given the key roles of humour and laughter in social relationships, it is important to understand the circumstances under which depressed individuals respond to humour and use laughter in the presence of others. While the literature base on emotional reactivity continues to grow to characterize the topography of emotional deficits in depression, there is a paucity of research on how depressed persons respond to humourous stimuli, and, moreover, how depressed individuals respond when hearing others produce laughter while being exposed to humourous stimuli. Past studies evaluating responsivity to humour have been limited by their use of static stimuli (e.g., Falkenberg et al., 2010) over dynamic videos, whereby static images and cartoons restrict the generalizability of the patterns of responsivity to real world situations. Moreover, there are no studies examining how depressed individuals respond when
hearing others laugh. This study addressed this gap by presenting depressed individuals with humourous videos and coding mirth-based behavioural responses via facial affect and laughter produced in response to these videos. Furthermore, participants were informed that others were watching the same set of videos in real-time, thereby creating a faux social environment in which participants believed that there was a two way audio channel whereby the ‘others’ could hear their responses and they could ‘hear’ the others audible responses to the videos. In reality, half of the funny videos were artificially manipulated to have superimposed laughter (Laugh condition) and the other half had no laughter (No Laugh condition).

Relative to a healthy comparison group, it was expected that depressed individuals would display fewer instances and a shorter total duration of facial affective responsivity and laughter while watching videos clips (main effect of group). Concerning superimposed laughter on videos, it was hypothesized that both the healthy comparison and depressed groups would demonstrate more frequent and longer expressions and produce more frequent and longer laughs when hearing others laugh (main effect of condition; Laugh/No Laugh). It was also expected that the magnitude of this difference would be larger in depressed individuals; relative to the comparison group, depressed persons would demonstrate less expressivity and laughter when there was no superimposed laughter (interaction). This hypothesis is aligned with research suggesting that depressed persons, particularly those with social anxiety, would be more inclined to inhibit behaviour that may negatively impact what others think of them (i.e., laughing in response to a video that others do not appear to think is funny). Finally, to further examine this expected difference in the MDD group concerning differential patterns of responsivity to Laugh and No Laugh stimuli, hierarchical regressions were performed to assess the roles of social anhedonia and social anxiety in predicting mirth outcomes (facial expressivity and produced laughter). It was hypothesized that after accounting for social anhedonia, social anxiety would account for additional variance in the difference in mirth demonstrated by MDD participants in the Laugh and No Laugh conditions.
5.2 Method

5.2.1 Participants

Participants included in this study were the same subset of individuals who completed the study described in Chapter 4. See page 64 in Chapter 4 for description of participant inclusion and exclusion criteria.

5.2.2 Materials

5.2.2.1 Demographic questionnaire

Participants provided information about their age, gender, ethnicity, educational background.

5.2.2.2 Mini International Neuropsychiatric Interview (MINI)

See page 65 in Chapter 4 for MINI description.

5.2.2.3 The Revised Social Anhedonia Scale (RSAS)

See page 26 in Chapter 2 for RSAS description. The internal consistency of the scale in the present study was excellent ($\alpha = .91$).

5.2.2.4 The Social Interaction Anxiety Scale (SIAS)

See page 27 in Chapter 2 for SIAS description. The internal consistency of the scale in the present study was excellent ($\alpha = .95$).

5.2.2.5 Hamilton Depression Rating Scale (HAM-D)

See page 65 in Chapter 4 for HAM-D description internal consistency statistic. The internal consistency of the scale in the present study was good ($\alpha = .87$).

5.2.2.6 Experimental Stimuli

See page 66 of Chapter 4 for details on piloting of videos. Note that of the 72 total videos retained after piloting, 36 were used for the study described in Chapter 4 and the other 36 were used for this study.
Videos for this study ranged in duration from 7 seconds to 40 seconds in length (mean = 20.31, SD = 7.24).

After the selection process, videos were altered to have spontaneous laughter superimposed to create two sets of videos, one set of 36 videos with superimposed laughter and one set of 36 videos without superimposed laughter. Two versions were created; each version included 18 of the videos without superimposed laughter and 18 of the videos with superimposed laughter. The videos in version 1 with laughter superimposed did not have laughter superimposed in version 2 and vice-versa. Participants were randomized to one of the two versions. Laughter excerpts were obtained from AVLaughterCycle project database, which is a freely available database of men and women’s spontaneous laughter in response to watching humourous videos (Urbain et al., 2010). One male and one female were selected on the basis that: (1) both laughed at least 18 times and (2) all 18+ laughs were classified as voiced laughs (Bachorowski et al., 2001). Appropriate points to overlay laughter (points of hilarity; PoH) were determined by agreement, wherein two undergraduate research assistants and the first author listened to the audio of five randomly selected participants included in the pilot study (see page 66 of Chapter 4) to determine both the points at which most people laughed and the average length of the laugh at each point. All raters completed this task separately and then met to review observations. In the videos where two PoHs were identified, both were retained and more than one laugh was superimposed onto those videos ($n = 5$). Superimposed laughs were similar in length (+/- 1 second) to identified PoHs. The male and female laughs were overlaid onto videos to begin within 1 second of one another. In order to relay realistic sounds, several additional audible noises and design procedures were put in place. First, the noticeable inhalation and exhalation noises evident immediately before and after laughs from the laughter database were included. Sounds of inhalation and exhalation have been identified as characteristic features of laughter (Provine & Yong, 1991; Provine, 2001; Ruch & Ekman, 2001). Second, noises including short sighs, quick exhales, and sniffling were superimposed onto videos at random, such that 21 of 42 videos included these noises. Third, a 5-second black screen was added to each video. Sometimes the PoH was at
the end of the video; the black screen allowed for the laughter to continue past the point of when the video itself ended. Fourth, and lastly, in order to project a naturalistic perception of the affability and mirth-like behaviour of the fake participants, the amplitude of each male laugh was manipulated to be 5 decibels (dB) higher than the female laugh. This manipulation was performed to (i) present the male as consistently laughing more loudly than the female in order to portray consistent profiles of these individuals’ mirth to the listener and (ii) a difference of 5dB was selected because 5dB is a clearly noticeable difference to listeners in loudness of a stimulus (White, 1975).

As with the procedure described in Chapter 4, videos were presented in a fixed pseudorandom order with no more than two videos from the same category presented in a row and, new to this study, no more than two Laugh or No Laugh videos presented in a row. All participants viewed the videos in the same order, but the order of presentation of whether the videos did or did not have superimposed laughter was different, such that there were two orders of presentation versions. These versions were created to offset the likelihood that responses to video would be a function of the order in which presented videos did or did not have superimposed laughter (see Appendix Q for list of videos for two orders). Version is hereinafter referred to as version order.

5.2.2.7 Coding and Measurement of Facial Expressions

See page 66 in Chapter 4 for a description of the Facial Expression Coding System (FACES).

5.2.2.8 Laughter Coding

See pages 66 of Chapter 4 for a description of laughter coding methods.

5.2.3 Procedure

After completing a short task for a separate study (Chapter 4; this appointment occurred at the follow-up point to the study presented in Chapter 4), participants viewed all 42 video clips for this study. Participants sat in a room alone, wearing headphones, with a white noise maker in the hallway to offset
any noise from lab staff. Stimuli were presented in four blocks of 10 or 11 videos. Participants were informed that they were going to see a series of video clips, some of which are neutral and others were not, during which time they had provided written consent be video and audio recorded. Participants were also told that there were two additional participants in other rooms in the building watching the video clips at the same time. We informed participants that this was to simulate a social environment, in which all three participants could hear one another, but could not see one another, while the videos were playing. Participants were asked not to attempt to directly communicate with other participants. Participants were told there would be a slight delay between clips owing to the fact that participants would answer the self-reported questions about the video at different speeds. Further, in order ensure that all participants were watching the videos in sync with one another, the next video would begin when the last person had answered the last self-reported question. In reality, experimenters manipulated the delay time such that all participants experienced a 10-second delay between the time the participant answered the last self-reported question and the time the next video began. Between blocks of videos participants were given a 30-second break. Upon completion, participants were debriefed on the overarching goals of the study, informed of the deception element (no other participants viewing videos at that time), and given an opportunity to ask questions of the experimenter. During this time, as a manipulation check, participants were also directly asked whether or not they believed that other participants were present.

5.3 Results

5.3.1 Sample Characteristics

A total of 36 participants with a diagnosis of MDD and 36 healthy controls completed the study. Participants ranged in age from 18 to 60 years old ($M = 40.26, SD = 13.70$), with a total of 16 males and 56 females. The average number of years of education was 16.13 years ($SD = 3.00$). The majority of participants identified themselves as being Caucasian ($n = 60, 83\%$), however a subset of other ethnicities were also reported: Middle Eastern ($n = 2, 3\%$), Caribbean ($n = 1, 1\%$), South Asian ($n = 2, 3\%$), East
Asian \((n = 2, 3\%\)\), and Mixed/Other \((n = 5, 7\%\)\). Descriptive characteristics of the sample, by group are presented in Table 5.1.

**Table 5.1 Descriptive Characteristics of the Sample by Group**

<table>
<thead>
<tr>
<th></th>
<th>Depressed ((n = 36))</th>
<th>Healthy Comparison ((n = 36))</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (M (SD))</strong></td>
<td>40.72 (14.03)</td>
<td>39.81 (13.54)</td>
<td>.779</td>
</tr>
<tr>
<td><strong>Sex (n (%))</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>29 (80.56)</td>
<td>27 (75.00)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7 (19.44)</td>
<td>9 (25.00)</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity (n (%))</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>31 (86.11)</td>
<td>29 (80.56)</td>
<td></td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>1 (2.78)</td>
<td>1 (2.78)</td>
<td></td>
</tr>
<tr>
<td>Caribbean</td>
<td>0</td>
<td>1 (2.78)</td>
<td></td>
</tr>
<tr>
<td>South Asia</td>
<td>1 (2.78)</td>
<td>1 (2.78)</td>
<td></td>
</tr>
<tr>
<td>East Asia</td>
<td>1 (2.78)</td>
<td>1 (2.78)</td>
<td></td>
</tr>
<tr>
<td>Mixed/Other</td>
<td>2 (5.56)</td>
<td>3 (8.33)</td>
<td></td>
</tr>
<tr>
<td><strong>Years of Education (M (SD))</strong></td>
<td>15.61 (2.74)</td>
<td>16.64 (3.20)</td>
<td>.148</td>
</tr>
<tr>
<td><strong>Randomly Assigned Version Order</strong></td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>Version 1</td>
<td>19 (52.78)</td>
<td>19 (52.78)</td>
<td></td>
</tr>
<tr>
<td>Version 2</td>
<td>17 (47.22)</td>
<td>17 (47.22)</td>
<td></td>
</tr>
<tr>
<td><strong>Manipulation check</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Believed superimposed laughter was real</td>
<td>27 (75)</td>
<td>24 (66.66)</td>
<td>.437</td>
</tr>
<tr>
<td>Did not believe superimposed laughter was real</td>
<td>9 (25)</td>
<td>12 (33.33)</td>
<td></td>
</tr>
<tr>
<td><strong>HAM-D Total (M (SD))</strong></td>
<td>17.61 (8.75)</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>SIAS Total (M (SD))</strong></td>
<td>36.31 (14.60)</td>
<td>21.47 (9.03)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>RSAS Total (M (SD))</strong></td>
<td>15.33 (8.87)</td>
<td>7.42 (4.60)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>Diagnoses (n (%))</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major depressive episode (current/recurrent)</td>
<td>24 (66.67)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Dysthymia</td>
<td>20 (55.56)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Panic disorder</td>
<td>8 (27.78)</td>
<td>1 (2.78)</td>
<td></td>
</tr>
<tr>
<td>Social phobia</td>
<td>14 (38.89)</td>
<td>2 (5.56)</td>
<td></td>
</tr>
<tr>
<td>GAD</td>
<td>19 (52.78)</td>
<td>1 (2.78)</td>
<td></td>
</tr>
<tr>
<td>Agoraphobia</td>
<td>4 (11.11)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>PTSD</td>
<td>5 (13.89)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>OCD</td>
<td>1 (2.78)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* HAM-D = Hamilton Depression Rating Scale; SIAS = Social Interaction Anxiety Scale; RSAS = Revised Social Anhedonia Scale.

*Note.* Percentages of psychiatric diagnoses do not add up to 100\% due to comorbid diagnoses.

*Note.* GAD = Generalized Anxiety Disorder; PTSD = Post-traumatic Stress Disorder; OCD = Obsessive Compulsive Disorder.

*Note.* Medications for participants are presented in Appendix P.

### 5.3.2 Data Screening

Prior to commencement of data analyses, t-tests were conducted to assess for differences in dependent variables based on the version order (Version 1, \(n = 38\); Version 2, \(n = 34\)) to which participants where
randomized and whether participants believed the manipulation of presence of live participants (Believed manipulation, \( n = 51 \); Did not believe manipulation, \( n = 21 \)). These are presented in Table 5.2. There were significant differences based on the order of superimposed laughter (version order) on dependent variables of duration of laughter without superimposed laughter, and the difference scores (present – absent) of mirth responsivity for laughter frequency, laughter duration, and facial expressivity duration. As such, version order was used as a covariate for all analyses. There were no significant differences between individuals who did and did not endorse believing the manipulation; this variable was not used as a covariate\(^1\).

\(^1\) The pattern of results remained the same across all analyses when evaluated with the manipulation check as a covariate.
Table 5.2 Differences in Dependent Variables Based on Assignment to Version Order and Manipulation Check Results

<table>
<thead>
<tr>
<th></th>
<th>Version Order</th>
<th>Manipulation Check</th>
<th>p</th>
<th></th>
<th></th>
<th></th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Mean (SD)</td>
<td>2 Mean (SD)</td>
<td>p</td>
<td>Believed it Mean (SD)</td>
<td>Did not believe Mean (SD)</td>
<td></td>
<td>p</td>
</tr>
<tr>
<td></td>
<td>n = 38</td>
<td>n = 34</td>
<td></td>
<td>n = 51</td>
<td>n = 21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laughter frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superimposed laughter</td>
<td>14.92 (10.45)</td>
<td>10.91 (6.94)</td>
<td>.057</td>
<td>15.67 (10.71)</td>
<td>13.09 (10.03)</td>
<td>.490</td>
<td></td>
</tr>
<tr>
<td>present</td>
<td>15.32 (12.74)</td>
<td>18.59 (12.74)</td>
<td>.280</td>
<td>16.89 (13.81)</td>
<td>11.45 (9.06)</td>
<td>.165</td>
<td></td>
</tr>
<tr>
<td>Laughter duration (seconds)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superimposed laughter</td>
<td>23.29 (19.52)</td>
<td>14.47 (10.91)</td>
<td>.023</td>
<td>24.85 (21.77)</td>
<td>19.45 (12.44)</td>
<td>.344</td>
<td></td>
</tr>
<tr>
<td>present</td>
<td>23.66 (22.53)</td>
<td>32.29 (28.27)</td>
<td>.154</td>
<td>26.93 (25.01)</td>
<td>15.63 (12.32)</td>
<td>.072</td>
<td></td>
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<tr>
<td>Facial Expressivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superimposed laughter</td>
<td>16.42 (8.26)</td>
<td>16.64 (7.23)</td>
<td>.903</td>
<td>16.30 (6.94)</td>
<td>16.72 (11.29)</td>
<td>.908</td>
<td></td>
</tr>
<tr>
<td>present</td>
<td>17.74 (8.04)</td>
<td>17.74 (8.02)</td>
<td>.999</td>
<td>18.11 (7.75)</td>
<td>16.82 (9.03)</td>
<td>.659</td>
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</tr>
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<td>Facial Expressivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration (seconds)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superimposed laughter</td>
<td>121.79 (68.31)</td>
<td>110.59 (63.58)</td>
<td>.475</td>
<td>128.41 (71.06)</td>
<td>105.55 (61.04)</td>
<td>.356</td>
<td></td>
</tr>
<tr>
<td>present</td>
<td>126.05 (74.03)</td>
<td>156.74 (86.22)</td>
<td>.098</td>
<td>135.15 (76.24)</td>
<td>100.27 (64.91)</td>
<td>.192</td>
<td></td>
</tr>
<tr>
<td>Difference Scores (present – absent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laughter Frequency</td>
<td>.39 (8.04)</td>
<td>7.68 (7.23)</td>
<td>&lt;.001</td>
<td>1.22 (7.36)</td>
<td>-1.64 (9.60)</td>
<td>.327</td>
<td></td>
</tr>
<tr>
<td>Laughter Duration (seconds)</td>
<td>.37 (15.34)</td>
<td>17.82 (20.22)</td>
<td>&lt;.001</td>
<td>2.07 (16.04)</td>
<td>-3.82 (13.19)</td>
<td>.289</td>
<td></td>
</tr>
<tr>
<td>Facial Expressivity</td>
<td>1.32 (4.21)</td>
<td>1.09 (5.34)</td>
<td>.841</td>
<td>1.81 (3.40)</td>
<td>.09 (5.77)</td>
<td>.371</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>4.26 (26.89)</td>
<td>46.15 (39.58)</td>
<td>&lt;.001</td>
<td>6.74 (26.67)</td>
<td>-5.27 (26.72)</td>
<td>.216</td>
<td></td>
</tr>
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</table>

90
5.3.3 Repeated-measures Multivariate Analyses of Covariance

Four repeated-measures multivariate analyses of covariance (MANCOVAs) were conducted to test the hypotheses that there would be differences between depressed and healthy comparison groups on mirthful responses to humorous videos based on whether or not there was superimposed laughter. Version order was used as a covariate. These analyses were conducted using the following four dependent variables: total instances of laughter, total duration of laughter, FACES total frequency positive expressions, and FACES duration of positive facial expressions. Means and standard deviations are presented in Table 5.3.

Table 5.3 Means and Standard Deviations for Laughter and Facial Expressivity Responses to Videos by Group

<table>
<thead>
<tr>
<th></th>
<th>Depressed Group (n = 36)</th>
<th>Healthy Comparison (n = 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laughter Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superimposed laughter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>absent</td>
<td>10.28 (7.07)</td>
<td>15.78 (10.18)</td>
</tr>
<tr>
<td>present</td>
<td>14.69 (12.71)</td>
<td>19.03 (12.62)</td>
</tr>
<tr>
<td>Laughter Duration (seconds)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superimposed laughter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>absent</td>
<td>14.61 (10.77)</td>
<td>23.64 (19.93)</td>
</tr>
<tr>
<td>present</td>
<td>25.81 (27.74)</td>
<td>29.67 (23.47)</td>
</tr>
<tr>
<td>Facial Expressivity Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superimposed laughter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>absent</td>
<td>15.28 (7.92)</td>
<td>17.78 (7.46)</td>
</tr>
<tr>
<td>present</td>
<td>16.75 (7.74)</td>
<td>18.72 (8.18)</td>
</tr>
<tr>
<td>Facial Expressivity Duration (seconds)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superimposed laughter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>absent</td>
<td>100.50 (57.54)</td>
<td>132.50 (70.50)</td>
</tr>
<tr>
<td>present</td>
<td>131.31 (84.39)</td>
<td>148.72 (77.71)</td>
</tr>
</tbody>
</table>

5.3.3.1 Laughter MANCOVAs

Aligned with hypotheses, the repeated-measures MANCOVA for total instances of laughter revealed a significant main effect of group (MDD versus healthy comparison) and a main effect of laughter presence (absent versus present). The main effect of the covariate (version order) was not significant, \(F(1,69) = .02, p = .878, \eta_p^2 = .01\); the interaction of the covariate (version order) and condition (laughter presence) was significant, \(F(1,69) = 15.99, p = .001, \eta_p^2 = .19\). Concerning specific hypotheses-based results, MDD participants produced fewer laughs overall \((M = 12.48, SD = 10.09)\) relative to the healthy comparison group \((M = 17.40, SD = 10.09)\), \(F(1,69) = 4.27, p = .043, \eta_p^2 = .06\). And all participants
produced more instances of laughter when there was superimposed laughter ($M = 16.86$, $SD = 12.64$) relative to when laughter was absent ($M = 13.03$, $SD = 8.59$), $F(1,69) = 5.92$, $p = .018$, $\eta^2 = .08$.

Inconsistent with hypotheses, the interaction was not significant, $F(1,69) = .41$, $p = .523$, $\eta^2 = .01$, suggesting that the difference in laughter produced in response to hearing superimposed laughter was not significantly different between groups. The pattern of results remained the same without the covariate in the model.² Group and condition differences did not remain significant when evaluated using a Bonferroni family-wise error rate ($p = .01$).

The second repeated-measures MANCOVA evaluated differences based on duration of produced laughter. Duration was measured in seconds. The main effect of the covariate (version order) was not significant, $F(1,69) = .30$, $p = .984$, $\eta^2 < .01$. The interaction of the covariate (version order) and condition (laughter presence) was significant, $F(1,69) = 17.37$, $p = < .001$, $\eta^2 = .20$. There was a significant main effect of laughter presence, such that all participants laughed for a longer period of time while viewing videos that had superimposed laughter ($M = 27.74$, $SD = 25.50$) relative to videos without superimposed laughter ($M = 19.13$, $SD = 15.49$), $F(1,69) = 6.89$, $p = .011$, $\eta^2 = .09$. However, inconsistent with hypotheses, neither the main effect of group nor the interaction were significant, $F(1,69) = 2.04$, $p = .158$, $\eta^2 = .03$ and $F(1,69) = 1.53$, $p = .221$, $\eta^2 = .02$, respectively. Thus, groups were not different in the duration of laughter produced (MDD: $M = 20.21$, $SD = 19.15$; healthy comparison: $M = 26.65$, $SD = 19.15$) and there were no systematic differences between groups in their responses to videos. The pattern of results remained the same without the covariate in the model.³ The main effect of laughter presence was not retained when evaluated using a Bonferroni family-wise error rate ($p = .01$).

---

² Laughter presence: $F(1,70) = 14.64$, $p = < .001$, $\eta^2 = .17$
Group: $F(1,70) = 4.33$, $p = .041$, $\eta^2 = .06$
Interaction: $F(1,70) = .34$, $p = .562$, $\eta^2 = < .01$

³ Laughter presence: $F(1,70) = 13.75$, $p = < .001$, $\eta^2 = .16$
Group: $F(1,70) = 2.07$, $p = .155$, $\eta^2 = .03$
Interaction: $F(1,70) = 1.24$, $p = .270$, $\eta^2 = .02$
5.3.3.1.1 Exploratory ANCOVAs in Type of Laughter Responses

Four exploratory ANCOVAs were performed to evaluate the potential differential contribution of instances and duration of unvoiced and voiced laughter to global differences uncovered by the aforementioned MANCOVAs. Version order was used as a covariate. Groups differed on the frequency of voiced laughs, $F(1,69) = 4.65$, $p = .035$, $\eta^2_p = .06$, such that individuals in the healthy comparison produced significantly more voiced laughter ($M = 13.19$, $SD = 14.90$) relative to depressed individuals ($M = 6.89$, $SD = 9.11$). The main effect of the covariate (version order) was not significant in this model, $F(1,69) = .34$, $p = .565$, $\eta^2_p = <.01$. A follow-up independent t-test revealed that this group difference in voiced laughter was significant when participants viewed videos without laughter superimposed, $t(49.71) = 2.34$, $p = .022$, and was significant at a trend level during videos with superimposed laughter, $t(70) = 1.82$, $p = .072$. Healthy comparison participants produced more voiced laughter both when they heard ($M = 7.86$, $SD = 9.05$) and did not hear ($M = 5.33$, $SD = 6.84$) superimposed laughter, compared to depressed individuals who were more inclined to produce voiced laughter when they heard superimposed laughter ($M = 4.50$, $SD = 6.34$ and $M = 2.39$, $SD = 3.21$, respectively). The group difference was maintained when tested in a model without the covariate. The significant group difference on the frequencies of voiced laughs was not retained when evaluated using a Bonferroni family-wise error rate ($p = .025$).

Groups did not significantly differ on duration of voiced laughter, $F(1,69) = 2.08$, $p = .084$, $\eta^2_p = .04$; the main effect of the covariate (version order) was also not significant, $F(1,69) = 1.19$, $p = .664$, $\eta^2_p = <.01$. Groups also did not differ on frequency of unvoiced laughter, $F(1,69) = 1.20$, $p = .278$, $\eta^2_p = .02$, nor did they differ on duration of unvoiced laughter and $F(1,69) = .20$, $p = .655$, $\eta^2_p <.01$. The main effects of the covariate (version order) was not significant in either of these models, $F(1,69) = .09$, $p =$

4 Frequency of voiced laughter: $F(1,70) = 4.69$, $p = .034$, $\eta^2_p = .06$
.768, $\eta^2_p = .01$ and $F(1,69) = .22, p = .645, \eta^2_p = .01$, respectively. The pattern of results remained the same without the covariate in the model.\(^5\)

5.3.3.2 Facial Expressivity MANCOVAs

A repeated-measures MANCOVA tested the differences within and between groups based on total frequency of positive facial expressions observed in response to videos with and without laughter superimposed, as coded according to the FACES coding system. The main effect of the covariate (version order) was not significant, $F(1,69) = <.01, p = .950, \eta^2_p = <.01$; the interaction of the covariate and condition (laughter presence) was also non-significant, $F(1,69) = <.04, p = .842, \eta^2_p = <.01$. Inconsistent with hypotheses, there was no main effect of group, $F(1,69) = 1.60, p = .211, \eta^2_p = .02$. There was also no significant main effect of laughter presence, $F(1,69) = .77, p = .384, \eta^2_p = .01$, nor was there an interaction, $F(1,69) = .22, p = .643, \eta^2_p = <.01$. Thus, the frequency of positive facial expressions were not different across groups (MDD: $M = 16.01, SD = 7.51$; healthy comparison: $M = 18.25, SD = 7.51$) and the rate of expressions did not change based on whether participants viewed videos with ($M = 17.74, SD = 8.03$) or without laughter superimposed ($M = 16.53, SD = 7.75$). The pattern of results was different without the covariate in the model, such that the main effect of laughter presence was significant whereas the main effect of group and the interaction remained non-significant.\(^6\)

A repeated-measures MANCOVA was also performed on the total duration of positive expressions observed in response to videos with and without laughter superimposed. Duration was measured in seconds. The main effect of the covariate (version order) was not significant, $F(1,69) = .38, p = <.542, \eta^2_p = <.01$; the interaction of the covariate and condition (laughter presence) was significant, $F(1,69) = 3.12, p = .082, \eta^2_p = .04$

Frequency of unvoiced laughter: $F(1,70) = 1.21, p = .275, \eta^2_p = .02$

Duration of unvoiced laughter: $F(1,70) = .20, p = .653, \eta^2_p = <.01$

\(^5\) Duration of voiced laughter: $F(1,70) = 4.62, p = .035, \eta^2_p = .06$

Group: $F(1,70) = 1.62, p = .208, \eta^2_p = .02$

Interaction: $F(1,70) = .22, p = .640, \eta^2_p = <.01$
The main effect of laughter presence was significant, $F(1,69) = 10.77, p = .002, \eta_p^2 = .14$, such that all participants demonstrated positive expressions for a longer duration of time when hearing superimposed laughter ($M = 140.01, SD = 80.09$) relative to when they did not hear laughter ($M = 116.50, SD = 64.56$). Further, the interaction was significant at a trend level, $F(1,69) = 3.54, p = .064, \eta_p^2 = .05$. Based on the group means also presented in Table 5.3, these findings suggest that individuals in the healthy comparison group expressed positive facial affect for a comparable period of time across both superimposed ($M = 148.72, SD = 77.71$) and non-superimposed videos ($M = 132.50, SD = 70.50$), whereas those in the MDD group demonstrated facial expressivity for a longer period of time in response to the superimposed laughter videos ($M = 131.31, SD = 84.39$) relative to the non-superimposed videos ($M = 100.50, SD = 57.54$). There was no main effect of group (MDD: $M = 115.90, SD = 70.86$; healthy comparison: $M = 140.61, SD = 70.86$), $F(1,69) = 2.19, p = .144, \eta_p^2 = .03$. The pattern of results remained the same without the covariate in the model. Results remained the same when evaluated using a Bonferroni family-wise error rate ($p = .01$).

### 5.3.4 Hierarchical Linear Regressions

Four hierarchical linear regressions were conducted to test the hypotheses that differences in frequency and duration of laughter and facial expressivity in response to watching videos with and without superimposed laughter would be predicted by social anhedonia and social anxiety among individuals in the MDD group. The four dependent variables were computed by subtracting the mirth expressed while there was no superimposed laughter on videos from the mirth expressed while there was laughter superimposed on videos (e.g., Total frequency of laughs while watching videos with superimposed laughter − Total frequency of laughs while watching videos without superimposed laughter). These analyses were only conducted in the MDD group. As version order was identified as a covariate in

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7 Laughter presence: $F(1,70) = 25.89, p < .001, \eta_p^2 = .27$
Group: $F(1,70) = 2.21, p = .142, \eta_p^2 = .03$
Interaction: $F(1,70) = 2.49, p = .119, \eta_p^2 = .03$
previous analyses, it was entered into the first block of all linear regressions. Regression coefficients are presented in Table 5.4.

5.3.4.1 Laughter Linear Regressions

The regression equation for total frequency of produced laughter was significant with version order in the first block $F(1,34) = 6.78, p = .014, R^2\Delta = .17$. The regression remained significant with social anhedonia in the second block, $F(1,33) = 3.93, p = .029, R^2\Delta = .03$, and was significant at a trend level with social anxiety in the second block, $F(1,32) = 2.90, p = .050, R^2\Delta = .02$. However, the beta coefficients for social anhedonia and social anxiety did not reach statistical significance, suggesting that the effect of version order was driving the significant differences across each model.

The regression equation for total duration of produced laughter was significant with version order in the first block $F(1,34) = 7.45, p = .010, R^2\Delta = .18$. The regression remained significant with social anhedonia in the second block, $F(1,33) = 3.80, p = .033, R^2\Delta = .01$, but was no longer significant with social anxiety in the second block, $F(1,32) = 2.49, p = .078, R^2\Delta <.01$. Importantly, the beta coefficients for social anhedonia and social anxiety did not reach statistical significance, suggesting that the effect of order was driving significant differences in the first two models.

5.3.4.2 Facial Expressivity Linear Regressions

The regression equation for total frequency of positive facial expressions was not significant with order in the first block $F(1,34) = .01, p = .936, R^2\Delta = <.001$. The regression remained non-significant with social anhedonia in the second block, $F(1,33) = .77, p = .470, R^2\Delta = .05$, and with social anxiety in the second block, $F(1,32) = .74, p = .535, R^2\Delta = .02$. None of the beta coefficients reached statistical significance.

The regression equation for total duration of positive facial expressions was significant with order in the first block $F(1,34) = 18.07, p <.001, R^2\Delta = .35$. The regression remained significant with social anhedonia in the second block, $F(1,33) = 8.82, p = .001, R^2\Delta <.01$, and was also still significant with social anxiety in the second block, $F(1,32) = 6.22, p = .002, R^2\Delta <.01$. However, the beta
coefficients for social anhedonia and social anxiety did not reach statistical significance, suggesting that the significant differences across each model were driven by version order differences.

| Table 5.4 Regression Coefficients for Laughter and Facial Expressivity in the MDD group |
|-------------------------------------|-----|-----|-----|-----|
| Frequency of Laughter |
| Model 1 | Version order | 5.77 | 2.22 | .41 | 2.60 | .014 |
| Model 2 | Version order | 6.05 | 2.23 | .43 | 2.71 | .011 |
| Social anhedonia | .131 | .13 | .16 | 1.03 | .310 |
| Model 3 | Version order | 6.15 | 2.24 | .43 | 2.75 | .010 |
| Social anhedonia | .18 | .14 | .23 | 1.32 | .197 |
| Social anxiety | -.08 | .08 | -.16 | -.94 | .355 |
| Duration of Laughter |
| Model 1 | Version order | 17.46 | 6.40 | .42 | 2.73 | .010 |
| Model 2 | Version order | 17.87 | 6.51 | .43 | 2.75 | .010 |
| Social anhedonia | .20 | .37 | .09 | .55 | .585 |
| Model 3 | Version order | 17.97 | 6.61 | .44 | 2.72 | .010 |
| Social anhedonia | .25 | .41 | .11 | .61 | .544 |
| Social anxiety | -.07 | .25 | -.05 | -.29 | .775 |
| Frequency of Positive Expressions |
| Model 1 | Version order | .11 | 1.35 | .01 | .08 | .936 |
| Model 2 | Version order | -.08 | 1.35 | -.01 | -.06 | .954 |
| Social anhedonia | -.10 | .08 | -.21 | -1.24 | .224 |
| Model 3 | Version order | -.02 | 1.36 | <.01 | -.02 | .988 |
| Social anhedonia | -.07 | .08 | -.15 | -.80 | .429 |
| Social anxiety | -.04 | .05 | -.16 | -.83 | .411 |
| Duration of Positive Expressions |
| Model 1 | Version order | 47.96 | 11.28 | .59 | 4.25 | <.001 |
| Model 2 | Version order | 48.28 | 11.51 | .60 | 4.24 | <.001 |
| Social anhedonia | .16 | .66 | .04 | .25 | .807 |
| Model 3 | Version order | 48.88 | 11.53 | .60 | 4.24 | <.001 |
| Social anhedonia | .45 | .72 | .09 | .63 | .536 |
| Social anxiety | -.43 | .43 | -.15 | -1.00 | .323 |

Note. Bolded p-values survived Bonferroni corrections (.05/4 = .013)
Note. The pattern of results remained the same without the covariate in the first block.

5.4 Discussion

The current study examined the differences in mirth-based emotional reactivity in response to humourous video clips among individuals with major depressive disorder relative to a healthy comparison group. The focus of this study was especially novel because participants were under the impression that others could hear their audible responses to videos and because participants heard superimposed voiced laughter (Laugh condition) during half of the video clips and no laughter during the other half (No Laugh condition).
condition; counter-balanced across version order). Socially relevant symptoms of social anhedonia and social anxiety were entered into predictive models to account for hypothesized differences in the MDD group in their responsivity to the \textit{Laugh} and \textit{No Laugh} videos. The findings of this study extend previous literature in that they (i) capture instances of laughter rather than only smiling and facial affective responsivity and (ii) do so in the context of humourous stimuli.

Aligned with hypotheses, and consistent with past research on the ECI theory of emotional responsivity in depression (Bylsma et al., 2008; Rottenberg & Hindash, 2015), depressed individuals produced significantly fewer instances of laughter compared to the healthy comparison group. Subsequent follow-up analyses demonstrated that this group difference was driven by more frequent instances of voiced laughter by individuals in the healthy comparison group. This pattern of responses coincides with studies demonstrating that depressed individuals produce fewer instances of affiliative behaviours in social situations (Girard et al., 2014; Kupferberg et al., 2016; Rehman et al., 2008; Segrin, 2000). Moreover, voiced laughter is considered a stronger signal of prosociality, where voiced, but not unvoiced, laughter elicits positive affect in the listener (Bachorowski & Owren, 2001; Ruch & Ekman, 2001). This relative under-production of voiced laughter may be a contributing factor to the finding that non-depressed individuals often have negative reactions to interacting with depressed persons, resulting in subsequent rejection (a phenomenon consistent with the interpersonal model of depression; Coyne, 1976b; for a review, see Hames et al., 2013). Specifically, individuals report interactions with depressed persons as being less enjoyable, accompanied by reports of diminished overall likeability, and reduced desire for future interactions (Sacco & Vaughan, 2006; Segrin & Abramson, 1994). Several studies have replicated these patterns of interpersonal rejection using confederates trained to demonstrate dysphoric behaviours such as reduced eye contact, monotonous speech, and sad facial expressions (e.g., Pineles, Mineka, & Nolan, 2004; Vaerum & McCabe, 2001). However, none has specifically manipulated the presence of laughter. Future research may address this current limitation in the literature to better
understand the specific role of the absence and presence of laughter in the context of other depressive symptomatology.

Interestingly, group differences in this study were not evident in frequency or duration of positive facial expressions (as measured by FACES; Kring & Sloan, 2007), nor were there group differences in the duration of laughter. Thus, depressed and non-depressed persons only differed in the number of instances of produced laughter (specifically, voiced laughter), but not how long they laughed or how often or for how long they produced positive facial expressions. The failure to detect group differences in facial affective mirth variables was in contrast to hypotheses and past research demonstrating a reduction in facial affect while when encountering amusing stimuli (Rottenberg et al., 2002) and blunted responsivity to other socially relevant stimuli (for a review, see Bylsma et al., 2008) among depressed individuals. However, given the constraints of the faux social environment in this study, whereby participants were under the impression that others could only hear them, not see them, it is perhaps not surprising that the differences between the MDD and healthy comparison groups did not reach statistical significance (though they are different in the anticipated direction). Demonstrations of prosocial behaviours such as smiling are effortful (Gailliot, 2009); moreover, smiling is often considered to be a behaviour that is for the benefit of viewers (Johnston, Miles, & Macrae, 2010). Thus, one possible explanation is that the lack of necessity to demonstrate visual signals of interest and engagement (e.g., smiling, brow and cheek activity) is the absence of an audience. Future research is needed to more comprehensively evaluate the degree to which specific mirthful behaviours differ among individuals with and without depressive disorders, and how these may differ across situations with and without others present.

Also in support of hypotheses were the findings of significant main effects of condition, such that there were more frequent and longer instances of laughter as well as a longer duration of facial expressions when all participants heard others laughing (Laugh condition) as compared to when they did not (No Laugh condition). Findings are consistent with reports suggesting that the social context in which one is exposed to affectively salient stimuli influences the nature of nonverbal behaviours (Lee &
Wagner, 2002; Martin, 2007). These data underscore the apparent contagious nature of laughter and positive affect, and coalesce with a host of extant literature demonstrating the potency of the contagion of laughter (for reviews, see: Gervais & Wilson, 2005; Provine, 2001). The findings also coincide with research demonstrating that hearing laughter elicits smiling and laughter in listeners (Provine, 1992) and with previous literature suggesting that superimposing laughter onto humourous videos provokes more mirthful behaviours in viewers (Neuendorf & Fennell, 1988; Provine, 1996). An important distinction in this study was that participants were told that the laughter was live, as perceptions of laughter as live versus canned have been shown to affect perceptions of humourous material (Lawson, Downing, & Cetola, 1998). To this end, the results presented here may better emulate what might happen in the real world because participants were told that the laughter they heard was from real people rather than a contrived laugh track. In the current study, there were no group differences in how many people believed the manipulation, nor did believability of the manipulation differentiate participants on any dependent variables. However, 29% of the total sample did not believe that the superimposed laughter was really produced by other live participants, and, while not statistically significantly so, there was a pattern of mirthful responses being lower among those who did not believe the manipulation. Thus, replication in future research is needed to better understand how perceptions of the genuineness of heard laughter might affect mirthful behaviours.

Inconsistent with hypotheses, the main effect of laughter presence did not translate to the frequency of facial expressions, only to the total duration of expressions. From a study design perspective, the data recording procedures employed in this study may offer one explanation. For instance, once a participant began smiling or laughing because they heard someone else laughing, there may not have been any ‘breaks’ in their facial affect. The FACES coding system is designed to capture instances of expressivity based on the presence of a neutral expression to denote the end of one expression and the start of the next. In the case where one begins to smile and then vacillates between smiling and laughing but not returning to a neutral expression, this response would drive up the total duration of seconds of
facial affect, but only be coded as one instance of facial expressivity. A design employing electromyography (EMG) may better capture the relative change in number of fluctuations over time; EMG is frequently used to measure changes in facial expressivity (Bylsma et al., 2008; Calvo & D’Mello, 2010) and has been shown to be a reliable indicator of changes specific to smiling (Larsen, Berntson, Poehlmann, Ito, & Cacioppo, 2008; Norman, Necka, & Berntson, 2016). Another extension of these results would be the inclusion of interaction partners that are stratified by pre-existing relationship status (e.g., strangers, friends, romantic partners). Previous research has shown that people are more likely to express smiling in the presence of a friend than a stranger (Devereux & Ginsburg, 2001; Wagner & Lee, 1999). As such, the generalizability of these results is limited in that they may only extend to strangers. Given the notable social difficulties evidenced across multiple interaction partners among individuals with depression (Fink & Shapiro, 2013; Hirschfeld et al., 2000), it is an important step to broaden our understanding of how mirth is expressed in response to humourous stimuli when exposure is with friend or romantic partner, rather than a stranger as was the case in this study.

Inconsistent with hypotheses, there were no significant interactions between group and condition on any of the mirth variables (though, the interaction for duration of facial expressivity was at a trend level). Thus, relative to one another, neither healthy comparisons nor depressed individuals demonstrated more or less mirth responsivity to videos based on whether or not the videos had superimposed laughter. It was expected that depressed persons would be more inclined to inhibit their responses when ‘others’ were not laughing (No Laugh), thereby demonstrating a greater difference in reactions relative to when they heard ‘others’ laughter (Laugh) while viewing the videos. This prediction was based on literature demonstrating that individuals with MDD are highly sensitive to rejection (Ehnvall et al., 2014) and social threat cues (Kasch et al., 2002), which results in efforts to avoid situations in which they may experience rejection (Leventhal, 2008). This is especially pronounced in the context of the often comorbid symptom of social anxiety (Fava et al., 2000; Kessler et al., 2003; Mallott et al., 2009; Voncken, Alden, Bögels, & Roelofs, 2008) wherein individuals often use impression-management strategies to present an
“artificial self” in order to fit in (Plasencia, Alden, & Taylor, 2011). Indeed, 39% of the current MDD sample met criteria for a diagnosable social anxiety disorder suggesting that a notable proportion of individuals would have been likely to experience significant social anxiety during the experimental paradigm. As one might expect, audience presence induces anxiety (Seta, Crisson, Seta, & Wang, 1989), but the notion of a concealed audience in this study may have diminished the effect of audience presence on anxiety. Another possible explanation is that depressed persons do generally experience similar gains in mirthful behaviour in response to hearing others laugh while watching humourous video clips. This interpretation is somewhat aligned with the non-significant group differences across frequency of facial expressions and duration of facial expressions and laughter. Despite the failure to support initial hypotheses, this is an exciting finding suggesting that depressed persons appear to have somewhat normative responses to humour stimuli under certain circumstances. Future research is needed to further replicate and explore these findings, especially as they may manifest in everyday life outside of the laboratory.

Not aligned with hypotheses, social anhedonia and social anxiety did not uniquely predict any variance in the difference in mirth produced by depressed individuals in the Laugh relative to No Laugh conditions. All models for frequency of laughter and duration and facial expressivity were significant, whereas only the models including version order and social anhedonia were significant for duration of laughter, and none of the models were significant for the frequency of facial expressivity. However, evaluation of the beta weights suggested neither set of symptoms were significant predictors of the models. Results are interpreted with caution because the role of version order was unanticipated. This same level of caution should be considered when interpreting the repeated measures MANCOVA results because the interaction of version order and laughter presence was significant in several of the models, though the pattern of results generally remained the same regardless of whether the analyses included version order as a covariate. As noted in the Method, two versions were created to counter balance the presence of superimposed laughter on video clips, such that the half of the videos that had superimposed
laughter in one version did not have superimposed laughter in the other version, and vice versa. The order of videos was fixed but the order of presence of laughter was pseudo random. There was no criterion set for how many Laugh and No Laugh videos would appear at the start of the paradigm. Thus, one possible explanation for the divergence in how participants responded to the videos may have been a function of one version order including three times as many Laugh videos in the first 10 videos than the other version order (i.e., 6 of the first 10 videos had laughter superimposed in one version, with 2 videos without laughter and 2 neutral videos; see Q). Future research is needed replicate the mirth responsivity of depressed and non-depressed individuals when exposed to humourous stimuli, with careful consideration of when superimposed laughter is heard to more specifically delineate the role of hearing other’s laughter.

5.4.1 Limitations and Future Directions

The findings of this study should be interpreted in the context of several limitations. First and foremost, as aforementioned, the role of version order is a major limitation that obfuscates interpretability of the regressions undertaken in this study. The unanticipated effect of the pseudo random counter-balancing procedures inadvertently highlights a potential confound surrounding the way in which stimuli with superimposed laughter are presented. Future studies are needed to more specifically examine how the apparent order effects detailed in this study may impact how individuals respond to viewing humourous videos. Another limitation concerns the limited generalizability of these findings. The data were collected in a lab in a manipulated social environment wherein individuals heard what they were told were a male and a female’s audible reactions to set of humourous video clips depicting several types of content (animals, children, incongruous, aggressive, news), and participants had already been exposed to a similar procedure (i.e., Chapter 4). As is noted in Chapter 4, it is an important future direction that data be collected outside of the laboratory, where momentary ecological assessments (e.g. Thompson et al., 2012) are becoming increasingly important to understand real-world behaviour that is not otherwise captured in a lab setting. Further, only 71% of the participants believed the faux social manipulation. Past research has demonstrated that people’s perceptions of humourous videos are affected by whether they believe the
superimposed laughter they are hearing is live or fake (Lawson et al., 1998), thus it stands to reason that belief in the manipulation may have changed the way individuals responded. Specifically, hypotheses surrounding likelihood of participants displaying more affiliative behaviour (i.e., more laughter) because of the social element of this study may not have applied to the 29% who did not perceive the situation as being social in nature. Indeed, Lieberman and colleagues (2009) found that superimposed laughter in the form of a laugh track can negatively affect humourousness ratings, suggesting that the 29% who thought the laughter was canned may have had very different responses to the videos than those who believed the paradigm was a shared experience. Another factor that may limit generalizability is the use of a male and a female’s laughter for the superimposed laughter. While a male and a female were chosen to counterbalance the presentation of gender so as to avoid possible perceptions of gender-based in-group/out-group biases (e.g., Rudman & Goodwin, 2004) and because presence of mixed gender canned laughter yields higher ratings on humour judgments (Furnham, Hutson, & McClelland, 2011), other literature suggests that social mimicry is different in mixed gender social interactions relative to same-gender social interactions (Hess & Bourgeois, 2010). Thus, future research may benefit from creation of gender-matched and mixed gender conditions to assess for differences in associated mirth based on gender of the participant’s dyadic partner. A final consideration is the variability of content displayed in the videos. Previous research suggests that the variability in how individuals respond to humourous stimuli is in large part due to individual differences in preferences for type of humour and how much they relate to the protagonist character in the stimuli (Lieberman et al., 2009; Martin, 2007; Moran, 1996). The videos selected were derived from a larger sample that underwent piloting through several means to determine the clips that incited the most laughter and were deemed funniest. Moreover, the inclusion of several types of content was aligned with past research (Gignac et al., 2014), and was meant to capture a series of events that would emulate real-world happenings to allow for several clips to which all participants could relate. Future research is needed to more clearly evaluate the types of humour that are
funny to individuals and consider ways in which stimuli from the category deemed funniest to a specific participant may be included in laboratory humour paradigms.

Despite these limitations, the current study contributes novel details to our understanding of how individuals with depression demonstrate mirth and respond to others laughter in the context of encountering humourous stimuli. Given the important role of humour and the experience of laughter in the promotion and maintenance of positivity and intimacy in social relationships (Kashdan et al., 2014), it is necessary that future research further examine how individuals engage in affiliation via mirth. To this end, it stands to reason that the engagement in mirth and exposure to opportunities for shared laughter in the context of behavioural activation therapy and humour therapy may be promising avenues for psychotherapeutic advances for individuals with depression.
Chapter 6

General Discussion

The research presented in this dissertation explored the use of humour styles and emotional responsivity to humourous stimuli through the use of self-reported psychopathology variables and humour styles (Chapters 2 & 3), and by comparing responses of depressed individuals to a healthy comparison group (Chapters 4 & 5). The first two studies (Chapters 2 & 3) were conducted online using Amazon Mechanical Turk (MTurk). One assessed the relations among symptom clusters of depression, social anxiety, and social anhedonia with adaptive and maladaptive humour styles (Chapter 2), while the second considered the contribution of approach- and avoidance-based motivational styles and facial expressivity of positive emotions in the prediction of humour usage (Chapter 3). These studies highlight the pernicious relationship between psychopathology and socially facilitative humour styles and adaptive behaviour, underscoring the importance of addressing mechanisms that contribute to social difficulties in depressive disorders. The second set of studies (Chapters 4 & 5) took place in a laboratory, and assessed differences between individuals with and without a major depressive disorder. Specifically, group comparisons evaluated subjective and behavioural (facial affect and laughter) responses to funny videos. These studies extended extant literature by measuring real-time and retrospective responses to humourous stimuli when viewing video clips in solitude (Chapter 4) and in a manipulated environment that simulated a social interaction in which participants heard others laughing during video clips (Chapter 5). The in-person, laboratory studies demonstrate the differential reactivity of depressed individuals relative to their non-depressed counterparts in response to humourous stimuli. In doing so, these data provide further evidence to suggest that the emotional experiences and subsequent expressions of emotion are dampened in the context of depressive illnesses. The major findings from these related chapters are summarized below, followed by a general discussion of major themes and clinical implications, and recommendations for future research.
6.1 Chapter 2

Chapter 2 sought to replicate previous literature examining the relations between depressive and social anxiety symptoms with four types of adaptive (affiliative, self-enhancing) and maladaptive (aggressive, self-defeating) humour styles. This study was also the first – to my knowledge – to evaluate the unique relation of social anhedonia to humour styles, and to consider the magnitude of the relations among these three symptom clusters among individuals in a current major depressive episode. Aligned with extant literature (Martin et al., 2003; Martin, 2007; Tucker, Judah, et al., 2013), these data revealed inverse relations of depressive and social anxiety symptoms with both types of adaptive humour styles, and a positive relationship with self-defeating humour. By comparison, social anhedonia was negatively associated with both adaptive humour styles, and minimally associated with both maladaptive humour styles. Social anhedonia’s relative lack of a significant relation with self-defeating humour represents a departure from the pattern of relations of depressive and social anxiety symptoms with self-defeating humour. Interestingly, the pattern of results across all psychopathology variables was somewhat, albeit non-significantly so, different when considered in the context of a current major depressive episode. This suggests that symptom clusters may have differential relations with social dysfunction depending on severity of current symptomatology. The results of this study contribute novel details to our understanding of the use of humour styles as they relate to depressive symptomatology, particularly in the course of an acute episode. Given the association between humour styles and critical aspects of quality of one’s social life, it is proposed that humour styles may be considered as a relevant treatment target.

6.2 Chapter 3

Chapter 3 extended the correlational research presented in Chapter 2 to more specifically evaluate the predictive power of approach/avoidance motivational systems and expression of positive emotions after accounting for psychopathology variables in modeling the use of different adaptive and maladaptive humour styles. This chapter also demonstrated the mediational roles of behavioural approach and positive expressivity in decoupling the inverse relation between depressive symptoms and affiliative humour.
Results revealed that social anhedonia, social anxiety, behavioural approach, and positive expressivity predicted affiliative humour, whereas the final model predicting self-enhancing humour included social anhedonia, depression, behavioural approach, behavioural avoidance, and positive expressivity, but not social anxiety. This pattern of results demonstrates the roles of variables that thwart social engagement (i.e., social anhedonia and social anxiety) and those that promote social connection (i.e., behavioural approach and positive expressivity) in predicting the use of humour to facilitate affiliation. Alternatively, the positive affect associated with behavioural approach and positive expressivity (Fredrickson, 1998; Gable et al., 2000; Keltner & Bonanno, 1997) underscores their roles in predicting one’s propensity to engage in adaptive emotion regulation skills to see the humourous side of negative events. Social anhedonia, behavioural approach, and positive expressivity predicted aggressive humour. Both social anhedonia and approach-based behaviours have been previously shown to be associated with aggression (Fanning et al., 2012; Ford et al., 2014); by comparison, expressions of positivity are not evident during hostile interactions (Prkachin & Silverman, 2002), suggesting that propensity to demonstrate positive affect may predict fewer instances of aggressive humour usage. Future research is needed to address the nature of this relationship to more concisely delineate the relation between trait positivity and aggressive behaviour relative to the effect of expressing positive facial affect during otherwise hostile interactions.

Surprisingly, only depressive symptom severity predicted self-defeating humour. Indeed, depression is associated with low self-esteem (Roberts & Monroe, 1994) and has repeatedly been shown to be strongly associated with self-defeating humour (for a review, see Martin, 2007). Given the pernicious nature of self-defeating humour in affecting social functioning, future research is warranted to better understand which variables predict the use of self-denigration as a means to connect with others. The mediation model in this study suggests that the deleterious effects of depressive symptoms on the use of affiliative humour may be lessened by the use of approach-based strategies and expression of positive facial affect. Accordingly, treatments in which the improvement of affiliative behaviours is a primary outcome variable may benefit from targeting these two domains.
6.3 Chapter 4

Chapter 4 examined the real-time and retrospective self-reported and observed behavioural responses to humourous videos by groups of clinically depressed and non-depressed healthy comparison persons. Ratings of enjoyment and funniness alongside observed positive facial expressions and laughter were positively correlated in both groups, suggesting consistency in responses across multiple modalities of internal and expressed experiences in response to videos. Compared to the healthy comparison group, depressed individuals reported less enjoyment and lower funniness ratings as well as demonstrating fewer instances and a shorter duration of positive expressions and laughter. These findings are aligned with past research demonstrating a relative blunting of positive emotional affect and behavioural expressivity of affect among depressed individuals (Bylsma et al., 2008; Rottenberg, Gross, & Gotlib, 2005). Moreover, this study extended this literature to include laughter as a measure of responsivity and assessed whether subjective responses were maintained at a follow-up time point 1 week later. Interestingly, group differences were maintained at the follow-up, but the magnitude of depreciation of enjoyment and funniness was not different across groups. Thus, the depressed group did not demonstrate the expected negative retrospective bias. Results of this study coincided with findings from the emotion literature, extending the theory of emotion context insensitivity (Rottenberg, 2005), and also showed that depressed individuals do not recall initially positive experiences as being more negative when retrospectively re-rating experiences of enjoyment and ratings of funniness. These findings contribute to our understanding of deficits in social functioning associated with depression. The dampening of affect across multiple modalities of positive experience and expressivity of positivity may perpetuate social rejection and difficulties such as limited closeness and intimacy experienced by depressed persons.

6.4 Chapter 5

The study described in Chapter 5 extended the research from Chapter 4 to examine mirth-based emotional reactions to humourous videos when depressed and non-depressed participants were exposed to others’ laughter during videos. Specifically, participants were told that two other people were watching videos at
the same time and that they would be able to hear one another. In reality, videos were counterbalanced with some videos with and others without superimposed genuine voiced laughter. The frequency and duration of participants’ facial affect and laughter was coded. The findings of this study extend previous literature in that they (i) capture instances of laughter rather than only smiling and facial affective responsivity and (ii) do so in the context of humourous stimuli. Taken together, relative to the healthy comparison group, depressed individuals produced fewer instances of laughter, specifically instances of voiced (rather than unvoiced) laughter. There were no group differences in intensity, frequency, or duration of facial affectivity or duration of produced laughter. However, as expected, all participants demonstrated more frequent and longer instances of laughter as well as a longer duration of facial expressions when they heard others laughing relative to when they did not hear laughter. There was no evidence of statistically significant interactions, such that neither the healthy comparisons nor depressed individuals demonstrated more or less mirth responsivity to videos based on whether or not the videos had superimposed laughter. Neither social anhedonia nor social anxiety predicted the difference in mirth demonstrated by the depressed group during instances when they heard and did not hear superimposed laughter. Taken together, findings support extant literature demonstrating that laughter is contagious in that it induces mirth in others (Gervais & Wilson, 2005; Provine, 1992, 1996, 2001). Further, depressed persons demonstrated fewer instances of prosocial behaviour in the form of frequency of voiced laughter, also consistent with previous research findings of reduced prosocial behaviour among individuals with depression (Girard et al., 2014; Kupferberg et al., 2016; Rehman et al., 2008). Interestingly, results only partially supported the emotional context insensitivity theory (Rottenberg, 2005), as group differences were only evident in duration of laughter. It may be the case that responsivity to humourous stimuli is somewhat intact when encountered in a social situation. Future research is needed to replicate and expand upon these tentative conclusions, especially by studying mirth in real-world situations with dyadic partners of different statuses (e.g., friend, romantic partner). This will allow for a better understanding of how and when mirth is displayed and the way it contributes to social functioning in depressed persons.
6.5 Major Themes, Clinical Implications, and Future Directions

In summary, the current research program demonstrates that depressive symptoms have complex interactions with the use and enjoyment of, and responsivity to humour. Most notable are the findings that highlight:

i) The pattern and differential magnitude of relations among depressive symptoms, social anxiety, social anhedonia, and approach/avoidance motivational systems with facets of adaptive and maladaptive humour

ii) An extension of previous emotion literature to include mirthful behaviour captured along subjective and observed facial affect and laughter demonstrating dampening of affective responsivity in individuals with major depressive disorder

iii) The apparent lack of depressed and non-depressed group differences in mirth responsivity when in a social setting, suggesting an important role of context in how depressed individuals respond to and demonstrate mirth

All symptoms are not held equal in their association with humour styles, wherein the findings uncovered by this research project suggest that social anhedonia appears to be most negatively associated with the use affiliative humour. Moreover, compared to depressive symptoms, both social anxiety and social anhedonia are more strongly inversely related to the underuse of adaptive humour strategies. These patterns are consistent with other reductions in adaptive behavioural manifestations of social anhedonia and social anxiety. Specifically, socially anhedonic individuals have a strong preference to be alone, intentionally withdrawing from forms of social support (Kwapil, 1998), and creating distance from social contacts (Brown et al., 2007). Alternatively, socially anxious individuals often fail to employ effective emotion regulation skills, which contributes to the overuse of maladaptive safety behaviours, such as poor reciprocity of smiling, fidgeting, and reassurance seeking (Heerey & Kring, 2007). Indeed, the relation between social anxiety and both maladaptive behaviours and experiential affective responsivity hold even
after considering the role of depressive symptoms (Kashdan, 2007; Mennin, Heimberg, Turk, & Fresco, 2005), suggesting that social anxiety alone uniquely contributes to social dysfunction. Thus, the propensity to use maladaptive humour and reduced likelihood of using adaptive humour coincides with the pattern of prosocial behaviours expected by individuals with diminished approach and high avoidance drives. This is further supported by data demonstrating that BIS and BAS follow opposite patterns in their relation to all four humour styles, with the most notable association being the strong positive relation of BAS, and strong negative relation of BIS, with adaptive humour styles. As such, it may be the case that the fear of rejection and outright avoidance behaviours evident in these symptom clusters are particularly important treatment targets when goals of psychotherapy are related to gains in social functioning.

However, future research is needed to clearly delineate which specific symptoms in these clusters that are most strongly associated with propensity to engage in maladaptive behaviours. This is especially relevant to understanding a possible predictive relationship between symptoms and behaviours, or what may be a vicious cycle of symptoms and behaviours perpetuating one another. Previous research suggests that negative social experiences promote feelings of loneliness, thereby perpetuating depressive symptomatology (Beekman et al., 1995). Although the current studies did not examine truly predictive relations in the context of a longitudinal design, these findings underscore the importance of considering a possible transactional relationship between approach-based motivation and adaptive behaviours. Indeed, BAS and the prosocial behaviour of positive expressivity fully mediate the negative relation between depressive symptoms and affiliative humour. This suggests that the presence of depressive features does not necessarily override the possibility that an individual may joke around with friends or purposely try to make others laugh; rather, the concurrent presence of positive facial affect and reward seeking behaviours may offset the impact of depressive symptoms on affiliative humour. To this end, it is important to continue investigating the impact of protective factors that foster resiliency in the face of depression and identify the factors that most negatively affect social functioning.
Interestingly, though consistent with conceptions of acute psychopathology, the pattern of humour use as related to symptoms of depression, anxiety, and anhedonia are different when considered in the context of a major depressive episode. Indeed, acutely depressed individuals were less likely to employ either adaptive or maladaptive humour strategies, suggesting a general pattern of reduced humour usage. An important consideration for future studies is the way in which humour is measured and its subsequent assumed direct relationship with social functioning. The HSQ is, to date, the most comprehensive measure of humour style (Martin et al., 2003), wherein humour style is defined as the way in which individuals use humour in everyday settings, typically for the purposes of connecting with others (Martin, 2007). As with all self-report measures, the HSQ falls short in that it cannot capture true usage of humour in social situations, rather a self-reported propensity to act in a certain way, and it does not explicitly consider one’s reasons for using one humour style over another. The sum of these studies emphasize the need for psychotherapy and future research to focus on how to promote and maintain approach-based behaviours that set the occasion for social interactions ripe with opportunities to incite connectivity and intimacy via humour and mirth. Of particular importance will be the continued evaluation of the specific depressive symptoms that may affect use of humour, with a specific focus on when and under which circumstances which depressed individuals would be more or less likely to use humour in social relationships.

In order to better support depressed individuals in achieving socially relevant goals, it is critical to understand the circumstances under which prosocial and affiliative behaviours manifest and how these compare to non-depressed individuals. Compared to a healthy comparison group, results from these studies demonstrate that depressed individuals experience and express dampened enjoyment and mirth (facial affect and laughter) in response to humourous videos. This trend did not extend to the intensity of facial expressivity; thus, groups were only significantly different on the subjective variables and the frequency and duration of facial expressions and laughter, but not the magnitude of facial affect. Interestingly, there was no evidence of a negative retrospective bias in the depressed group. This may
have important ramifications for treatment providers. Specifically, even though depressed individuals are inclined to experience reduced positive affect in response to typically rewarding stimuli, memories of positive emotional responses to humour do not appear to either intensify or degrade over time.

Concerning positive responsivity to humourous stimuli, presence of a negative retrospective bias may facilitate recollection of negative information (e.g., Mathews & MacLeod, 2005) but not necessarily affect the recollection of positive events when specifically probed about experiential details. However, it is important to note that the follow-up interval in this study was only one week, and recall of affectively valenced memories has been shown to be different over various temporal intervals (e.g., Walker, Vogl, & Thompson, 1997). As such, future research should further examine this finding to consider whether and how memories related to humourous events change over time. Overall, these findings are aligned with literature detailing flattened affective reactivity in depressed persons (e.g., Rottenberg & Hindash, 2015), but also include the novel variables of frequency and duration of laughter. This is especially relevant given the documented social bonding properties of laughter (Kashdan et al., 2014), whereby the absence of laughter, and its associated properties of bonding, may contribute to depressed persons reported experiences of reduced closeness and intimacy in social relationships (Nezlek et al., 2000). One critical aspect in need of future research is that of the specific mechanisms that cause reductions in affectivity among individuals with depression. To this end, there are several possible variables, some of which include effort and decision-making, memory, and social cognition. Despite being innate behaviours (Provine, 2001), smiling and laughter are effortful (Gailliot, 2009). Depressed individuals often report marked fatigue (American Psychiatric Association, 2013) and tend to not only avoid expending effort in the pursuit of rewards, but also struggle to appropriately use information about the magnitude and probability of achieving a given reward to guide decisions about their behaviour (Treadway, Bossaller, Shelton, & Zald, 2012). This notion is further bolstered by a strong literature repeatedly demonstrating that individuals with depression have cognitive impairments in executive functioning (i.e., problem solving; for a review, see: Snyder, 2013). As such, depressed persons may not have the necessary physical
stamina or decisional abilities to appropriately modulate their behaviours in order to demonstrate positive affect in social situations. Furthermore, the presence of deficits in memory (Bora, Harrison, Yücel, & Pantelis, 2013; Rose & Ebmeier, 2006) and social cognition (e.g., theory of mind; for a review, see Cusi et al., 2012) may introduce difficulties for how quickly depressed persons are able to process humourous stimuli. For instance, the incongruity theory of humour (“nonserious social incongruity”; Gervais & Wilson, 2005) posits that we find humourous stimuli humourous because of a perceived inconsistency between our expectations and the ‘reality’ in the context of the joke. In essence, our expectations are violated in a way that is non-threatening (as opposed to a violation to our expectations that poses a threat to us, such as encountering a shark in a swimming pool) and it is this juxtaposition – that is often surprising – that prompts humour and mirth. Incongruences may be related to violations of grammar or word play (as in Bob telling the Gym Instructor that he’s not free on Tuesdays to be taught the splits), violations of grace or taste (e.g., slapstick, jokes about sex), or violations of expected turn of events (e.g., child misses the piñata with the bat and instead hits a bystander), and so on. The first stage of humour processing is noticing the incongruity. However, should the incongruity be missed or overlooked because of impaired cognitive skills (e.g., memory, attention, theory of mind), it is no longer funny that someone tells the gym instructor they aren’t able to attend training sessions on a Tuesday, rather just confusion at what may seem like an illogical tangent in context. Thus, failure to experience enjoyment and demonstrate mirth may occur for several reasons, thereby underscoring the need to examine individual difference variables that contribute to the failure to experience a typical response to humourous stimuli.

In the context of a faux social environment, depressed persons demonstrated reduced duration of laughter relative to the healthy comparison group; this difference was especially pronounced in the production of voiced (over unvoiced) laughter. Voiced laughter is a poignant affiliative prosocial tool used to connect with others (Bachorowski & Owren, 2001). As such, these findings coalesce with established literature in which depressed persons demonstrate fewer instances of affiliative behaviour (Girard et al., 2014; Kupferberg et al., 2016; Rehman et al., 2008; Segrin, 2000). However, there were no
group differences in frequency of laughter or frequency and duration of positive facial expressions. One exciting interpretation of these data is that depressed individuals experience similar gains in mirthful behaviour, relative to non-depressed individuals, when exposed to social situations in which others are laughing. The studies presented here did not specifically examine changes in mood or depressive symptoms before and after exposure to humourous stimuli, but future research may consider whether the experience of shared laughter directly affects depressive symptoms. This would greatly support the need for further examination of the efficacy of humour and laughter therapy (e.g., Brodaty et al., 2014; Ko & Youn, 2011; Quintero et al., 2015) as potentially viable adjunctive treatments for individuals with depression. The inherent assumption of the efficacy of these types of humour treatments is the transactional and likely cyclical nature of the way in which behaviour, experiences, and symptoms interact with one another. Compared to non-depressed individuals, depressed persons report more frequent instances of negative interactions (Benazon, 2000; Hale III, Jansen, Bouhuys, Jenner, & van den Hoofdakker, 1997; Kennedy et al., 2007; Segrin, 2000), which promote maintenance of depressive symptoms (Beekman et al., 1995), and non-depressed persons often have negative reactions to depressed persons (Hames et al., 2013). These findings suggest that targeting humour related aspects of functioning may be an important step in offsetting the interpersonal deficits evident among depressed individuals – a way to incite positivity into an otherwise self-perpetuating negative cycle.

Some important considerations concerning general sense of humour and mirthful responsivity are those that may affect all participants, depressed or otherwise, such as gender, age, and culture. Gender, for instance, has been shown to differentiate individuals on use of specific humour styles, whereby men are more likely than women to use aggressive humour (Dyck & Holtzman, 2013) and make more attempts at making others laugh (Martin & Sullivan, 2013; Myers, Ropog, & Rodgers, 1997). Both men and women appear less likely to employ affiliative and aggressive humour as they age (Martin, 2007), suggesting a propensity to use less extraverted styles of humour across one’s lifespan. Moreover, despite the universality of expressions of mirth (e.g., smiling, laughing), one’s culture may shape the way in which
humour is used and expressed. For instance, compared to Western cultures, individuals from Eastern cultures tend to be more conservative in the type of content used in jokes (e.g., significantly fewer sexual jokes) and are less inclined to use self-enhancing humour (i.e., use humour as a coping strategy; Nevo, Nevo, & Yin, 2001). Interestingly, regardless of cultural background, women tend to smile more often than men (LaFrance, Hecht, & Paluck, 2003). Taken together, while there were no differences between groups on the global descriptive variables of age, gender, and culture, the limited scope of analyses considering the role of these variables may limit the generalizability of the findings. This highlights the need for additional research that considers the potential role of gender, age, and culture to better understand how, when, and by whom humour is used and mirth is expressed.

In closing, the series of studies subsumed in this research project demonstrates that the relations among humour use, mirth, and depressive symptomatology are nuanced. The way in which individuals use humour is a function of a number of variables including, but not limited to, severity of current symptoms and motivational drives that govern likelihood of approaching rewarding activities, such as socializing with others. Moreover, while the subjective and observed responsivity of depressed persons may be dampened when encountering humourous stimuli, it is not absent, and appears to manifest in similar magnitude to non-depressed persons when the stimuli are encountered in the presence of mirthful individuals. These findings underscore the importance of treatment providers considering humour as an avenue to create opportunities with their clients to promote social connectedness and incite change in social relationships. Laughter may not be the best medicine, but a dose – in the context of empirically based protocols – may go a long way. Whether laughter is best infused – if at all – into rapport building, behavioural experiments, the restructuring of schemas, or any other facet of psychotherapy is largely unknown. As such, future research is needed to specifically evaluate how and when humour may be built into established therapy modalities.
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depression: Evidence from manual and automatic facial expression analysis. In *Automatic Face and Gesture Recognition (FG), 2013 10th IEEE International Conference and Workshops on* (pp. 1–8). IEEE.


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Journal of Biological Psychiatry, 10(4-3), 925–928.


Current Directions in Psychological Science, 22(6), 455–460.


*Psychology, 121*(3), 553–558.


Appendix A

Advertisement for MTurk Recruitment

Answer a psychological survey: “Relations Among Humour Style, Depressive Severity, Social Anhedonia, Social Anxiety, and Mirth”

We are looking for individuals between the ages of 18-60, who have normal or corrected vision, and are proficient in the English language, to complete a psychological survey. The survey is about how individuals use and appreciate humour (i.e., mirth), with a focus on the specific role of different humour styles and mirth related to depressive symptoms.

The study will take approximately 45 minutes to complete. Participants will be awarded $3 for completion of all questionnaires in this survey. Please read all questions carefully. At the end of the survey, you will receive a code to paste into the box below to receive credit for taking our survey.

Please make sure that you have not already completed this survey, as duplicate responses will not be paid. If you are unsure if you have taken this survey before, the survey link contains duplicate screening. If your worker ID is found, you will simply be asked to return the HIT.

This study has been approved by the Queen’s University (Kingston, Ontario, Canada) Health Sciences Research Ethics Board.
Appendix B

MTurk REB Approval Letter

QUEEN'S UNIVERSITY HEALTH SCIENCES & AFFILIATED TEACHING HOSPITALS RESEARCH ETHICS BOARD-DELEGATED REVIEW
February 04, 2015

Ms. Katherine Holshausen
Department of Psychology
Queen’s University

Dear Ms. Holshausen

Study Title: PSYC-155-15 Relations Among Humor Style, Depression Severity, Social Anhedonia, Social Anxiety, and Mirth
File # 6014555
Co-Investigators: Dr. C. Bowie

I am writing to acknowledge receipt of your recent ethics submission. We have examined the protocol (December 2014), updated recruitment advertisement, Situational Humor Response questionnaire, Marlowe-Crowne Social Desirability Scale, Emotion Regulation questionnaire, The Affective Style questionnaire, Berkeley Expressivity questionnaire, BIS/BAS, Center for Epidemiologic Studies Depression Scale – Revised, Social Interaction Anxiety Scale, Revised Social Anhedonia Scale, Chapman Infrequency Scale, Humor Styles questionnaire, Revised Demographic questionnaire, updated debriefing form and revised information/consent form for your project (as stated above) and consider it to be ethically acceptable. This approval is valid for one year from the date of the Chair's signature below. This approval will be reported to the Research Ethics Board. Please attend carefully to the following listing of ethics requirements you must fulfill over the course of your study:

Reporting of Amendments: If there are any changes to your study (e.g. consent, protocol, study procedures, etc.), you must submit an amendment to the Research Ethics Board for approval. Please use event form: HSREB Multi-Use Amendment/Full Board Renewal Form associated with your post review file # 6014555 in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

Reporting of Serious Adverse Events: Any unexpected serious adverse event occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other serious adverse events must be reported within 15 days after becoming aware of the information. Serious Adverse Event forms are located with your post-review file 6014555 in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

Reporting of Complaints: Any complaints made by participants or persons acting on behalf of participants must be reported to the Research Ethics Board within 7 days of becoming aware of the complaint. Note: All documents supplied to participants must have the contact information for the Research Ethics Board.

Annual Renewal: Prior to the expiration of your approval (which is one year from the date of the Chair’s signature below), you will be reminded to submit your renewal form along with any new changes or amendments you wish to make to your study. If there have been no major changes to your protocol, your approval may be renewed for another year.

Yours sincerely,

[Signature]
Chair, Health Sciences Research Ethics Board
February 04, 2015

Investigators please note that if your trial is registered by the sponsor, you must take responsibility to ensure that the registration information is accurate and complete
Appendix C

MTurk Letter of Information and Consent

Letter of Information "Relations Among Humor Style, Depressive Severity, Social Anhedonia, Social Anxiety, and Mirth"

Thank you for your interest in this study. Please read the letter of information below, and indicate whether you would like to participate in this study.

PRIMARY INVESTIGATORS: Katherine Holshausen, MSc, Queen's University; Dr. Christopher Bowie, PhD, Queen's University (Kingston, Ontario, Canada)

BACKGROUND INFORMATION:
You are being invited to participate in a research study directed by Katherine Holshausen, MSc, under the supervision of Dr. Christopher Bowie. The purpose of this study is to understand the relations among humor style, humor appreciation, and depressive symptoms. This study is being conducted with funds provided to Dr. Bowie by Queen's University. This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen's policies.

DETAILS OF THE STUDY:

1. The aim of the study: The purpose of this study is to better understand how individuals use and appreciate humor (i.e., mirth), with a focus on the specific role of different humor styles and mirth related to depressive symptoms.

2. Description of study procedures: If you consent to participate in this study, you will be asked a series of questions about yourself, including general demographics, symptoms of depression and anxiety, use of humor, and mirthful behaviours. This survey can only be completed online. The survey will take approximately 45 minutes of your time. The estimated sample size for this study is 400 participants.

3. Risks: Some people experience psychological or emotional distress from answering questions about personal or sensitive issues. If you experience distress at any time, you can skip a question or stop the survey. If you decide that you do not want to complete the survey, you can stop at any time without penalty.

4. Benefits: Participation in this study will contribute to research on the use of humor as it relates to symptoms of depression.

5. Inclusions: You can participate in this study if you (1) are between the ages of 18 and 60, (2) have normal or corrected vision (i.e., if you wear corrective lenses; please wear them while completing the survey), and (3) are fluent in English.

6. Confidentiality: Information obtained in this study is stored by a survey management company called Fluid Surveys™ (owned by US-based Survey Monkey™) and Amazon retains identifying information about you. Consequently, USA authorities under provisions of the PATRIOT Act may access this survey data. However, your data will be regarded as strictly confidential and your anonymity will be protected at all times concerning the storage and usage of your responses in our lab at Queen’s University. Any personal identifying information (e.g., date of birth) will NOT be linked to your survey responses. At Queen’s University, only Dr. Christopher Bowie’s research staff will have access to your data. The data...
may also be published in professional journals or presented at scientific conferences, but any such presentations will be of general findings and will not breach individual confidentiality. Should you be interested, you are entitled to a copy of the findings. The data will only be used for this project and will be destroyed after 10 years.

7. Voluntary nature of study/Freedom to withdraw or participate: Your participation in this study is voluntary. You may withdraw from this study at any time without penalty. Although it be would be greatly appreciated if you would answer all material as frankly as possible, you should not feel obliged to answer any material that you find objectionable or that makes you feel uncomfortable. If you skip any questions, you can still submit your survey responses and we will only analyze data from questions that have been answered. If you decide to withdraw from the study and do not want to submit your survey responses you may do so without penalty. If you do not submit your responses we will not have access to them and therefore your data will not be used.

8. Compensation: You will be paid $3 for completion of this survey via Amazon Mechanical Turk.

SUBJECT STATEMENT AND SIGNATURE SECTION:
I have read and understand the consent form for this study. I have had the purposes of this study explained to me. I have been given sufficient time to consider the above information and to seek advice if I chose to do so. I am voluntarily signing this form. I will receive a copy of this form for my information.

If at any time I have further questions, problems, or adverse events, I can contact:
Primary Investigator: Katherine Holshausen at k.holshausen@queensu.ca or 613-533-6000 ext. 78478, or
Supervisor: Dr. Christopher Bowie at bowiec@queensu.ca or 613-533-3347

If you have any concerns about your rights as a research participant please contact - Dr. Albert Clark, Chair of the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board at (613)-533-6081 or clarkaf@queensu.ca.

Thank you. Your interest in participating in this research study is greatly appreciated.

By selecting "yes" below, I am indicating that I agree to participate in this study.

I agree to participate in this study:
☐ Yes
☐ No
Appendix D
MTurk Debriefing Form

Debriefing Form
“Relations Among Humor Style, Depressive Severity, Social Anhedonia, Social Anxiety, and Mirth”

Primary Investigator:
Katherine Holshausen, MSc
Department of Psychology
Queen’s University
Kingston, Ontario, Canada
(613) 533-6000 x78478
E-mail: k.holshausen@queensu.ca

Supervisor:
Christopher Bowie, PhD
Department of Psychology
Queen’s University
Kingston, Ontario, Canada
(613) 533-6000 x78478
Email: cpdlab@queensu.ca

Major depressive disorder (MDD) has been identified as the leading cause of disability worldwide, impacting several functional domains, including social functioning. While there is substantial evidence evaluating the factors that contribute to social dysfunction and the relative role of depression-related symptoms of social anhedonia and social anxiety, we know little about the specific social behaviours that are impaired among individuals with MDD. One promising avenue is that of humor. Humor is a relatively ubiquitous social phenomenon that facilitates social interactions by bringing people closer together and is associated with feelings of reward and enjoyment. The purpose of this study is to elucidate how individuals with depression use humor (i.e., humor style) and demonstrate humor appreciation (i.e., mirth), and the differential relations of two common but independent symptoms of depression: social anxiety and social anhedonia with mirth. This study will use an online survey study to gather data on the relations among self-reported humor appreciation (mirth), social anxiety and social anhedonia, and impression management. The online survey will be accessible to individuals online, where depressive symptoms will be measured as a continuous variable. The results of this study have potential implications for our understanding of factors related to social dysfunction in depression, and could inform relevant treatment targets for individual- and group-based interventions.

As stated earlier, your responses in the study will be confidential. Your responses will be assigned a code number, and only people who are associated with this research will see your responses.

If you are interested in learning more about mental illness, anxiety, and depression, please visit one of the following websites:

National Alliance on Mental Illness (NAMI): http://www.nami.org/Template.cfm?Section=By_Illness
National Institute of Mental Health:

Mental Health America:
http://www.mentalhealthamerica.net/

Should you wish to speak with someone about any distress that you experience related to mental illness, please contact one of the following helplines:

**Help Finding a Therapist:** 1-800-THERAPIST (1-800-843-7274)
**National Alliance on Mental Illness (NAMI):** 1-800-950-NAMI (6264)
**Suicide Prevention Lifeline:** 1-800-273-TALK
**Suicide & Crisis Hotline:** 1-800-999-9999

Your participation in this study is greatly appreciated. If you’d be interested in obtaining a copy of the results once the study is complete, you may contact any of the researchers: Katherine Holshausen: k.holshausen@queensu.ca or Dr. Christopher Bowie: bowiec@queensu.ca. If you have a more general interest in this area of research, you may also wish to consult the following references:


This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen's policies.

If you have any complaints, concerns, or questions about this research, please feel free to contact Dr. Christopher Bowie at bowiec@queensu.ca.

If you have any concerns about your rights as a research participant please contact - Dr. Albert Clark, Chair of the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board at (613)-533-6081 or clarkaf@queensu.ca.

Thank you very much for your participation!
## Appendix E

### Differences Between Included Versus Excluded MTurk Participants

<table>
<thead>
<tr>
<th></th>
<th>Included</th>
<th>Excluded</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( n = 368 )</td>
<td>( n = 51 )</td>
<td></td>
</tr>
<tr>
<td>Age ( M ) (( SD ))</td>
<td>34.99 (9.83)</td>
<td>32.37 (8.65)</td>
<td>.103</td>
</tr>
<tr>
<td>Sex ( n ) (%)</td>
<td></td>
<td></td>
<td>.203</td>
</tr>
<tr>
<td>Female</td>
<td>180 (48.91)</td>
<td>14 (27.45)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>186 (50.54)</td>
<td>26 (50.98)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2 (.54)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ethnicity ( n ) (%)</td>
<td></td>
<td></td>
<td>.002</td>
</tr>
<tr>
<td>Caucasian</td>
<td>281 (76.36)</td>
<td>25 (49.02)</td>
<td></td>
</tr>
<tr>
<td>Latino/Hispanic</td>
<td>21 (5.71)</td>
<td>7 (13.73)</td>
<td></td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>2 (.54)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>African</td>
<td>25 (6.79)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Caribbean</td>
<td>3 (.82)</td>
<td>2 (3.92)</td>
<td></td>
</tr>
<tr>
<td>South Asia</td>
<td>5 (1.4)</td>
<td>3 (5.88)</td>
<td></td>
</tr>
<tr>
<td>East Asia</td>
<td>13 (3.5)</td>
<td>2 (3.92)</td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td>12 (3.3)</td>
<td>1 (1.96)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3 (.82)</td>
<td>1 (1.96)</td>
<td></td>
</tr>
<tr>
<td>Education ( n ) (%)</td>
<td></td>
<td></td>
<td>.280</td>
</tr>
<tr>
<td>Some high school</td>
<td>1 (.03)</td>
<td>1 (1.96)</td>
<td></td>
</tr>
<tr>
<td>High school diploma/GED</td>
<td>42 (11.41)</td>
<td>5 (9.80)</td>
<td></td>
</tr>
<tr>
<td>Some college/university</td>
<td>124 (33.70)</td>
<td>15 (29.41)</td>
<td></td>
</tr>
<tr>
<td>College diploma</td>
<td>88 (23.91)</td>
<td>5 (9.80)</td>
<td></td>
</tr>
<tr>
<td>University degree</td>
<td>76 (20.65)</td>
<td>9 (17.64)</td>
<td></td>
</tr>
<tr>
<td>Post graduate degree</td>
<td>35 (9.51)</td>
<td>3 (5.88)</td>
<td></td>
</tr>
<tr>
<td>Marital Status ( n ) (%)</td>
<td></td>
<td></td>
<td>.768</td>
</tr>
<tr>
<td>Single</td>
<td>147 (39.95)</td>
<td>13 (25.49)</td>
<td></td>
</tr>
<tr>
<td>Single, but in a relationship</td>
<td>69 (17.88)</td>
<td>8 (15.69)</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>123 (33.42)</td>
<td>17 (33.33)</td>
<td></td>
</tr>
<tr>
<td>Separated/divorced</td>
<td>24 (6.52)</td>
<td>3 (5.88)</td>
<td></td>
</tr>
<tr>
<td>Widowed</td>
<td>4 (1.09)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Values may not add up to 100% due to missing data.
Appendix F
Advertisements for In-Lab Study

Kijiji Advertisement

Title:
Participants needed for paid research study on watching and rating videos

Body of the advertisement:
We are recruiting individuals between the ages of 18 and 60 for a paid ($45) study. The study is described below:

The goal of this study is to better understand how individuals use and appreciate humor, and the relation between people’s reported and behavioural responses to humorous videos. Participation in the study involves two visits to our lab, for a total of 2 hour and 45 minutes. The first visit is 2 hours, and the second visit is 45 minutes.

During this time you will answer a series of questions about (1) how you have been feeling, (2) your everyday behaviours, and (3) your thinking. You will also watch video clips (during which time you will be audio and video recorded), and we will place recording sensors on two fingertips on one hand and on your sides to measure your heart rate and perspiration.

Participants will be paid $45 for their time.

This study has been approved through the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board.

If you are interested in or have questions about the study, please call at 613-533-6000 ext. 78478 or email cpdlab@queensu.ca

Principal Investigators:
Katherine Holshausen, MSc, and Christopher R. Bowie, PhD,
Departments of Psychology and Psychiatry,
Queen’s University
OPPORTUNITY TO PARTICIPATE IN RESEARCH!

Are you feeling sad, down, or depressed?

You are invited to take part in a study being conducted at Queen’s University to help us understand how people use and appreciate humour in their everyday lives.

Study Procedures:

- Answer some questions about how you have been feeling
- Questionnaires regarding your everyday behaviours and thinking
- Watch video clips, during which time you will be audio and video recorded

COMPENSATION OF $45 WILL BE PROVIDED FOR PARTICIPATION

If you are interested in participating, please contact:

Katherine Holshausen at
1(877) 669 – 8510 ext.104 or at 9kh34@queensu.ca

This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen’s policies.
Appendix G

In Lab REB Approval Letter

QUEEN'S UNIVERSITY HEALTH SCIENCES & AFFILIATED TEACHING HOSPITALS RESEARCH ETHICS BOARD-DELEGATED REVIEW
February 09, 2015

Ms. Katherine Holshausen
Department of Psychology
Queen's University

Dear Ms. Holshausen

Study Title: PSYC-156-15 Subjective and Objective Responses to Humorous Stimuli and Retrospective Enjoyment of Humor in Depression
File # 6014608
Co-Investigators: Dr. C. Bowie

I am writing to acknowledge receipt of your recent ethics submission. We have examined the protocol (December 2014), telephone script – MDD participant, telephone script – Healthy Control, debriefing form and revised information/consent form for your project (as stated above) and consider it to be ethically acceptable. This approval is valid for one year from the date of the Chair’s signature below. This approval will be reported to the Research Ethics Board. Please attend carefully to the following listing of ethics requirements you must fulfill over the course of your study:

**Reporting of Amendments:** If there are any changes to your study (e.g. consent, protocol, study procedures, etc.), you must submit an amendment to the Research Ethics Board for approval. Please use event form: HSREB Multi-Use Amendment/Full Board Renewal Form associated with your post review file # 6014608 in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

**Reporting of Serious Adverse Events:** Any unexpected serious adverse event occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other serious adverse events must be reported within 15 days after becoming aware of the information. Serious Adverse Event forms are located with your post-review file 6014608 in your Researcher Portal (https://eservices.queensu.ca/romeo_researcher/)

**Reporting of Complaints:** Any complaints made by participants or persons acting on behalf of participants must be reported to the Research Ethics Board within 7 days of becoming aware of the complaint. Note: All documents supplied to participants must have the contact information for the Research Ethics Board.

**Annual Renewal:** Prior to the expiration of your approval (which is one year from the date of the Chair’s signature below), you will be reminded to submit your renewal form along with any new changes or amendments you wish to make to your study. If there have been no major changes to your protocol, your approval may be renewed for another year.

Yours sincerely,

[Signature]

Chair, Health Sciences Research Ethics Board
February 09, 2015

Investigators please note that if your trial is registered by the sponsor, you must take responsibility to ensure that the registration information is accurate and complete.
Appendix H

Piloting Study Letter of Information and Consent

Piloting: Rate Funny Video Clips for the Study, “Responses to Humourous Stimuli”

Thank you for your interest in this study. Please read the letter of information below, and indicate whether you would like to participate in this study.

PRIMARY INVESTIGATORS: Katherine Holshausen, MSc, Queen's University; Dr. Christopher Bowie, PhD, Queen's University (Kingston, Ontario, Canada)

BACKGROUND INFORMATION:
You are being invited to participate in a research study directed by Katherine Holshausen, MSc, under the supervision of Dr. Christopher Bowie. The purpose of this study is to pilot the video clips that we will be using for a subsequent study run in our lab. This study is being conducted with funds provided to Katherine Holshausen by the Vanier Scholar Program of the Canadian Institutes of Health Research (CIHR) and to Dr. Bowie from Queen’s University. This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen's policies. You will be provided with a copy of this document for your records.

DETAILS OF THE STUDY:

1. The aim of the study: The purpose of this study is pilot the video clips to determine which clips people find funny.

2. Description of study procedures: If you consent to participate in this study, you will be asked to watch a series of video clips and answering 2 brief questions about each video clip. While watching these video clips your responses will be audio and video recorded. The survey will take approximately 20 minutes of your time. The estimated sample size for this study is 50 participants.

3. Risks: There are no anticipated risks to participating in this study. If you decide that you do not want to complete the survey, you can stop at any time without penalty.

4. Benefits: Participation in this study will contribute to research on the use of humour as it relates to symptoms of depression.

5. Inclusions: You can participate in this study if you (1) are between the ages of 18 and 60, (2) have normal or corrected vision (i.e., if you wear corrective lenses; please wear them while completing the survey), and (3) are fluent in English.

6. Confidentiality: All information obtained during the course of this study is confidential. Data will be stored in locked files and will be available only to Katherine Holshausen, Dr. Bowie, and their research team. You will not be identified in any publication or reports.

The information you provide will not have your name or any identifying information on it. Instead, we will assign you a random code. This code is linked to your name in my locked laboratory on a password protected computer. All of the forms, even though they only have a code, are kept in a locked cabinet where only members of the research team will have access to it. Information kept on a computer will be
protected by a password. Once the study is complete, an archive of the data, without identifying information, will be stored for ten years before it is destroyed.

7. Voluntary nature of study/Freedom to withdraw or participate: Your participation in this study is voluntary. You may withdraw from this study at any time without penalty. Although it be would be greatly appreciated if you would answer all material as frankly as possible, you should not feel obliged to answer any material that you find objectionable or that makes you feel uncomfortable. If you skip any questions, you can still submit your survey responses and we will only analyze data from questions that have been answered. If you decide to withdraw from the study and do not want to submit your survey responses you may do so without penalty. If you do not submit your responses we will not have access to them and therefore your data will not be used.

8. Compensation: You will be compensated $5 for completion of this study.

How do I find out what was learned in this study?
I expect to have this study completed by approximately October 2015. If you would like a brief summary of the results, please let me know and I will meet with you following the completion of this study to discuss them.

Questions about the study
If you have questions about the study, you may ask the experimenter. Questions may also be directed to Katherine Holshausen (k.holshausen@queensu.ca), Dr. Christopher Bowie (cpdlab@queensu.ca), or the Head of the Department of Psychology (psychead@queensu.ca). Once the study is completed, we can send you its results at your request.

If you have any concerns about your rights as a research participant please contact - Dr. Albert Clark, Chair of the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board at (613)-533-6081 or clarkaf@queensu.ca.

This study has been granted clearance according to the recommended principles of Canadian ethics guidelines and Queen’s policies.
Name (please print clearly):
______________________________________________

A. I have read and understood the letter of information. I have had sufficient time to consider the letter of information and make a decision regarding my participation. I have been given time to pose questions, and my questions have been answered.

B. The procedures of this study have been explained to me. I know what will be asked of me as a participant.

C. I understand that my participation is voluntary, and that I may withdraw from the study at any time. I will inform the experimenter if I wish to withdraw from the study.

D. I understand the risk involved in this study, which involves answering personal questions about myself. I understand that this risk is mild, and that I am not required to answer any questions or participate in any tasks that make me feel uncomfortable.

E. I am aware that my responses will be kept confidential. I understand that only Dr. Bowie and his research team will have access to the information I provided today. I understand that I have been assigned a random code, and that I am not identified on any study materials or in future publications.

F. I understand that I will be audio and video recorded, and I have consented to this procedure.

G. I know that I may request a copy of the final results of this study.

H. I understand that if I have questions, concerns, or complaints, I know that I may direct them to Katherine Holshausen (k.holshausen@queensu.ca), Dr. Christopher Bowie (cpdlab@queensu.ca), the Head of the Department of Psychology (psychead@queensu.ca), or the Chair of the Health Sciences Research Ethics Board (clarkaf@queensu.ca).

By signing below, I am indicating that I have understood the above statements and freely consent to participate in this research.

Signature: ________________________________________

Date: ______________________
Appendix I
In-Lab Study Letter of Information and Consent

A Study of “Responses to Humorous Stimuli”

Principal Investigator: Katherine Holshausen, MSc
Department of Psychology
Queen’s University
Kingston, Ontario, Canada
(613) 533-6000 x78478
E-mail: k.holshausen@queensu.ca

Supervisor: Dr. Christopher R. Bowie
Department of Psychology
Queen’s University
Kingston, Ontario, Canada
(613) 533-6000 x78478
Email: cpdlab@queensu.ca

Research sponsor: Queen’s University

Purpose of the study
The purpose of this study is to better understand how individuals use and appreciate humour, and the relation between people’s reported and behavioural responses to humorous videos.

What will happen during the study?
This study involved two parts. Part 1 will take place today if you decide to participate. Part 2 will take place one week from today.

Part 1
Today’s assessment involves several tasks. We will ask you to do the following.
   A. Answer questions about how you have been feeling.
   B. Answer questions about your everyday behaviours and your thinking.
   C. Watch video clips, during which time you will be audio and video recorded, and we will place recording sensors on two fingertips on one hand and on your sides to measure your heart rate and perspiration.

Part 2
The assessment next week will include:
   A. Answering some questions about the video clips you watch today.
   B. Watching some new video clips during which time you will be audio and video recorded, and we will again place recording sensors on two fingertips on one hand and on your sides to measure your heart rate and perspiration.

Today’s assessment (Part 1) takes approximately 2 hours to complete, but we can take a break if you would like. The next assessment (Part 2; a week from today) takes approximately 45 minutes to complete.
Are there any risks to doing this study?
The risks involved in participating in this study are minimal. You may feel uncomfortable answering some questions or dislike the feeling of the sensor on your hand and sides to measure heart rate and skin response. You do not need to answer questions that you do not want to answer or that make you feel uncomfortable, and we can remove the psychophysiological equipment if you wish. You can stop taking part at any time.

Are there any benefits to doing this study?
By participating in this study, you will help us learn more about the individual differences that are associated with humour appreciation, and the relation between people's reported and behavioural responses to humourous videos. This information might be used to improve treatment outcomes.

Reimbursement
You will be compensated $30 for completing Part 1 today, and $15 for completing Part 2 next week.

Confidentiality
All information obtained during the course of this study is confidential. Data will be stored in locked files and will be available only to Katherine Holshauen, Dr. Bowie, and their research team and the Health Protection Branch in Canada. There is a possibility that your medical record, including identifying information, may be inspected by Health Protection Branch in Canada in the course of carrying out regular government functions and by the Research Ethics Board. You will not be identified in any publication or reports.

The information you provide will not have your name or any identifying information on it. Instead, we will assign you a random code. This code is linked to your name in my locked laboratory on a password protected computer. All of the forms, even though they only have a code, are kept in a locked cabinet where only members of the research team will have access to it. Information kept on a computer will be protected by a password. Once the study is complete, an archive of the data, without identifying information, will be stored for ten years before it is destroyed.

Legally required disclosure

i) Although I will protect your privacy as outlined above, if the law requires it, I have a duty to contact legal authorities if
   a. I become aware of child abuse where a child might still be at risk
   b. You express to me that you are at risk of harming yourself or others
   c. You express to me that another health care professional has engage in sexual abuse

ii) If legal authorities request the information you have provided, I may be required to reveal it.

Participation and withdrawal
Your participation in this study is voluntary. It is your choice to be part of the study or not.

If you decide to be part of the study, you can decide to stop (withdraw), at any time, even after signing the consent form or part way through the study. If you decide to withdraw, there will be no consequences to you. In cases of withdrawal, any data you have provided will be destroyed unless you indicate otherwise. If you would like to withdraw at any time, please inform the experimenter; at this point, the experiment will be immediately discontinued.

If you do not want to answer some of the questions you do not have to, but you can still be in the study.
Your decision whether or not to be part of the study will not affect your opportunities to be involved in future studies at Queen’s University.

**How do I find out what was learned in this study?**
I expect to have this study completed by approximately March 2016. If you would like a brief summary of the results, please let me know and I will meet with you following the completion of this study to discuss them.

**Questions about the study**
If you have questions about the study, you may ask the experimenter. Questions may also be directed to Katherine Holshausen (k.holshausen@queensu.ca), Dr. Christopher Bowie (cpdlab@queensu.ca), the Head of the Department of Psychology (psychead@queensu.ca), or the Chair of the Health Sciences Research Ethics Board (clarkaf@queensu.ca). Once the study is completed, we can send you its results at your request.

_This study has been granted clearance according to the recommended principles of Canadian ethics guidelines and Queen’s policies._
A. I have read and understood the letter of information. I have had sufficient time to consider the letter of information and make a decision regarding my participation. I have been given time to pose questions, and my questions have been answered.

B. The procedures of this study have been explained to me. I know what will be asked of me as a participant.

C. I understand that my participation is voluntary, and that I may withdraw from the study at any time. I will inform the experimenter if I wish to withdraw from the study.

D. I understand the risk involved in this study, which involves answering personal questions about myself. I understand that this risk is mild, and that I am not required to answer any questions or participate in any tasks that make me feel uncomfortable.

E. I am aware that my responses will be kept confidential. I understand that only Dr. Bowie and his research team will have access to the information I provided today. I understand that I have been assigned a random code, and that I am not identified on any study materials or in future publications.

F. I understand that I will be audio and video recorded, and I have consented to this procedure.

G. I know that I may request a copy of the final results of this study.

H. I understand that if I have questions, concerns, or complaints, I know that I may direct them to Katherine Holshausen (k.holshausen@queensu.ca), Dr. Christopher Bowie (cpdlab@queensu.ca), the Head of the Department of Psychology (psychead@queensu.ca), or the Chair of the Health Sciences Research Ethics Board (clarkaf@queensu.ca).

By signing below, I am indicating that I have understood the above statements and freely consent to participate in this research.

Signature: ____________________________ Date: ______________________

Consent for audio recording data:
I hereby consent to allow for the audio recordings collected while I am watching the videos to be used in future studies. I understand that this means that future participants in lab studies may hear my audio recordings, but that I will not be identified by name nor will any identifying information be associated with these recordings.

Yes _____ (initials)
No _____ (initials)
Appendix J

Piloting Study Debriefing Form

Debriefing Form
Piloting: Rate Funny Video Clips for the Study, “Responses to Humorous Stimuli”

Primary Investigator:
Katherine Holshausen
Department of Psychology
Queen’s University
Kingston, Ontario, Canada
(613) 533-6000 x78478
E-mail: k.holshausen@queensu.ca

Supervisor:
Dr. Christopher R. Bowie
Department of Psychology
Queen’s University
Kingston, Ontario, Canada
(613) 533-6000 x78478
Email: cpdlab@queensu.ca

Thank you for participating!

Major depressive disorder (MDD) has been identified as the leading cause of disability worldwide, impacting several functional domains, including social functioning. While there is substantial evidence evaluating the factors that contribute to social dysfunction and the relative role of depression-related symptoms of social anhedonia and social anxiety, we know little about the specific social behaviours that are impaired among individuals with MDD. One promising avenue is that of humour. Humour is a relatively ubiquitous social phenomenon that facilitates social interactions by bringing people closer together and is associated with feelings of reward and enjoyment. The purpose of this study is to elucidate how individuals with depression use humour (i.e., humour style) and demonstrate humour appreciation (i.e., mirth), and the differential relations of two common but independent symptoms of depression: social anxiety and social anhedonia with mirth.

The first step to running the study described above we first need to pilot the videos that we will be showing. Thank you for being a part of the piloting stage for these video clips!

The results of this study have potential implications for our understanding of factors related to social dysfunction in depression, and could inform relevant treatment targets for individual- and group-based interventions.

This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen’s policies. Questions regarding your rights as a research participant and/or ethical concerns may be directed to:

Queen’s University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board

Dr. Albert Clark, Chair
613-533-6081

This study has been granted clearance according to the recommended principles of Canadian ethics guidelines and Queen’s policies.
Appendix K

In-Lab Study Debriefing Form

Debriefing Form
“Subjective and Objective Responses to Humourous Stimuli and Retrospective Enjoyment of Humour in Depression”

Primary Investigator:
Katherine Holshausen
Department of Psychology
Queen’s University
Kingston, Ontario, Canada
(613) 533-6000 x78478
E-mail: k.holshausen@queensu.ca

Supervisor:
Dr. Christopher R. Bowie
Department of Psychology
Queen’s University
Kingston, Ontario, Canada
(613) 533-6000 x78478
Email: cpdlab@queensu.ca

Thank you for participating!

Major depressive disorder (MDD) has been identified as the leading cause of disability worldwide, impacting several functional domains, including social functioning. While there is substantial evidence evaluating the factors that contribute to social dysfunction and the relative role of depression-related symptoms of social anhedonia and social anxiety, we know little about the specific social behaviours that are impaired among individuals with MDD. One promising avenue is that of humour. Humour is a relatively ubiquitous social phenomenon that facilitates social interactions by bringing people closer together and is associated with feelings of reward and enjoyment. The purpose of this study is to elucidate how individuals with depression use humour (i.e., humour style) and demonstrate humour appreciation (i.e., mirth), and the differential relations of two common but independent symptoms of depression: social anxiety and social anhedonia with mirth.

In this study we were interested in how you responded to watching different funny video clips so that we could evaluate the relationship between your subjective (i.e., your ratings), objective (e.g., heart rate), and observed (e.g., laughing) responses to these clips. We were also interested to see whether people respond differently when they hear other people’s laughter while watching clips. The laughter you heard wasn’t actually other people watching the clips at the same time as you, all of the laughter was prerecorded and we determined when you would and would not hear it.

The results of this study have potential implications for our understanding of factors related to social dysfunction in depression, and could inform relevant treatment targets for individual- and group-based interventions.
All of the information we collected today will be kept strictly confidential. You are not identified on any of the testing materials, nor will you be identified in future publications of our findings.

We are not able to provide feedback on your performance today. However, you may request a copy of the study’s results by contacting us at the CPD Lab (cpdlab@queensu.ca).

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Should you wish to speak with someone about any distress that you experience related to mental illness, please contact one of the following helplines:

**Suicide Hotline: Telephone Aid Line Kingston:** 1(613) 544-1771  
**Ministry of Health Mental Health Helpline:** 1-866-531-2600  
**Frontenac Community Mental Health & Addiction Services: Crisis Line:** 1(613) 544-4229

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If you have a more general interest in this area of research, you may also wish to consult the following references:


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This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen's policies.

Questions regarding your rights as a research participant and/or ethical concerns may be directed to:

**Queen’s University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board**  
Dr. Albert Clark, Chair  
613-533-6081

*This study has been granted clearance according to the recommended principles of Canadian ethics guidelines and Queen’s policies.*
Appendix L

Advertisement for Piloting Videos for In-Lab Studies

Title:
Participants needed for paid research study on rating audio clips and funny videos

Body of the advertisement:
There are currently two studies for which we are recruiting participants. You may participate in just one or both studies. They are described below:

(1) The goal of this study is to better understand which types of videos people tend to find funny and cause laughter. Participation in the study involves 20 minutes to watch a series of video clips in our lab (while being audio and video recorded) and to answer two brief questions about each video. Participants will be paid $5 for their time.

(2) The goal of this study is to determine how people respond to different people in a workplace. The study is designed to help us understand how people respond to bosses, new co-workers, and friend co-workers. Participation in the study involves 30 minutes to listen a series of audio clips in our lab (while hooked up to heart rate and stress monitoring equipment) and to answer one brief question about each audio clip. Participants will be paid $5 for their time.

If you participate in both studies, you will be compensated $10. If you would like to participate in both studies you may participate in both at the same visit or, if you prefer, you may schedule two separate visits.

These studies have been approved through the Queen’s University Research Ethics Board and the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board.

If you are interested in or have questions about the study, please call at 613-533-6000 ext. 78478 or email cpdlab@queensu.ca

Principal Investigators:
Katherine Holshausen, MSc, and Christopher R. Bowie, PhD,
Departments of Psychology and Psychiatry,
Queen’s University

*Note: Piloting for Humour Studies was coupled with piloting for an unrelated research project in the Cognitive & Psychotic Disorders Lab
Appendix M
Details of Included/Excluded Piloted Humourous Videos

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>50% 3+</th>
<th>20% 5+</th>
<th>Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggressive</td>
<td>Man is terrified by fake dinosaur</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Man falls through the ceiling</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Man gets a soccer ball to the face</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Boxing match set to music</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Treadmill falls apart as man runs</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Raptor's mascot falls repeatedly</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Man falls over</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggressive</td>
<td>Father frightens his son while in the shower</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Woman falls while trying to kiss someone</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Stuffed monkey is thrown at a man</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Aggressive</td>
<td>Glitter explodes all over a man's office</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggressive</td>
<td>Boy gets a soccer ball in the face</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Man scares his wife</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Teen falls on floor during backfired prank</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Aggressive</td>
<td>Shelves of wine fall in front of store employee</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Aggressive</td>
<td>Two men fight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggressive</td>
<td>Man pushes friend off deck</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggressive</td>
<td>Woman misses diving board while jumping</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>Cat in the bath</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Animals</td>
<td>Cat falls over fence</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Animals</td>
<td>Cat sees itself in the mirror</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Animals</td>
<td>Man is frightened by a penguin</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Animals</td>
<td>Penguin slips on ice</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Animals</td>
<td>Corgi jumps into the lake by doing a belly flop</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Animals</td>
<td>Kitten jumps and misses it's landing</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Animals</td>
<td>Orangutan stuffs a banana into his mouth</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Animals</td>
<td>Dog jumps when a tuba is played</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Animals</td>
<td>Small goat makes noises</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Animals</td>
<td>Cat jumps over a wall</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Animals</td>
<td>Cat jumps in time with Super Mario music</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Animals</td>
<td>Sleepwalking dog</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Animals</td>
<td>Dog's bark sounds like a human scream</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Animals</td>
<td>Goat 'yells' at man as he talks</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Animals</td>
<td>Dog gets lost in the snow</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Animals</td>
<td>Bear moves in time with music</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>Cat pushes another cat down flight of stairs</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Category</td>
<td>Event</td>
<td>Score</td>
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<tr>
<td>--------------</td>
<td>----------------------------------------------------------------------</td>
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<tr>
<td>Animals</td>
<td>Cat barks like a dog</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>Puppy can't catch toy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>Pug pees all over his owner</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>Dogs bark at cats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>Puppy doesn't understand depth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>Voiced dubbed over fish 'talking'</td>
<td></td>
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</tr>
<tr>
<td>Animals</td>
<td>Bird scares a cat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incongruous</td>
<td>Man confuses train with a tornado</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incongruous</td>
<td>Embarrassed man walks away</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incongruous</td>
<td>Flapping tarp on boat appears to be talking</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incongruous</td>
<td>Man tries to drink in front of an air compressor</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incongruous</td>
<td>Cereal comes out of box as a whole piece</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incongruous</td>
<td>Man tries and fails at free styling a poem on live TV</td>
<td></td>
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<tr>
<td>Incongruous</td>
<td>Frozen beer surprises man</td>
<td></td>
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</tr>
<tr>
<td>Incongruous</td>
<td>Man awkwardly breaks a rare object</td>
<td>5</td>
<td></td>
<td></td>
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<tr>
<td>Incongruous</td>
<td>Bad rendition of flutes play a song</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incongruous</td>
<td>Robot fails to deliver a snack</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incongruous</td>
<td>Voiceover of a spider sleeping</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Incongruous</td>
<td>Student posing as superman gets stuck</td>
<td>4</td>
<td></td>
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<tr>
<td>Incongruous</td>
<td>Fan fails to sing along during Beyonce song</td>
<td></td>
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<tr>
<td>Incongruous</td>
<td>Senior woman is confused by prank</td>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td>Incongruous</td>
<td>Grinch struggles to understand yoga</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incongruous</td>
<td>Child surprises football player</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Incongruous</td>
<td>Woman answers question incorrectly</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incongruous</td>
<td>Miscommunication due to language barrier</td>
<td>4</td>
<td></td>
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</tr>
<tr>
<td>Incongruous</td>
<td>Man is surprised by unexpected delivery</td>
<td></td>
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<tr>
<td>Incongruous</td>
<td>Woman disbelieves a strange gift</td>
<td></td>
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</tr>
<tr>
<td>Incongruous</td>
<td>Man can't make sense of gravity</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Kids</td>
<td>Baby falls head first into ice</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td>Child is surprised by friendly beluga</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td>Girl doesn't realize she's won a contest</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td>Boy talks about perils of having too many girlfriends</td>
<td>5</td>
<td></td>
<td></td>
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<tr>
<td>Kids</td>
<td>Child falls off of swing onto face</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td>Dog chases a boy around the yard</td>
<td></td>
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<tr>
<td>Kids</td>
<td>Boy falls off a pole</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td>Small boy can't kick a ball right in front of him</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td>Baby eats grapefruit</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td>Little boy has trouble explaining his dream</td>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td>Kids</td>
<td>A boy dances at a wedding</td>
<td>5</td>
<td></td>
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<tr>
<td>Kids</td>
<td>Child complains about being poked in the heart</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td>Child cannot whistle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td>Little girl can't say banana</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Event Description</td>
<td>Difficulty</td>
<td>Notes</td>
<td></td>
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</tr>
<tr>
<td>Kids</td>
<td>Baby tastes her first lemon</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td>Baby is afraid of mother blowing her nose</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kids</td>
<td>Child has an evil laugh</td>
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<td>Two children rush to an ice-cream truck</td>
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<td>Child at fair talks about turtles</td>
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<td>Children talk to each other</td>
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<td>Children are confused by sandcastle</td>
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<td>Little girl doesn't understand certain words</td>
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<td>Reporter goes silent while broadcasting</td>
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<td>News reporter talks about seasons</td>
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<td>Woman recounts a bizarre fire</td>
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<td>Reporter is scared of fish and falls onto a man</td>
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<td>Reporter walks off of camera during broadcast</td>
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<td>News reporter screams at chicken</td>
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<td>Reporter gets confused</td>
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<td>Man being interviewed has unusual laugh</td>
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<tr>
<td>News</td>
<td>Man falls off of dock on live TV</td>
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<td>Man barks like a dog on the news</td>
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<td>News reporter falls while on air</td>
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<tr>
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<td>Reporter falls on camera</td>
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<td>Reporter goes cross-eyed</td>
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<td>Man accidentally falls into water</td>
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<td>News reporter watches someone fall in snow</td>
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<td>News</td>
<td>Man forgets what drugs are on air</td>
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<tr>
<td>News</td>
<td>Reporter misspeaks on live air</td>
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<td>News reporter misuses the word 'canoodle'</td>
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<td>News</td>
<td>Reporter is unable to deliver news report</td>
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<tr>
<td>News</td>
<td>Reporter reports on wrong story</td>
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<td>News</td>
<td>Reporter struggles to read teleprompter</td>
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</table>
Appendix N

FACES Coding Decisional Chart for Expressions of Amusement
Appendix O

Screen Display Seen by Participants During Retrospective Rating Paradigm

Grinch screams during yoga class.

Video from which screenshot was captured is available for viewing at:
https://www.youtube.com/watch?v=HsvyjePPFRs

or see:
"The Grinch tries yoga."
A segment from: Christmas at Christian Life, 2013
www.christianlife.org
## Appendix P

**Participant Medication Use for Chapters 4 & 5**

<table>
<thead>
<tr>
<th>Medication Type</th>
<th>Medication</th>
<th>Number of Participants Using the Medication</th>
<th>n (%)</th>
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<td><strong>Anticonvulsant</strong></td>
<td>Lamotrigine</td>
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<tr>
<td><strong>Antidepressant</strong></td>
<td>Citalopram</td>
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<td>2.70</td>
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<td>Clomipramine</td>
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<td>Escitalopram</td>
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<td><strong>Stimulant</strong></td>
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<td>Ritalin</td>
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*Note. Percentages do not add up to 100% because some participants were on multiple medications.*
Appendix Q
Order of Videos Superimposed with Laughter by Version

Version 1

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<th>NO LAUGHTER (18)</th>
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<td>45 - News</td>
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<td>6</td>
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<tr>
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<td>*202 – bittersweet</td>
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