8-7-2018 1:30 PM

Trajectories of the Effects of Sad Mood Induction Procedures (MIPs)

Jennifer C. P. Gillies
The University of Western Ontario

Supervisor
Dozois, David J. A.
The University of Western Ontario

Graduate Program in Psychology
A thesis submitted in partial fulfillment of the requirements for the degree in Master of Science

Abstract

Mood Induction Procedures (MIPs) are used widely in cognitive vulnerability to depression research. Although research supports certain MIPs as effective, little research has validated the assumption that MIP-induced sad moods are sufficiently persistent. This study addressed three questions: How long does an MIP-induced mood last? What are the shapes of the trajectories of the mood effects? Do these trajectories differ by type of MIP? Four-hundred-and-one undergraduate students were randomly assigned to undergo one of three commonly used sad MIPs or a neutral MIP. Mood was repeatedly measured immediately prior to and following the MIP. Results did not support the widely held belief that commonly used MIPs induce a sufficient and persistent sad mood. Current theories of cognitive vulnerability may therefore be biased by empirical findings predicated on such assumptions. This study has profound implications for the validity of current conceptualizations of depression and recommendations for the treatment of this disorder.

Keywords: mood induction procedure (MIP); mood priming; depression; cognitive vulnerability; cognitive reactivity; cognitive schema

Acknowledgements

This master's thesis would not have been possible without the influence of and considerable help and support from a great many individuals. First, I am deeply grateful to my supervisor, Dr. David Dozois. Your constant guidance, encouragement, and sense of humour made the typically stressful master's thesis process an immensely enjoyable one. You are a truly remarkable supervisor and mentor, and I very much look forward to continuing to work with you.

Thank you also to my committee members, Dr. Nick Kuiper, Dr. Paul Tremblay, and Dr. Anabel Quan-Haase, for your time and thoughtful feedback. Special thanks to Dr. Tremblay for the considerable time you spent delving into the theory and practical applications of latent growth modeling with me. Thank you also to Dr. Rod Martin, for the seamless online programming for the study. And many thanks also to the research assistants without whom it would not have been possible to run the hundreds of participants needed. Alison Croke, Claudia Enderlein, Marcus Gottlieb, Aidan McNaughton, Madison Waller, and Tianyue Xu, your hard work and dedication is greatly appreciated.

I would like to thank my classmates, labmates, and friends for their unending help, humour, and support. Finally, I am deeply grateful to my parents, who instilled in me a love of language and a scientific curiosity that undoubtedly led me down this path. My sincerest thanks for your unwavering support and encouragement along the way.

Table of Contents

List of Tables

List of Figures

List of Appendices

Trajectories of the Effects of Sad Mood Induction Procedures (MIPs)

Numerous studies have demonstrated the effect of mood on countless psychological processes, such as cognition (Choma, Hodson, & Costello, 2012), behaviour (van Strien et al., 2013), and interpersonal functioning (Forgas, 2013). Having an effective and valid method of experimentally manipulating mood is therefore crucial for the empirical study and conceptualization of these effects. To this end, researchers have developed Mood Induction Procedures (MIPs; Lench, Flores, & Bench, 2011), which are used widely across diverse research areas. These experimental procedures are designed to induce either a positive or a negative affective state in participants to investigate the effect of mood on various constructs. For example, to study the effect of sad mood on memory, a researcher may use an MIP to induce a sad mood, and then have participants complete a memory task. Because there are numerous classes of MIPs, as well as myriad permutations of MIP protocols within each class, there are endless specific MIPs the researcher could use in this hypothetical study. Classes of MIPs include, for example, music MIPs, in which participants listen to a mood-evocative piece of music; autobiographical memory MIPs, in which participants recall a personal memory; Velten MIPs, in which participants read positive or negative self-referential statements (e.g., "I've doubted that I am a worthwhile person") and statements about somatic states (e.g., "I'm so tired"); and film MIPs, in which participants watch an emotionally charged film clip (Westermann, Spies, Stahl, & Hesse, 1996).

Although substantial empirical evidence has supported the effectiveness of certain classes of MIPs (for a review, see Westermann et al., 1996)—that is, participants' moods significantly change following the MIP—a dearth of research has investigated how long

an MIP-induced mood persists at the initial induced level and the pattern of abatement once the induced mood begins to return to baseline (hereinafter referred to as *the trajectory*). Given the theoretical importance and widespread use of MIPs in research, the lack of knowledge about the reliability and validity of the trajectories of their effects is concerning, both methodologically and conceptually. Researchers who use MIPs interpret their results under the assumption that the effectively induced mood state lasted long enough for participants to complete the measures or tasks of interest. For instance, the researcher studying the effect of sad mood on memory may induce a sad mood with a musical MIP (e.g., participants listen to a 7-min clip of sad music). The researcher expects that specific level of sadness to persist until the participant has completed the memory task. This persistence is essential because, if the induced mood dissipates before the memory task is completed, the results will not accurately demonstrate the effects of sad mood on memory. Thus, without an accurate appraisal of how long a mood effect can reliably be assessed, the conclusions drawn from extant research on mood effects may be heavily biased.

Conceptual Importance of MIPs in Cognitive Vulnerability Research

MIPs are used widely across diverse research areas, but they are especially useful in research investigating the mechanisms that contribute to the development, maintenance, and recurrence of depression (see Ingram, Miranada, & Segal, 1998). In particular, MIPs have been crucial in the study of cognitive vulnerability to depression, a concept central to cognitive theories of depression and grounded within *diathesis-stress* models. Cognitive vulnerability refers to the idea that some individuals exhibit latent negative cognitive structures (i.e., the *diathesis*) that become activated during stressful

situations (i.e., the *stress*); in turn, these activated cognitive structures are posited to activate or trigger negative cognitive processes that contribute to the development, maintenance, and recurrence of depression (Beck, 1967; Beck, Rush, Shaw, Emery, 1979). Such activation of negative information processing biases because of a stressor or sad mood is termed *cognitive reactivity*. Therefore, according to theories of cognitive vulnerability, individuals who possess the diathesis of these latent negative cognitive structures are particularly vulnerable to depression (Beck, 1967; Beck, et al., 1979).

To understand why MIPs have been so widely used in cognitive vulnerability research and also why it is imperative to elucidate the trajectories of the effects of MIPs, it is necessary to first gain an in-depth understanding of cognitive vulnerability theories. Although there are several cognitive vulnerability models of depression, the most well-known and empirically examined is Beck's seminal model.

Theories of Cognitive Vulnerability to Depression

Beck (1967) proposed a diathesis-stress model of depression in which maladaptive cognitive structures—termed *maladaptive cognitive schemas*—constitute a vulnerability or diathesis and thus remain dormant until activated by stressful life events. Beck posited that these maladaptive cognitive schemas provide the negatively biased scripts that are automatically used to efficiently interpret situations and respond to them. When such a schema (i.e., the diathesis) is activated by a stressor, information and memories are attended to, filtered, processed, and interpreted through the negatively biased lens of that schema. Information-processing theoretical frameworks of depression, such as associative network theory (ANT; also referred to as a spreading activation model; e.g., Bower, 1981; Ingram, 1984; Teasdale, 1983) and Teasdale's (1988)

differential activation hypothesis make similar proposals. Just as Beck proposed the existence of schemas, these frameworks posit that information and events are encoded as memories in cognitive networks of related concepts and descriptive propositions (Bower, 1981). That is,

> an event is represented in memory by a cluster of descriptive propositions. These are recorded in memory by establishing new associative connections among instances of the concepts used in describing the event. The basic unit of thought is the proposition; the basic process of thought is activation of a proposition and its concepts. The contents of consciousness are the sensations, concepts, and propositions whose current activation level exceeds some threshold. (Bower, 1981, p. 134)

Therefore, each memory is encoded as clusters of nodes that represent an individual concept or proposition. Collectively, these clusters form the entire memory and are often referred to as "memory nodes." (Bower, 1981; Teasdale, 1983). Bower (1981) proposed that, similarly, each emotion is represented within the cognitive structure as its own specific node, associated with related propositions such as autonomic patterns (e.g., fear would be associated with increased heartbeat), expressive behaviours (e.g., sadness would be associated with crying), and, importantly, memories. That is, each time a particular emotion is experienced, its corresponding node within the cognitive structure is activated. The emotion that is activated during a specific personal experience is thus temporally and causally associated with the encoded memory for that specific experience. For example, according to Bower, an event such as "I was dumped by my boyfriend at the park" would be encoded in memory through the forming of associations among prior

concepts of "myself," "rejection," "my boyfriend," and "the park." Deeper associations with absolutist beliefs (e.g., I am unlovable) are also connected to these more proximal associations. Additionally, the sadness node would be activated during this event, and thus a strong association would form between the sadness node and the related memory node.

According to these information-processing theories, a memory, sensation, or cognition comes into conscious awareness only when it is activated above a minimum threshold. The level of accessibility of these memories is therefore directly related to the level of activation of their memory nodes. A memory or cognition can be activated or made conscious either directly or indirectly. Direct activation of a memory or cognition occurs when a stimulus (or stimuli) in the environment very closely matches or responds to a memory node. For example, after a few months, the woman who was dumped by her boyfriend is not constantly consciously thinking about that experience. However, according to ANTs or Teasdale's differential activation hypothesis, if she watches a movie in which a similar relationship breakup occurs, this would directly activate her memory nodes above the minimum threshold necessary for that memory to enter conscious awareness. The woman's memory could, however, also be activated indirectly. According to Ingram (1984):

> Network theories assume that memories are connected with each other through associative linkages. Presumably, memories that are conceptually similar, or that have somehow become associated for the individual, are linked through associative pathways. The strength of these pathways is seen as a function of how strongly the memories are associated. Strongly associated memories will have

> strong and more closely associated linkages, and weakly associated memories will have weak or perhaps no associative pathways. According to network theory, when a memory is activated, activation is presumed to spread along its associative pathways, causing other memory nodes to become more likely to be activated. The memory nodes that stand the greatest likelihood of being activated in this manner are those that are connected through the strongest associative pathways. (p. 449)

In other words, indirect activation of a memory or cognition occurs when activation spreads from a directly activated node to other nodes. For example, if the woman were to walk by the park in which she was dumped, this would activate her "park" node. The woman's "myself," "rejection," and "boyfriend" nodes would have been encoded during the break up as component parts of a single memory, which would have also been strongly associated with feelings of sadness. Activation of the woman's park node (if above the minimum threshold) would thus spread to these strongly and closely related nodes, consequently bringing that memory of her break-up and the feeling of sadness into conscious awareness.

MIPs are thus considered an effective avenue for studying the diathesis-stress model of cognitive vulnerability to depression because they purportedly activate latent negative cognitive structures (e.g., maladaptive schemas, associative cognitive networks) experimentally, in a manner similar to the way that a stressful life event would activate such structures.

For example, an autobiographical memory MIP involves asking participants to recall a sad personal memory. According to ANTs, asking someone to recall a sad

memory would directly activate the node for that memory. Activation would then spread to the sadness node, which would have been strongly associated with that memory when it was encoded. According to cognitive vulnerability theories, vulnerable individuals would have an underlying negative cognitive structure that would include a strongly associated network of negative thoughts, beliefs, and attributions that would also be strongly linked with both their sadness node and the node representing the memory they were asked to recall for the MIP. Theoretically, non-vulnerable individuals, on the other hand, would lack this strongly and tightly interconnected negative cognitive structure (i.e., the diathesis). Therefore, in vulnerable individuals, activation (via recalling a sad memory) of a sad memory node would be proposed to spread to the related sadness node as well as to related negative or maladaptive cognitive structures and subsequent processes; if these structures and processes were activated above the minimum threshold, they would consequently be accessible and would more easily enter conscious awareness.

In contrast, by activating the sad memory node in non-vulnerable individuals, activation would be proposed to spread to the related sadness node, but there would not be a highly interconnected and strongly associated latent negative cognitive structure for the activation to spread to. Therefore, the justification for using MIPs is to allow researchers to test hypotheses related to cognitive vulnerability: If the diathesis-stress theory of cognitive vulnerability is supported, research should show that participants who are made to feel sad (e.g., by recalling a sad autobiographical memory) display negative cognitive biases *only* if they possess the cognitive vulnerability (i.e., the latent negative cognitive structure).

Indeed, research has, on numerous occasions, demonstrated this pattern of results (see Scher, Ingram, & Segal, 2005, for a review). For example, individuals with prior depression (but who are not currently depressed) show significantly more maladaptive cognitive processing than do never-depressed controls *only* after being experimentally manipulated into a sad mood induced with a sad-MIP (Ingram, Miranda, & Segal, 1998). Therefore, MIPs provide a method for studying cognitive vulnerability to depression by experimentally activating negative cognitive structures in a way that mimics how they would be activated preceding or during a depressive episode.

Reliability and Validity of MIPs

Major depressive disorder is a highly recurrent and debilitating disorder that is now considered the leading cause of disability worldwide (American Psychiatric Association, 2013; WHO, 2017). Understanding the mechanisms underlying the onset and maintenance, but particularly the recurrence of depression—such as cognitive vulnerability—is therefore essential, as doing so will help to direct prevention and treatment interventions that will ultimately reduce the devastating burden of depression. This goal cannot, however, be reached without having valid and reliable experimental procedures and methodologies. As previously mentioned, MIPs are largely assumed to be one such valid and reliable experimental procedure for studying cognitive vulnerability to depression. Although numerous studies have provided evidence that some MIPs do effectively induce sad mood states (Gerrards-Hesse, Spies, & Hesse, 1994; Martin, 1990;

Westermann et al., 1996), the overall validity and reliability of these procedures is currently unknown.

For example, there is no one agreed-upon method for determining the effectiveness of sad MIPs, and a variety of criteria have been used to operationally define an MIP-induced sad mood in cognitive vulnerability research. For example, many researchers measure mood prior to and following the administration of the MIP and then statistically compare those pre- and post-MIP mean mood scores. If these analyses indicate that the post-MIP mood is significantly sadder than the pre-MIP mood, it is concluded that the sad mood was successfully induced (e.g., Beevers, Ellis, & Reid, 2011; Jarrett et al., 2012; Meites, Deveney, Steele, Holmes, & Pizagalli, 2008; Segal, Kennedy, Gemar, Hood, Pedersen, & Buis, 2006).

In studies in which both a sad MIP and a neutral MIP are used, researchers often compare the mean post-MIP mood scores of the sad MIP condition and the neutral MIP condition (e.g., Beevers & Meyer, 2008; Ingram, Bernet, & McLaughlin, 1994; Ingram & Ritter, 2000). The implied reasoning is that, if the sad MIP was successful, individuals who were exposed to it should report significantly greater levels of sadness than those who were not exposed. (Most researchers also first confirm that there are no between-group differences in mood prior to the MIP.) Again, if these analyses demonstrate that participants in the sad MIP condition had a significantly sadder mood than participants in the neutral MIP condition following (but not prior to) the MIP, the sad mood is deemed to have been successfully induced.

Finally, a smaller number of researchers select an absolute minimum mood change value that participants must evince on the mood measure pre- to post-MIP for the

MIP to be considered effective (e.g., Newman & Sears, 2015; Singer & Dobson, 2007; Teasdale & Fogarty, 1979). For example, in a study of the relation between metacognitive process and depression relapse, Singer and Dobson (2007) measured mood along a visual analog scale (VAS) that ranged from 0 (*positive*) to 10 (*negative*). Pre- to post-MIP difference scores were calculated for each participant, and the mood induction was deemed unsuccessful for participants who did not demonstrate at least a 20-mm change in mood. Participants for whom the MIP was deemed unsuccessful were subsequently dropped from the analyses. Such absolute change criteria are most often employed in this way—that is, at the individual rather than the group level.

One important methodological consideration is whether the success of a mood induction is operationalized based on change in mood at the group level versus the individual level. As previously discussed, the purpose of using MIPs in cognitive vulnerability research is to activate latent negative cognitive structures and the consequent cognitive reactivity. Using group means to compare either (a) mood changes pre- to post-MIP or (b) differences in mood following a sad versus a neutral MIP potentially conceals the existence of participants for whom the MIP did not induce a sad mood (and, thus, for whom did not activate their latent negative cognitive structures). For example, if an MIP is deemed to be effective because the group means indicate an overall significant difference, all participants are included in subsequent analyses. A substantial proportion of participants may not, however, have individually demonstrated any (or a meaningful) change in mood. If that were indeed the case, including the outcome data for participants who did not experience an induced sad mood in the analyses would introduce error variance that could attenuate or even entirely obscure the outcome effect.

Temporal Persistence of MIPs

Further complicating the matter is that, regardless of how a successful mood induction is operationally defined, many researchers seem to work under the assumption that the induced sad mood persists for the entirety of their measures of interest. Very little research, however, has tested this important assumption. Most researchers who use MIPs in their designs *do* complete a manipulation check to confirm that the MIP successfully induced the intended mood (usually by using one of the three methods described above). Many of these researchers typically do not, however, confirm that the successfully induced mood state *persisted* until the relevant task or measure was completed. That is, they either do not measure mood a third time (i.e., following the completion of the task or measure of interest) or, if they do assess mood a third time, they do not include that measure in the statistical analyses (e.g., Beevers, Scott, McGeary, & McGeary, 2009; Gemar, Segal, Sagratti, & Kennedy, 2001; Segal, Gemar, & Williams, 1999).

That researchers often do not confirm that the successfully induced mood state persists throughout the relevant task or measure is extremely problematic: Again, the theory supporting the use of MIPs to study cognitive vulnerability is that activation of the sadness node will spread to the latent negative cognitive structures that exist in vulnerable individuals, thereby activating the negative cognitive processes associated with depression. According to ANTs, if an MIP-induced sad mood dissipates before the tasks or measures of interest can be completed, then activation of the sadness node would be presumed to similarly dissipate, thereby eliminating the source of activation for the associated negative cognitive structures. If the negative cognitive structures become inactive before the tasks or measures of interest can be completed, the depressogenic

cognitive processes will also fail to remain active for the duration of the task or measure. Consequently, results from studies in which this scenario occurs (i.e., when a sad mood dissipates before the tasks or measures of interest have been completed) may *appear* to indicate that, despite an effectively induced sad mood, there was minimal or no effect of mood on the outcome variable. Researchers may thus interpret their findings based on the incorrect conclusion that there was no effect of sad mood on the outcome variable.

Since there is almost no research elucidating the trajectories of sad MIPs, the fact that researchers typically do not confirm that an induced sad mood has persisted for the entirety of the administration of the outcome measure (a) calls into question the validity of the findings of a considerable number of influential studies and therefore (b) raises doubt about the theoretical conceptualizations of depression that have been updated based on the findings of these studies.

MIP Trajectory Research

In addition to the fact that many researchers neglect to confirm that the induced mood has persisted for the entirety of the relevant tasks or measures in their particular study, very few researchers have specifically investigated the trajectories of the effects of induced sad moods; of the few studies that *have* investigated these trajectories, all but one employed methodological designs that included using an MIP and/or measures of sadness that are rarely used in cognitive vulnerability research (i.e., Chou, Lee, and Ho, 2007; Frost & Green, 1982; Gomez, Zimmerman, Guttormsen Schär, & Danuser, 2009; Kliegel, Jäger, & Phillips, 2007). Research demonstrates that mood effects as well as ratings of mood can differ based on variations in MIP procedures and across various measures of mood (e.g., Westermann et al., 1996); this consequently renders the results of all but one

of the very few sad mood trajectory studies ungeneralizable to the majority of research on cognitive vulnerability to depression.

The one exception is a recent study in which Kuijsters, Redi, de Ruyter, and Heynderickx (2016) investigated the trajectories of the effects of sad mood following three sad MIPs in a sample of 15 university students and staff of a university in The Netherlands. The MIPs included (a) a short film segment, (b) a long film segment, and (c) a slideshow of images from the International Affective Picture System (IAPS) database (Lang, Bradley, & Cuthbert, 2008) that were rated as high on sadness. The researchers found that sad mood was significantly induced up to and including the measurement at 2 min post-MIP for the long film segment, and up to 6 min post-MIP for the short film segment. Though a sad mood was significantly induced immediately following the MIP for the IAPS slideshow, it was not maintained by the measurement at 2 min post-MIP.

These findings—that certain MIP-induced mood changes may not persist for even as long as two minutes—provide a stark illustration of what could be a major methodological flaw of research employing MIPs. Though the methodology of their study was stronger and the results somewhat more generalizable than the handful of other MIP trajectory studies, the sample size in Kuijsters et al.'s (2012) study was quite small, and the classes of MIPs used (i.e., pictures and videos) are not as frequently used in current depression research—more recent studies of cognitive vulnerability to depression have tended to use musical MIPs, autobiographical memory MIPs, or some combination of the two (e.g., Jarrett et al., 2012; Lethbridge & Allen, 2008; Segal et al., 1999). This leaves a great need for research investigating the trajectories of the effects of the most

commonly used sad MIPs, while—as much as possible—replicating the most commonly used depression research methodologies. In other words, in order to evaluate the validity of previous empirical findings from depression studies that employed MIPs in their design, the methodologies of future MIP *trajectory* research must be as similar as possible to those used in these previous depression studies.

The Current Study

The aim of this study was therefore to begin to fill these gaps in the literature using a highly controlled and ecologically valid methodology to help clarify the trajectories of the effects of MIPs commonly used in depression research. Given the preliminary and exploratory nature of this study, specific hypotheses were not proposed. Rather, the aim was to answer three questions, namely (1) how long does an MIP-induced mood last; (2) what are the shapes of the trajectories; and (3) do the shapes of these trajectories differ based on the type of MIP used? Answering these questions will not only provide empirically and theoretically supported recommendations for methodologies that researchers should use in future sad-MIP research but will also have serious implications for the validity of a significant body of existing depression research.

Consider, for example, Jarrett et al.'s (2012) study investigating cognitive reactivity in participants who were successfully treated with cognitive therapy. The researchers unexpectedly found that the MIP did not significantly increase cognitive reactivity, despite the fact that the MIP did significantly decrease mood from pre- to post-MIP. As a result, the authors concluded that their findings (1) "suggest that the absence of [cognitive reactivity] following treatment may be specific to [cognitive therapy] responders" (Jarrett et al., 2012, p. 285); (2) "challenge the idea that it is necessary to

prime mood in order to maximize dysfunctional attitudes' prediction of depressive relapse and/or recurrence" (p. 285); and (3) "emphasize the clinical importance of restructuring dysfunctional attitudes in preventing relapse and recurrence" (p. 285). The authors did not, however, address the possibility that, although the MIP was successful in initially inducing a sad mood, the induced sad mood may not have persisted for the entire time it took participants to complete the measure of dysfunctional attitudes.

Given Kuijsters et al.'s findings that certain MIPs may be effective in inducing a sad mood that persists for only as little as two minutes, coupled with the fact that it often takes longer than that to complete 40 DAS items (Nezu, Ronan, Meadows, & McClure, 2000), it is possible that Jarrett et al.'s conclusions (based on the finding of an absence of cognitive reactivity) are in fact inaccurate. For instance, it is possible that the sad mood—and thus the cognitive reactivity in response to the sad mood—was short-lived rather than persistent. Consequently, total scores on the measure of cognitive reactivity could have been attenuated by responses provided by participants who did not remain sad (and thus did not remain cognitively reactive).

It should be noted that drawing conclusions from the findings of a single study that are the result of potentially flawed methodology or using those conclusions to inform theory and practice is not, in and of itself, too concerning. However, if the vast majority of MIP depression researchers' results have been biased by misconceptions about the duration of an MIP-induced sad mood (and given that there is no MIP trajectory research that can demonstrate that this is *not* the case), the collective impact on a large body of depression research could be enormous. It is thus entirely possible that our models of cognitive vulnerability to depression and our treatment recommendations based on such

models would look remarkably different if we had insight into the trajectories of the effects of sad MIPs.

This study will therefore greatly aid in the development of standardized, validated MIP protocols to be used in future depression research. More important, however, is that the findings of this study can be used to begin validating or invalidating previous research findings and thus may have compelling ramifications for the conceptual understanding of depression that is based on these previous findings.

Method

Participants

Undergraduate students enrolled in an introductory psychology course at Western University (UWO) were recruited through UWO's online psychology research participant pool (SONA). Participants completed the study in a group setting in the Mood Lab computer lab, though they were stationed at individual computers with dividers that provide privacy. A maximum of five participants completed the study at the same time. Participants received a research credit as a partial fulfillment of their introductory psychology course.

The final sample included 401 participants (238 female; 160 male; 1 transgender; 2 did not identify a gender). Participants ranged in age from 17–58 years (M = 18.53, SD = 2.46). Their years of education ranged from 11–17 (M = 12.29, SD = 0.74). Of all the participants in the final sample, 41.5% identified as Caucasian, 22.5% Chinese, 10.3% South Asian, 18.3% as Other, and 6.8% indicated that they were multi-ethnic (by reporting more than one ethnicity). Three participants (0.8%) indicated that they did not know their ethnicity. The majority of participants (72.7%) reported that English was their

first language. Approximately a quarter of participants (22.8%) reported having received therapy or counseling for an emotional or psychological problem (either currently and/or in the past), while a small percentage of participants (7.8%) reported having taken medication for an emotional or psychological problem (either currently and/or in the past).

Materials

Mood Induction Procedures (MIPs). Six MIPs were used in the study. Participants were exposed either to one of three commonly used sad MIPs or to one of three matched-control, neutral MIPs. MIPs were all 7 min in length, and all MIP instructions were provided through over-ear headphones as well as in corresponding text on the computer screen. The experimental conditions (sad MIPs) included a sad music MIP, a sad autobiographical memory MIP, and a combination of both the sad music and sad memory MIPs. The procedures of the three neutral-MIP conditions were identical to those of the sad-MIP conditions, though the content of the memory recalled and/or music listened to was neutrally valenced, rather than sad (see Appendix A for transcripts of the MIP instructions).

Sad Music. Participants listened to the orchestral introduction "Russia under the Mongolian Yoke" by Prokofiev (1934), from the film *Alexander Nevsky*, re-mastered at half speed. Participants were told that the music is meant to create a temporary sad mood, but that the music may affect people differently. Participants were instructed to try to think about or notice the sadness in the music as it played for approximately 7 min.

Sad Memory. Participants were asked to recall, as vividly as possible, a sad event that occurred in their life. They were encouraged to carefully remember and evoke details

about that situation, how they felt, what their thoughts were at the time, and to try to immerse themselves into the mood of that moment as deeply as possible. Participants were instructed to think about this sad event for 3 min, after which they were instructed to type in as detailed a description of the event as possible (for approximately 4 min; participants were not able to move on to the next page until 4 min had passed).

Sad Music+Memory. Participants simultaneously completed the protocol for both the sad music and the sad memory MIPs; that is, participants were provided with the instructions from both MIPs, and they completed the sad memory task while simultaneously listening to the sad music.

Neutral Music. Participants listened to an excerpt from the Largo movement from "Symphony No. 9 in E minor, Op. 95" (commonly known as "New World Symphony") by Antonín Dvořák—a musical piece considered emotionally neutral and commonly used in MIP research (e.g., Pacheco-Unguetti & Parmentier, 2014)—for approximately 7 min. Contrary to the instructions for the sad music condition, participants were told only that they were about to listen to a piece of music and to pay attention to or notice the music as it played for approximately 7 min (i.e., there was no mention of a mood state).

Neutral Memory. Participants were asked to recall, as vividly as possible, an everyday task, errand, or chore that they had completed. They were encouraged to carefully remember and evoke details about that situation. As with the sad memory condition, participants were instructed to think about this event for 3 min, after which they were instructed to type in as detailed a description of the event as possible (for approximately 4 min; again, participants were not able to move on to the next page until 4 min had passed). They were not, however, instructed to remember how they felt or

what their thoughts were nor were they instructed to immerse themselves in the mood of that moment (unlike the participants in the sad memory condition).

Neutral Music+Memory. Participants simultaneously completed the protocol for both the neutral music and the neutral memory MIPs; that is, participants were provided with the instructions from both neutral MIPs, and they completed the neutral memory task while simultaneously listening to the neutral music.

The timing, music, and instructions used in the *experimental* conditions were chosen based on the protocols used most commonly in MIP research conducted by leading depression researchers (e.g., Jarrett et al., 2012; Lethbridge & Allen, 2008; Segal et al., 1999). The timing, music, and instructions used in the *control* conditions were chosen based on protocols that closely resembled sad-MIP protocols. For example, a number of studies that used "Russia Under the Mongolian Yoke" as a sad MIP also used "New World Symphony" as a neutral MIP (e.g., Bates, Thompson, & Flanagan, 1999; Berna et al., 2010; Yeung, Dalgleish, Golden, & Schartau, 2005) and found that the sad MIPs resulted in significant increases in sad mood, whereas the neutral MIPs resulted in no significant changes in mood.

Sad mood. A modified visual analog scale (VAS; Luria, 1975) was used to measure mood. The VAS is a 100-mm line, with anchors of *no sadness at all* on the left end of the line and *most sadness imaginable* on the right (see Appendix B). Participants were instructed to "indicate the degree of sadness [they were] currently experiencing by clicking at the appropriate point on the line." The score for each VAS ranges from 0 to 100 (i.e., the number of millimeters from the left end of the line), with greater scores

indicating greater levels of sad mood. Mood scores were calculated by measuring the distance (in mm) from the left-hand end of the line.

VASs are used widely in depression research employing MIPs and have exhibited strong reliability and validity (e.g., Jarett et al., 2012; Lethbridge & Allen, 2008). The VAS used in the current study differs from the VAS used by Luria (1975) in two ways. First, the anchors were changed to reflect a unipolar measure of sad mood (i.e., a continuum ranging from the absence to the presence of sad mood), rather than a bipolar measure (i.e., a continuum ranging from sad to happy), as this is in line with research suggesting that sad and happy moods are not mutually exclusive and can occur at the same time (Larsen & McGraw, 2014; Larsen, McGraw, & Cacioppo, 2001). It is also in line with the commonly used Visual Analog Mood Scales (VAMS; Stern, 1997), which also employ a unipolar, rather than a bipolar mood scale. Second, instructions to "please answer as quickly and accurately as possible" were added to ensure that participants did not spend too much time ruminating about their mood, thereby potentially intensifying their sad mood (see Thomsen, 2006). The number of seconds that participants spent reporting their mood on each VAS was recorded by the computer program.

Dysfunctional attitudes. The original 100-item Dysfunctional Attitudes Scale (DAS; Weissman, 1979) assesses the degree to which an individual's guiding beliefs are maladaptive (i.e., negative, rigid, and/or perfectionistic). Weissman (1979) refined this scale into two 40-item parallel forms (DAS-A and DAS-B), and the DAS-A has itself been refined into two 9-item parallel short forms (DAS-SF_1, DAS-SF_2; Beevers, Strong, Meyer, Pilkonis, & Miller, 2007). Such DAS short forms are frequently used in MIP research (e.g., Gemar et al., 2001; Jarrett et al., 2012; Lethbridge & Allen, 2008). To

replicate MIP methodologies that are most typical of those used in cognitive vulnerability research, the DAS-SF items were presented immediately prior to and immediately following the MIP. Remaining items from the original 100-item DAS were then presented as filler items in between mood measurements for the 10 minutes following the post-MIP DAS-SF. The number of seconds that participants spent responding to each DAS item was automatically recorded by the computer program.

The original DAS instructed participants to indicate the degree to which they hold dysfunctional attitudes on a 7-point Likert scale (i.e., *totally agree, agree very much, agree slightly, neutral, disagree slightly, disagree very much, totally disagree*). However, Beevers et al. (2007) found that a 4-point response format improved item characteristics on the DAS-SFs and thus adopted this format when the short forms were developed. For consistency, all DAS items were presented in the current study with the 4-point Likert scale used by Beevers et al., which ranges from 1 (*totally agree*) to 4 (*totally disagree*).

The DAS-A is widely used to measure dysfunctional attitudes associated with depression, and most research evaluating the psychometric properties of the DAS has thus focused on the DAS-A, which has demonstrated strong psychometric properties in clinical and nonclinical samples (e.g., Beevers et al., 2007; de Graaf, Roelofs, & Huibers, 2009; Nelson, Stern, & Cicchetti, 1992; Weissman, 1979). Both the DAS-SF_1 and DAS-SF_2 have been shown to highly correlate with the original DAS-A (rs > .90) and have also demonstrated acceptable internal consistency (αs > .80), as well as good convergent and predictive validity (Beevers, Ellis, & Reid, 2011; Beevers et al., 2007). The DAS-SF_1 and DAS-SF_2 exhibited acceptable internal consistency for the current sample (α = .76 and α = .74, respectively).

A total score for each of the 9-item DAS short forms is calculated by reverse-scoring (with the exception of item 3 on the DAS-SF_2) and then summing the items, with possible scores ranging from 9 to 36. Higher total scores reflect greater dysfunctional attitudes. Total scores were not, however, computed for this study, because DAS items were not used as an outcome measure; they were instead used to replicate typical cognitive vulnerability methodology.

Demographics. A questionnaire designed by the researchers for the current study (see Appendix C) was used to determine various demographic (age, gender, ethnicity, and number of years of education, English as first language) and clinical (history of treatment for emotional or psychological problems) characteristics.

Depressive symptoms. The Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) is a 21-item self-report questionnaire used to measure the presence and severity of depressive symptoms in adolescents and adults over the preceding two weeks. Each item is scored on a 4-point scale ranging from 0 (the symptom is completely absent; e.g., *I do not feel sad*) to 3 (the symptom is present and severe; e.g., *I am so sad or unhappy that I can't stand it*). Possible total scores range from 0 to 63, with higher scores indicating greater depressive symptom severity. The BDI-II has demonstrated strong psychometric properties, exhibiting high internal consistency (αs = .90–.91; Dozois, Dobson, & Ahnberg, 1998; Storch, Roberti, & Roth, 2004) and high convergent validity (e.g., r = .77; Storch, et al., 2004) in undergraduate samples; good test-retest reliability for non-psychiatric samples (rs .60–.83); and excellent content, construct, concurrent, and discriminant validity (see Dozois & Covin, 2004, for a review). Consistent with past

research, the BDI-II exhibited excellent internal consistency for the current sample (α = .91).

Participant engagement. A questionnaire designed by the researchers was used to (1) check whether participants in the music conditions (a) heard and listened to the music and (b) experienced a change in the intended affect and/or other affect; (2) assess for potential demand characteristics; and (3) assess whether participants were engaged and/or responded honestly throughout the study, particularly during the MIP (see Appendix D).

Positive Mood Induction Procedure (MIP). A positive MIP was used to ensure that any sad mood effects induced by the sad MIPs were eliminated prior to study completion. Participants watched a 90-second theatrical trailer for the film "The Adventures of Milo and Otis" (Kakutani, Ogata, & Hata, 1986) and were instructed to think about how they would feel if they experienced the situation depicted in the film clip. Previous research suggests that film clips with explicit instructions to enter a specific mood state are the most effective strategy for inducing elated mood (Westermann et al., 1996). This method has previously been shown to be effective in restoring participants' mood to initial levels following a negative MIP (Dearing & Gotlib, 2009).

Procedure

After providing their informed consent, participants were directed to a room in the Mood Lab with six computer stations; each station had dividers that provided privacy. Participants completed the entire study online at their workstation with over-ear headphones, which helped to minimize distractions as well as prevent participants from knowing that there were different study conditions (i.e., conditions that included music

versus those that did not). Upon opening the link to the study, participants were randomly assigned to one of the six conditions.[1]

To increase the likelihood that participants paid attention to and engaged with the MIP, they were first presented with a brief video description of the importance of actively engaging in the study and were asked to put away distracting items. All participants then completed the visual analog scale (VAS) mood rating to assess baseline mood. They then completed one of the two 9-item Dysfunctional Attitudes Scale (DAS) Short Forms (i.e., DAS-SF_1 or DAS-SF_2) before completing another VAS (to assess whether simply completing a DAS-SF has an effect on mood ratings) and then completing their assigned MIP. Participants completed a third VAS immediately following the MIP, and then completed the alternate DAS-SF; this was counterbalanced, such that half of the participants in each condition were presented with the DAS-SF_1 *prior to* the MIP and with the DAS-SF_2 *following* the MIP, and vice versa for the other half of the participants.

Participants then completed the remaining 82 items from the original, 100-item DAS as filler items, with intermittent mood ratings on VASs at 2, 4, 6, 8, and 10 min post-MIP. Parallel forms of the DAS are frequently used in cognitive vulnerability research, typically with DAS items presented prior to and then following the sad MIP. The current study used the DAS items in the same way to replicate the most commonly used methodology and procedures of cognitive vulnerability studies in order to maximize ecological validity. It was thus important to ensure that all participants completed DAS items throughout the 10-minute period following the MIP during which mood was

[1]Because the three neutral MIP conditions were included only to evaluate whether repeated measurement of mood affects mood ratings, fewer participants were required for the neutral MIP conditions. Random assignment therefore occurred based on a group stratification that considered the nonequivalent proportion of participants in the experimental versus control groups.

measured. Therefore, for participants who completed the DAS items following the MIP in less than 10 min, the computer randomly selected and presented DAS items for the remainder of the 10-minute period.

Following the completion of this portion of the study, participants completed a demographic questionnaire, the NEO-Five Factor Inventory (NEO-FFI), the Ruminative Response Scale (RRS), and the BDI-II. The ordering of these scales was counterbalanced within each of the six conditions. The NEO-FFI and RRS were included as part of the study design to answer research questions outside the scope of this thesis. Finally, participants completed the participant engagement measure and then underwent a positive MIP to ensure their moods returned to initial levels.

Participants were then individually debriefed with respect to the purpose of the study and were provided with course credit for participation.[2] The entire study took approximately 1 hour to complete.

Results

Preliminary Analyses

Demographic and clinical characteristics of the six MIP groups are presented in Table 1 and Table 2. Participants did not differ significantly in age, $F(5, 395) = 0.23$, $p = .951$; years of education, $F(5, 394) = 0.50$, $p = .778$; or BDI-II scores, $F(5, 394) = 1.20$, $p = .311$, across the six MIP conditions. As indicated in Table 2, participants similarly did not differ significantly across the six MIP conditions by gender, ethnicity, English as a first language, history of therapy/counselling, or history of taking medication for an emotional or psychological problem.

[2] Research assistants were extensively trained on a debriefing protocol designed to ensure that no participant left feeling sad or distressed. The protocol can be obtained by emailing jgilli24@uwo.ca.

Table 1

Continuous Demographic and Clinical Variables by MIP Condition

	Sad Music (n = 97)		Sad Memory (n = 102)		Sad Memory+Music (n = 98)		Neutral Music (n = 35)		Neutral Memory (n = 35)		Neutral Memory+Music (n = 34)	
Variable	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)
Age	18.67	(4.17)	18.60	(1.89)	18.53	(1.80)	18.49	(1.12)	18.29	(0.79)	18.26	(0.62)
Education	12.21	(0.61)	12.36	(0.77)	12.29	(0.86)	12.34	(0.80)	12.29	(0.79)	12.24	(0.50)
BDI-II	14.38	(9.54)	14.88	(10.09)	13.96	(9.28)	14.86	(10.06)	15.83	(10.25)	10.82	(9.60)

Note. BDI-II = Beck Depression Inventory-II. Education = years of completed education.

Table 2
Discrete Demographic and Clinical Variables by MIP Condition and Differences Across Conditions

Variable	Sad Music (n = 97) %	Sad Memory (n = 102) %	Sad Memory+Music (n = 98) %	Neutral Music (n = 35) %	Neutral Memory (n = 35) %	Neutral Memory+Music (n = 34) %	Test Statistic	p
Gender							[a]χ^2 (15) = 8.51	.902
Female	61.9	54.9	61.2	54.3	54.3	70.6		
Male	37.1	43.1	38.8	45.7	45.7	29.4		
Transgender	0.0	1.0	0.0	0.0	0.0	0.0		
Not specified	1.0	1.0	0.0	0.0	0.0	0.0		
Ethnicity							[a]χ^2 (25) = 23.82	.530
Caucasian	39.2	39.2	44.3	34.3	40.0	55.9		
Chinese	29.9	16.7	21.6	31.4	17.1	17.6		
South Asian	10.3	15.7	8.2	8.6	5.7	5.9		
Multi-ethnic	8.2	6.9	5.2	8.6	5.7	5.9		
Other	12.4	20.6	18.6	17.1	31.4	14.7		
EFL	71.1	70.3	77.9	67.6	71.4	75.8	[a]χ^2 (5) = 2.32	.803
Therapy	25.8	28.0	14.9	20.0	17.6	29.4	[a]χ^2 (5) = 6.86	.231
Medication	9.3	9.0	10.3	2.9	5.7	0.0	[a]χ^2 (5) = 5.63	.344

Note. MIP = mood induction procedure. EFL = English as first language. Therapy = history of therapy/counselling for an emotional or psychological problem. Medication = history of medication for an emotional or psychological problem.
[a]Analyses had insufficient cell sizes (expected count of less than 5), and results should therefore be interpreted with caution.

In fact, the means and proportions for these variables were, for the most part, very similar. Thus, none of these variables were included as covariates in any of the analyses.

Preliminary analyses conducted to examine any patterns of missing data indicated that less than 5% of data points were missing. Inspection of these missing data points and their distribution indicated that there was no reason to believe that these data were not missing at random. Most procedures used to manage missing data yield similar results when a large data set is missing less than 5% of data points that are distributed randomly (Tabachnick & Fidell, 2013). Listwise deletion was therefore used for all analyses conducted in SPSS Version 25. Analyses conducted in Mplus (Muthén & Muthén, 1998–2011) employed missing data estimation techniques using maximum likelihood.

Primary Analyses

How long does an MIP-induced sad mood last? The trajectories of the observed mean mood scores for each of the six MIP conditions (at all eight time points) are presented in Figure 1. As previously mentioned, a variety of criteria are used in cognitive vulnerability research to operationally define a successfully induced sad mood. The assessment of how long an MIP-induced sad mood lasts thus varies depending on the operational definition used. Duration of a sad mood was therefore assessed in three different ways, namely by using three commonly used operational definitions of a successful sad mood induction. One of the most commonly used criteria is that pre- and post-MIP VAS scores significantly differ. Therefore, for each of the three sad MIP conditions, six paired-samples *t* tests were conducted to compare each of the mean post-MIP VAS scores to the mean pre-MIP VAS score to determine the time points at which those mean VAS scores differed.

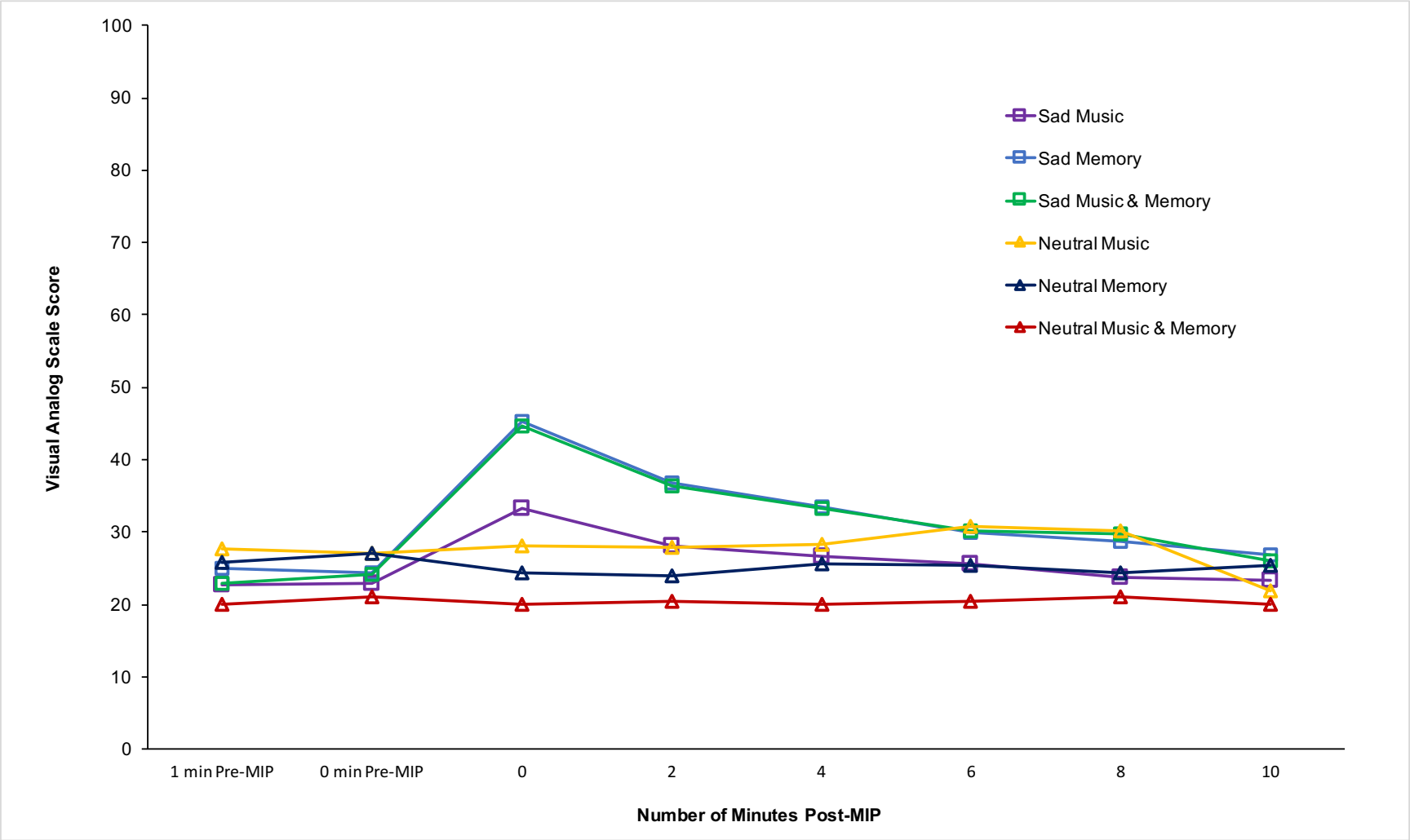

Figure 1. Observed visual analog scale (VAS) score group means for each of the six MIP conditions at all 8 time points (i.e., at 1 min pre-MIP, immediately prior to the MIP, and at 0, 2, 4, 6, 8, and 10 min post-MIP).

(Detailed results of these analyses are presented in Appendix E.) Table 3 shows the time points at which the mean post-MIP VAS scores do and do not significantly differ from the mean pre-MIP VAS scores, separately for each of the three sad MIP conditions.

A second commonly used criterion for operationalizing a successful sad mood induction is that the mean MIP mood scores of participants who were exposed to a sad MIP differ significantly from the mean MIP scores of those who underwent a control or neutral MIP following (but not prior to) the MIP (e.g., Beevers & Meyer, 2008; Ingram & Ritter, 2000). Therefore, in order to determine the time points at which the MIP successfully induced a sad mood according to this criterion, a series of three one-way ANOVAs were conducted to compare the mean VAS scores of each of the three sad MIP conditions with the mean VAS score of a combined neutral condition prior to and also at 0, 2, 4, 6, 8, and 10 min post-MIP. (The rationale and analyses to support the use of a single, combined neutral condition are provided in Appendix F. Details of these analyses are presented in Appendix G.) Table 3 presents the time points at which the mean VAS scores of the sad MIP conditions do and do not significantly differ from the mean VAS scores of the combined neutral MIP condition, separately for each of the three sad MIP conditions.

A third criterion for operationalizing a successful sad mood induction that has been used in sad-MIP research is a minimum absolute change on the mood measure from pre- to post-MIP. Minimum changes in mood of 10 mm and 20 mm on a VAS have been used in cognitive vulnerability research to indicate the success of a sad MIP (e.g., Martin, 1990; Newman & Sears, 2015; Singer & Dobson, 2007; Teasdale & Fogarty, 1979).

Table 3

Time Points Post-MIP at Which a Sad Mood is Considered Effectively Induced, According to Commonly Used Operational Definitions

	Minutes Post-MIP					
Criterion	0	2	4	6	8	10
Sad Music MIP						
Significant difference pre- vs. post-MIP	***	***	*			
Significant difference sad vs. neutral MIP	**					
Absolute change of ≥ 10 mm pre- to post-MIP						
Absolute change of ≥ 20 mm pre- to post-MIP						
Sad Memory MIP						
Significant difference pre- vs. post-MIP	***	***	***	***	**	*
Significant difference sad vs. neutral MIP	***	***	**			
Absolute change of ≥ 10 mm pre- to post-MIP						
Absolute change of ≥ 20 mm pre- to post-MIP						
Sad Music+Memory MIP						
Significant difference pre- vs. post-MIP	***	***	***	**	**	
Significant difference sad vs. neutral MIP	***	***	**			
Absolute change of ≥ 10 mm pre- to post-MIP						
Absolute change of ≥ 20 mm pre- to post-MIP						

Note. MIP = mood induction procedure. Blue cells and red cells indicate whether the sad mood was considered induced (blue) or was not considered induced (red) according to the specific operational definition used at a particular time point. For criteria that relied on statistical significance, asterisks denote the *p*-value at which the test indicated a statistically significant difference.
*$p < .05$. ** $p < .01$. *** $p < .001$.

The time points at which a sad mood is and is not deemed to be induced (at the *group* level) based on the criterion of a minimum absolute change in mood pre- to post-MIP of 10 mm and 20 mm are presented in Table 3, separately for each of the three sad MIP conditions. At the individual level, the percentage of participants for whom a sad mood was successfully induced based on these two operational definitions (i.e., a 10- or a 20-mm change in mood pre- to post-MIP) at each of the post-MIP time points is presented in Table 4. (Details of these analyses are presented in Appendix H.)

What are the shapes of the trajectories, and do the shapes of these trajectories differ based on the type of MIP used? Latent Growth Modeling (LGM) analyses were conducted to answer the latter two research questions: (2) what are the shapes of the trajectories? and (3) do the shapes of these trajectories differ based on the type of MIP used? The analyses were conducted using Mplus version 7 (Muthén & Muthén, 1998–2011). The Mplus procedure provides missing data estimation techniques using maximum likelihood. With this procedure, all available data are used to obtain the best parameter estimates. Trajectories were therefore estimated using all available data (rather than listwise deletion) for 401 participants (297 when only sad MIP conditions were included and 104 when only neutral MIP conditions were included), even when some of these participants had one or more missing VAS scores. A multi-group approach was used to determine and compare the estimated trajectories of the mood effects for the 10 minutes following the three sad MIPs. That is, the three experimental (i.e., sad MIP) conditions were defined as groups in the model, with each group consequently having its own trajectory and thus its own shape (including elevation, linear trend, and curvature).

Table 4

Percentage of Participants Experiencing a Successfully Induced Sad Mood at each Post-MIP Time Point, According to the Operational Definitions of at least a 10-mm and at least a 20-mm Absolute Change in Mood Pre- to Post-MIP

	Minutes Post-MIP					
Condition	0	2	4	6	8	10
	Absolute Change of ≥ 10 mm Pre- to Post-MIP					
Music MIP (*n* = 97)	45	28	25	23	24	22
Memory MIP (*n* = 102)	69	50	36	27	27	23
Music+Memory MIP (*n* = 98)	71	48	41	36	34	27
	Absolute Change of ≥ 20 mm Pre- to Post-MIP					
Music MIP (*n* = 97)	23	12	10	11	10	14
Memory MIP (*n* = 102)	44	32	22	13	10	08
Music+Memory MIP (*n* = 98)	46	32	25	19	19	11

Note. MIP = mood induction procedure. The darkest blue cells indicate percentages ≥ 50 < 75; the medium blue cells indicate percentages ≥ 25 < 50; the lightest blue cell cells indicate percentages ≥ 0 < 25.

LGM with multiple groups is conceptually quite similar to a split-plot factorial ANOVA but has the advantage of additionally providing estimated lines of best fit for the trajectories (i.e., trend lines). (In ANOVA, this can be done with polynomial contrasts, but this method lacks the benefits of the maximum likelihood approach.) Therefore, an LGM of the three sad MIP conditions was first estimated to examine overall group growth trajectories. In this first model, the MIP VAS score immediately preceding the MIP was specified as a covariate to control for reported mood prior to the MIP. Although there were no significant between-group differences on the pre-VAS score, it was still included as a covariate to control for any minor differences.

Three latent variables were specified for each of the three groups included in this model (i.e., the three sad MIP conditions)—the intercept, the slope, and the quadratic component. The *intercept* represents the start point of the trajectory (in this model, 0 min post-MIP). It has a mean that expresses whether the mean start point differs significantly from zero and a variance that indicates the extent to which participants differ at the start point of their trajectory. The *slope* assesses the extent to which a linear component of the trajectory is present. Like the intercept, the slope has a mean that expresses whether a significant mean linear trend exists and a variance that expresses the individual differences in slopes. The *quadratic* component assesses the extent to which a quadratic component of the trajectory was present. As with the other two latent variables, the quadratic component has a mean that expresses whether a significant mean curve component exists and a variance that conveys individual differences in this quadratic component.

The model had a $\chi^2_{(57)} = 261.01$, $p < .001$, CFI = .93, RMSEA = .19 [90% CI = .17 to .21], and SRMR = .18.[3] For continuous data, CFI values greater than or equal to .95 and RMSEA and SRMR values less than .06 and .08, respectively, indicate a good-fitting model in structural equation models. In LGM, the fit indices are influenced by how closely the observed trajectories overlap with the estimated linear and quadratic trajectories. Any deviations at any particular time point between the observed score and the line of best fit will reduce the fit indices. Thus, although the fit indices would suggest that the model does not fit well, the source of misfit is likely the result of individual scores that deviate from the line of best fit. Such minor deviations can lead to such poor indices of fit (P. Tremblay, personal communication, June 1, 2018). Inspection of the trajectories of the estimated and observed means for the three conditions (see Figure 2) demonstrates that the model trajectories (with their decreasing linear trend with a curvature) do fit the observed data fairly well.

As previously mentioned, a significant intercept mean indicates that the start point of the estimated line is significantly different from 0. A significant slope mean indicates that the best-fitted line has a significant linear component, and a significant quadratic component mean indicates that the line of best fit is best described as having a significant quadratic component.

[3] The output for this model reported a warning that the residual covariance matrix for each of the three groups was not positive definite. The output stated that "this could indicate a negative variance/residual variance for an observed variable, a correlation greater or equal to one between two observed variables, or a linear dependency among more than two observed variables" and that the issue was with the 10-min post-MIP VAS score. This warning is, however, known to occur sometimes when a quadratic component is specified in the model and is also inconsequential for the current study, as standard errors were not used in these analyses.

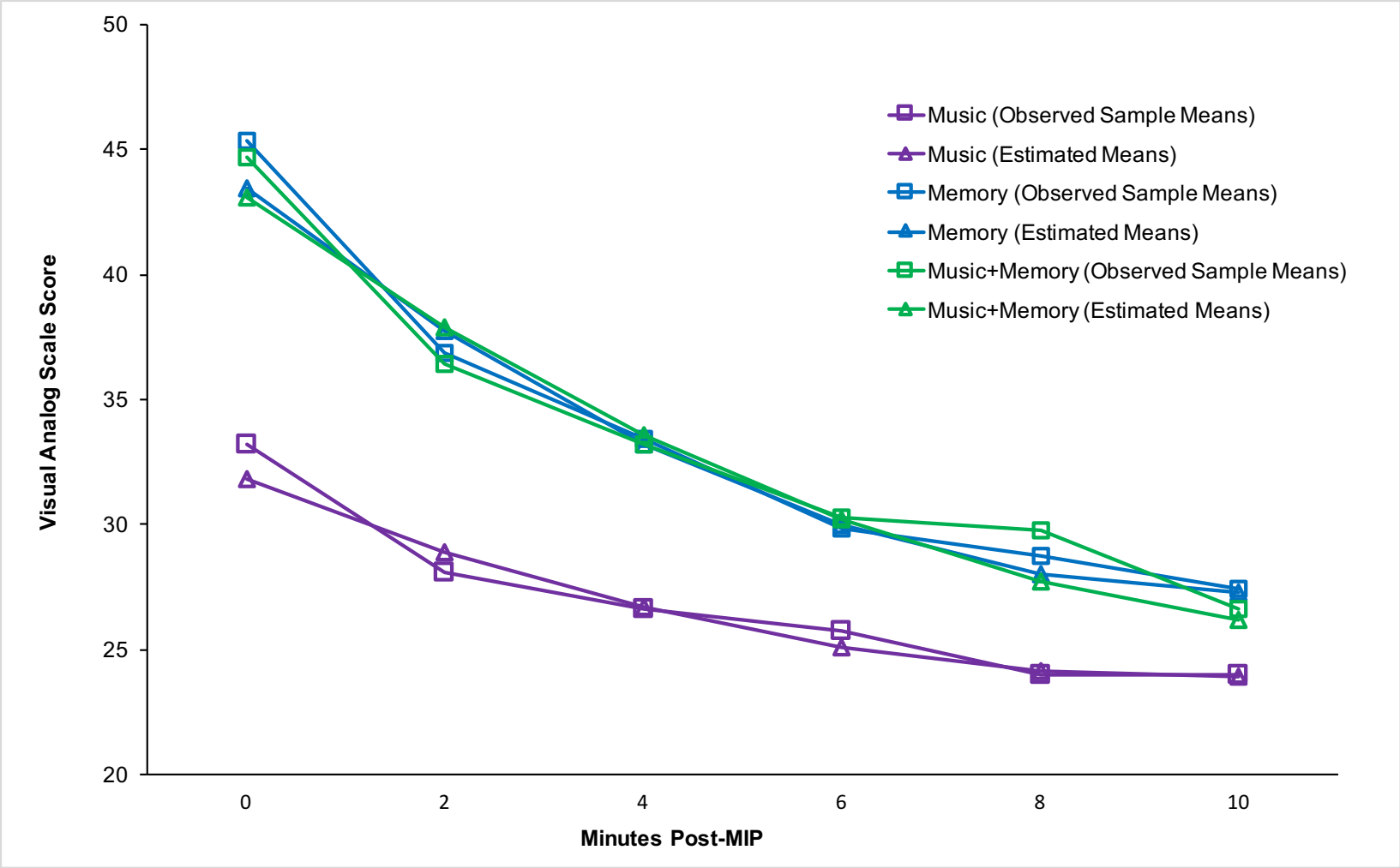

Figure 2. Observed and estimated visual analog scale (VAS) score means for the three sad MIP conditions at all post-MIP time points.

Significant intercept/slope/quadratic component variances indicate that there is substantial variance in the intercepts/slopes/quadratic components of individual participants within each of the sad MIP conditions. The intercepts, slopes, and quadratic components of the means and the variances for each of the sad MIP conditions are presented in Table 5 (means) and Table 6 (variances). As can be seen in these tables, the lines of best fit for each of the three sad MIP conditions all have significant intercept, slope, and quadratic component means and variances. The regression coefficient for the covariate (i.e., the pre-MIP VAS score) for each of the sad MIP conditions was also significant (.75, .78, and .51, for the music, memory, and music+memory conditions respectively, *p*s < .001), indicating that, for a one unit increase in the pre-MIP VAS score, there was a .75, .78, or .51 increase in the intercept (i.e., the mean VAS score at 0 min post-MIP) for the music, memory, and music+memory conditions, respectively.

Table 5

Latent Growth Modeling Estimated Variable Means for each Sad MIP Condition

	Intercept		Slope		Quadratic Component	
Condition	*M*	*p*	*M*	*p*	*M*	*p*
Music	14.70	< .001	-3.23	< .001	0.33	.014
Memory	24.45	< .001	-6.39	< .001	0.63	< .001
Music+Memory	30.83	< .001	-5.64	< .001	0.45	.003

Note. MIP = mood induction procedure.

Table 6

Latent Growth Modeling Estimated Variable Variances for each Sad MIP Condition

	Intercept		Slope		Quadratic Component	
Condition	σ^2	*p*	σ^2	*p*	σ^2	*p*
Music	113.58	< .001	40.68	< .001	1.31	< .001
Memory	159.17	< .001	37.08	.001	1.42	< .001
Music+Memory	274.23	< .001	51.31	< .001	1.53	< .001

Note. MIP = mood induction procedure.

Statistical Comparisons of the Trajectories Across Groups

To compare whether the trajectories for the three sad MIPs were significantly different, a nested models comparison procedure for the LGM multi-group analyses—akin to a series of ANOVAs with follow-up testing—was conducted. In the previous analyses, each group had its own intercept, slope, and quadratic component. To determine whether these components differ across groups, one can run models in which certain parameters (e.g., the intercept) are constrained to be identical across groups. This will lead to some level of misfit. A nested chi-square test that compares whether the misfit is significant can be used. This is an indirect method of obtaining a test statistic that indicates whether groups differ on this constrained parameter (e.g., the intercept). The same procedure can be repeated, instead constraining other parameters (e.g., the slope or the quadratic component). Therefore, for the first post-MIP time point (i.e., 0 min post-MIP), an omnibus test was conducted wherein the LGM model that was used to determine the initial fit indices was re-run, but the three intercepts of the three conditions were constrained or "forced" to be the same. A χ^2 difference test was then conducted using the χ^2 value from the initial analysis and the χ^2 value from this "forced" omnibus test. A significant χ^2 difference denotes that the model that forces the three intercepts to be the same produces a significantly worse fit than the model that allows the intercepts to differ. This indicates that at least two of the groups have significantly different intercepts. Just as a significant ANOVA is followed up with post-hoc tests, when forced omnibus tests were significant, three post-hoc tests were conducted: The original LGM analysis was re-run three times, each time constraining a different set of two of the intercepts of two of the three conditions to be the same (i.e., the intercepts for [1] the music condition

and the memory condition, [2] the music condition and the music+memory condition, and [3] the memory condition and the music+memory condition). Three χ^2 difference tests were then conducted, each comparing the χ^2 values of these three forced post-hoc models to the χ^2 value from the initial, unforced model. A significant χ^2 difference value for one of these post-hoc models would denote a significantly worse fit, thus indicating that the intercepts of the two conditions differ significantly. A nonsignificant difference would indicate that the intercepts of the two conditions are not significantly different.

A similar series of analyses (i.e., a forced omnibus model, followed up by 3 post-hoc "forced" models) was repeated for each of the remaining post-MIP time points (i.e., at 2, 4, 6, 8, and 10 min post-MIP) to evaluate whether the intercepts of these remaining post-MIP time points significantly differed across groups. The parameters in these analyses differed slightly from the one described above. Specifically, unlike the models used to compare the estimated 0-min post-MIP VAS scores, the models used to compare the estimated 2-, 4-, 6-, 8-, and 10-min post-MIP VAS scores did not include the covariate (i.e., the pre-MIP VAS score). Because the remaining post-MIP VAS scores were not regressed on the covariate, the models used to compare the intercepts at 2+ min post-MIP should not include the covariate. An unconditional, unforced LGM model was therefore run without a covariate. The χ^2 value from this analysis was then used as the baseline to which the χ^2 values from the subsequent forced omnibus and post-hoc analyses could be compared.

These analyses indicated that the intercepts of the sad music condition differed significantly from the intercepts of both the memory and the music+memory conditions at 0, 2, and 4 min post-MIP. The intercepts of the memory condition and the

music+memory condition did not significantly differ at any time point, and none of the intercepts significantly differed across conditions at 6, 8, and 10 min post-MIP.[4] Detailed results of these analyses are presented in Appendix I.

The same procedure was again repeated to compare whether the slopes of the three MIP conditions significantly differed. That is, in an omnibus test, the three slopes of the three MIP conditions were forced to be the same. A χ^2 difference test was then conducted using the χ^2 value from the initial, unconstrained model (which included the covariate) and the χ^2 value from this forced omnibus test. (The covariate was specified in the models used for this series of tests.) Again, a significant χ^2 difference would indicate that constraining the slopes of the three groups to be the same results in a significantly worse model fit, indicating that at least two of the groups have significantly different slopes. The omnibus χ^2 difference test was indeed significant, so it was followed up by three post-hoc tests comparing slopes of (a) the music condition to the memory condition, (b) the music condition to the music+memory condition, and (c) the memory condition to the music+memory condition. As can be seen in Appendix J, the slopes of the music MIP and memory MIP conditions differ significantly. Inspection of Figure 2 and Table 5 reveals that the slope of the memory condition is steeper than the slope of the music condition.

This same procedure was again repeated (specifying the covariate in the model) to compare whether the quadratic components of the three MIP conditions significantly

[4] It should be noted that such comparisons conducted in LGM are done so using the estimated—and not the observed—means. However, a series of one-way ANOVAs, which compared observed means, indicated the same pattern of results.

differed. These analyses indicated that the quadratic components did not significantly differ across groups, $\Delta\chi^2_{(2)} = 2.27$, $p > .05$.

Discussion

As previously mentioned, a major assumption made by researchers studying cognitive vulnerability to depression is that MIPs commonly used in depression research induce sad moods that persist for the entirety of the tasks or measures of interest. To test this assumption, this study aimed to answer three questions: (1) How long does an MIP-induced mood last; (2) what are the shapes of the trajectories; and (3) do the shapes of these trajectories differ based on the type of MIP used?

Determining how long an MIP-induced sad mood lasts depends on how an MIP-induced mood is operationally defined. As previously discussed, cognitive vulnerability researchers have used a variety of criteria to operationally define an MIP-induced sad mood, including (1) a statistically significant change in mood pre- to post-MIP, (2) a statistically significant difference between the post-MIP mood scores of participants exposed to a control versus a sad MIP, and (3) a pre-determined absolute VAS change from pre- to post-MIP (either at the group or at the individual level).

For participants assigned to the music MIP condition, a sad mood was not effectively induced for longer than 4 min post-MIP, regardless of the operational definition used (see Table 3). Additionally, when using the criterion of at least a 10 mm change pre- to post-MIP, less than half of participants assigned to the music MIP would be considered as exhibiting an effectively induced sad mood immediately following the MIP. When the minimum pre- to post-MIP change value of 20 mm was used, only 23%

of participants would have been considered as displaying an effectively induced sad mood immediately following the MIP.

For participants assigned to the memory MIP condition, a sad mood could be considered effectively induced anywhere between 0 and 10 min post-MIP, depending on the operational definition used (see Table 3). When using the criterion of at least a 10 mm change pre- to post-MIP, 69% of participants assigned to the memory MIP would be considered as reporting an effectively induced sad mood immediately following the MIP. When the minimum pre- to post-MIP change value of 20 mm was used, 44% of participants would have been considered as displaying an effectively induced sad mood immediately following the MIP.

Finally, for participants assigned to the music+memory MIP condition, a sad mood could be considered effectively induced anywhere between 0 and 8 min post-MIP, depending on the operational definition used (see Table 3). Similar to participants in the memory MIP condition, 71% of participants assigned to the music+memory MIP would be considered as displaying an effectively induced sad mood, when using the criterion of at least a 10 mm change pre- to post-MIP. When the minimum pre- to post-MIP change value of 20 mm was used, 46% of participants would have been considered as displaying an effectively induced sad mood immediately following the MIP.

The length of time for which a sad mood is considered to have been effectively induced following a sad MIP thus varies according both to the type of MIP used and to the criterion used to operationally define an effectively induced sad mood. The general finding, however, is that MIP-induced sad moods do not persist for a sufficient amount of

time for most participants to complete the tasks or measures that are frequently used in cognitive vulnerability research to assess the outcome variable of interest.

The trajectory of the induced sad mood for the entire experimental sample is best described as a substantial increase from pre- to post-MIP, with a steep decrease in sad mood within the first 2 min following the MIP, and a slightly more gradual decrease from 2 min post-MIP to 10 min post-MIP.

Finally, the trajectories of the MIP-induced moods did indeed differ significantly based on the type of MIP used. Specifically, individuals in the sad music MIP had a much smaller increase in sad mood following the MIP than did both those in the sad memory MIP and those in the sad music+memory MIP, who had almost identical trajectories (see Figure 1 and Figure 2). The trajectory of the sad music MIP mood effect continued to differ significantly from the trajectories of the other two experimental conditions until 4 min post-MIP, after which none of the three trajectories differed significantly from each other, or from the combined neutral condition.

Music MIP

The sad mood trajectories of the music+memory and memory-only conditions were nearly identical, but the initial increase in sad mood following the music MIP was much smaller than the initial increase in sad mood following the other two sad MIPs. This finding suggests that the autobiographical memory component of the music+memory MIP drove the sad mood effect of the music+memory MIP and that the musical component did not add any meaningful mood induction effect.

This finding is in direct contrast to early research suggesting that music, and RUTMY in particular, is an effective sad MIP (e.g., Clark, 1983; Clark & Teasdale,

1985; Clark, Teasdale, Broadbent, & Martin, 1983; Martin, 1990; Westermann et al., 1996). For example, in her review of MIPs, Martin (1990) cites three studies ("Clark and Teasdale, 1985; Clark, Teasdale, Broadbent, & Martin, 1983; and Martin, Harrison, & Clark, in preparation" p. 677) that support her assertion that musical MIPs "give rise to a level of reported depressed/despondent emotion equivalent to an intermediate clinical level" (p. 678). A closer examination of the methodology and statistical analysis in these early studies, however, provides a better understanding of the contrast between results of the current study and earlier work in the literature (such as that reviewed by Martin, 1990).

For instance, the first study Martin cites is Clark and Teasdale's (1985) investigation of the constraints on the effects of mood on memory. Like the participants in the music condition in the current study, participants in Clark and Teasdale's study listened to RUTMY (played at half speed) for 7 min. Clark and Teasdale used a measure of sad mood (i.e., a 105-mm line ranging from *I do not feel at all despondent* to *I feel extremely despondent*) similar to the one used in the current study (i.e., a 100-mm line ranging from *no sadness at all* to *most sadness imaginable*). Mean scores of despondency in Clark and Teasdale's study were approximately 25 prior to and 60 following the sad MIP, which is contrasted with mean scores of approximately 23 and 33 in the current study.

The second article Martin cites does not describe the MIP used and states only that "a musical mood induction was used" (Clark, et al., 1983, p. 176). Given the overlap of the authors of these three cited articles, however, it is likely that the same MIP and the same MIP instructions used in Clark and Teasdale's (1985) study were used in Clark et

al.'s (1983) study. Clark et al. did not report pre-MIP ratings of mood but did report an average post-MIP mood score of 54 (on a similar VAS ranging from 0 *I do not feel at all despondent* to 100 *I feel extremely despondent*). This post-MIP VAS score of 54 is considerably higher than the post-MIP VAS score of 33 found in the current study.

One notable difference between the two cited studies and the current study was in the MIP instructions: The instructions in the Clark and Teasdale study "stressed that the music would not automatically put [participants] into a depressed (or happy) mood and that [participants] would have to try really hard to get into the mood, using whatever means they found most effective" (p. 1598). As previously mentioned, it is likely that these same instructions were also presented in the Clark et al. study. Additionally, in the Clark et al. study, only participants "whose self-ratings of mood changed in the predicted direction and [who] stated in the postexperiment questionnaire that their moods had genuinely changed" (p. 176) were included in the analyses. Presumably, the reported mean post-MIP VAS scores therefore do not include the scores of participants who were not effectively induced into a sad mood.

The third study cited in Martin's (1990) review—Martin, Harrison, & Clark (in preparation)—could not be located. To reiterate, Martin cited three studies as support for the assertion that musical MIPs result in a sad mood comparable to that seen in mild to moderate depression. A close examination of the two available studies (i.e., Clark & Teasdale, 1985; Clark et al., 1983), however, reveals the possibility that Martin's assertion may be an overstatement, as the associated MIP instructions and criteria for inclusion in statistical analyses may be inflating these sad mood scores.

The potential for inflation of sad mood scores in early MIP studies seems to be supported by other research. For example, a meta-analysis by Westermann et al. (1996) found that—contrary to previous research—music MIPs, while moderately effective, are not *the* most effective class of MIPs. Westermann and colleagues offered a number of potential explanations for why the effectiveness of MIPs (including musical MIPs) may have been overestimated in the literature, including demand characteristics and "file-drawer" effects. With regard to demand characteristics, these researchers found that effect sizes decreased as the number of controls for demand characteristics increased. This result suggests that specifically asking participants to enter a particular mood state may inflate reported mood, which may lead to the overestimation of MIP effectiveness.

With regard to the issue of file-drawer effects, the authors noted that effect sizes were considerably smaller in studies whose purpose was to specifically examine the effectiveness of MIPs compared to studies that employed MIPs in their design to test the effect of mood on a particular outcome variable (Westermann et al., 1996). The authors speculate that this is likely because studies that rely on MIPs to induce mood for the purpose of studying a particular outcome variable would not be published if the MIP was not effective in inducing the mood. In contrast, a study investigating the effectiveness of an MIP that finds small or zero effect sizes is still important and publishable. Thus, the file-drawer effect is likely also contributing to the overestimation of MIP effectiveness generally, which would include the effectiveness of musical MIPs and RUTMY, specifically.

Thus, the results of the current study may be more consistent with previous research than it would seem at first glance. Indeed, a study investigating the effectiveness

of the Velten and a musical MIP (Slyker & McNally, 1991) found that only approximately 50% of participants who listened to RUTMY (played at half speed) met the criterion of a minimum 10-mm or 20-mm increase on a VAS. This is fairly consistent with the results of the current study, which found that 45% and 23% of participants in the music MIP met the 10- and 20-mm VAS increase criteria, respectively.

It would seem, then, that the finding in this study that RUTMY (played at half speed) is not particularly effective at inducing a sad mood is, in fact, consistent with previous research. That is, the effectiveness of RUTMY (played at half speed) may initially have been overstated by early researchers, owing to a combination of specific methodological factors, demand characteristics, inclusion criteria for statistical procedures, and file-drawer effects.

One distinction that cannot be made based on the findings of this study is whether music—or whether RUTMY, specifically—is not a particularly effective MIP. It could be, for example that many individuals do not consider RUTMY played at half speed to be sad. If this were the case, the sad mood trajectory would be attenuated by those participants who did not experience the music as sad. That is, the music MIP—when the musical piece is considered sad—may actually induce a sad mood commensurate to that of the memory MIP. However, because the musical piece is considered sad by only a small percentage of participants, their pre- to post-MIP mood change would be obscured by the lack of change in mood experienced by the participants who did not find the music sad.

This explanation is supported by three main findings of follow-up analyses: First, of the participants who listened to RUTMY as part of their MIP, only 57% endorsed the

music as sad. Second, when excluding participants who did *not* endorse the music as sad, post-MIP VAS scores did not differ significantly among the three sad MIP groups. Third, participants in the music MIP condition who did *not* endorse the music as sad had significantly lower post-MIP VAS scores than (a) those in the memory MIP condition and (b) those in the music MIP condition who *did* endorse the music as sad. (See Appendix K for details of these follow-up analyses.)

These findings therefore support that possibility that RUTMY played at half speed may produce a less effective sad mood effect because it is considered sad by only a small proportion of participants. Again, conclusions regarding whether this may or may not be the case with other musical MIPs cannot be drawn from the results of this study.

In summary, RUTMY did not induce as potent or as persistent a sad mood as did the autobiographical memory MIP and was successful in a substantially smaller percentage of participants (45% vs. 69% immediately post-MIP; using 10-mm as the criterion). Although more research is needed to demonstrate the robustness of these findings and to determine whether the weaker sad mood trajectory of the music MIP is representative of other musical MIPs, there are additional reasons that would caution against the use of musical MIPs in cognitive vulnerability research. From an empirical perspective, the effectiveness of musical selections may vary over time, across cultures, and across individuals. Researchers who use musical MIPs in their design therefore run the risk of having a greater number of participants for whom the MIP is ineffective, which could result in underpowered analyses or could require recruitment of a greater number of participants. Additionally, if musical preferences change over time and across

cultures, the replication and comparison of the results of studies from different time periods and different cultures becomes problematic.

Additionally, the use of sad musical MIPs—in cognitive vulnerability studies in particular—is not as theoretically supported as other classes of MIPs. If the purpose of inducing a sad mood and measuring the effects of that mood is to use the results to understand cognitive vulnerability to depression, then researchers should be inducing sad mood in a way that is as conceptually similar as possible to the way in which those moods would be induced in real life. There is considerable empirical evidence that stressful life events, for example, predispose an individual to depressive relapse, particularly events associated with loss, failure, or rejection (e.g., Hammen, 1991; Monroe, Rohde, Seeley, & Lewinsohn, 1999; Kendler, Hettema, Butera, Gardner, & Prescott, 2003; Kendler, Thornton, & Gardner, 2000, 2001; Simons, Angell, Monroe, & Thase, 1993). These empirical findings are consistent with ANTs. For example, according to ANTs, for a vulnerable individual who has been romantically rejected several times, being fired from a job would not only lead to feelings of sadness for that loss but would also directly activate related memory nodes that involved failure, rejection, and loss. Activation would then also spread from these memory nodes to the sadness node (because these related memory nodes would have previously occurred within the context of significant activation of the sadness node and would thus have been strongly associatively linked within the cognitive structure). Thus, activation of the sadness node as a result of being fired from a job would occur both directly from current inherent feelings of sadness as well as indirectly through spreading of activation from related activated memory nodes.

Because ANTs would dictate that both the sadness node and such memory nodes would be closely and strongly associated with the depressogenic information-processing biases that cognitive vulnerability researchers are interested in, theory would support the use of an MIP that induces a pattern of activation that most closely resembles that which would occur when an individual is faced with a stressful life event. A musical MIP, which would act directly on only the sadness node, would not induce such a pattern of activation. Thus, not only are musical MIPs fraught with methodological and empirical issues, their use is also less theoretically supported. Autobiographical memory MIPs that ask participants to recall a memory involving a loss, rejection, or failure would more closely resemble the proposed real-world pattern of activation.

Memory and Music+Memory MIPs

The results from this study are consistent with the findings from the only comparable MIP trajectory study (Kuijsters et al., 2016), despite the fact that different MIPs and mood measures were used. Specifically, both studies found that induced sad moods rapidly began to dissipate within just a few minutes following the MIP, with moods no longer significantly different from baseline by about 6 minutes post-MIP (see Table 3).

Additionally, while many cognitive vulnerability researchers do not measure or report mood ratings more than once following the MIP, some do. For example, Lethbridge and Allen's (2008) study of mood-induced cognitive and emotional reactivity, life stress, and prediction of depressive relapse included two post-MIP measures of mood. The methodology of Lethbridge and Allen's study also very closely resembles that of the current study. Participants who were fully remitted from a previous episode of major

depressive disorder completed the 40-item DAS immediately before and after undergoing the same music+memory MIP used in the current study. Mood was measured on a 100-mm unipolar VAS pre- and post-MIP, as well as after completing all 40 items of the parallel form of the DAS. Lethbridge and Allen (2008) did not indicate the average amount of time it took participants to complete the 40 items of the DAS. However, the mean and median time it took participants in the current study to complete 40 DAS items post-MIP was approximately 5 min (279 and 268 seconds, respectively).[5]

Mean VAS sad mood scores from Lethbridge and Allen's study (2008) were estimated based on the figure presented in their article (p. 1146). Assuming it took participants in the Lethbridge and Allen study approximately the same amount of time it took participants in the current study to complete 40 DAS items, mean VAS scores from the Lethbridge and Allen study can be estimated as measures of sad mood pre-MIP, 0-min post-MIP, and 5-min post-MIP. Figure 3 shows both the observed trajectory of the sad mood effect of the music+memory MIP from the current study and the extrapolated trajectory of the sad mood effect from the Lethbridge and Allen study (based on the mean VAS scores presented in a graph and working under the assumption that the parallel DAS took 5 min to complete).

[5]The time it took participants in the current study to complete 40 post-MIP DAS items was calculated by subtracting the time they spent completing VAS ratings from the post-MIP time at which they finished the 40th DAS item. For participants who completed fewer than 40 items within the 10-min post-MIP time period, the time they spent completing VAS ratings was subtracted from the time at which they completed their last post-MIP DAS item; an average DAS-item completion time was calculated and multiplied by 40 to create an estimated completion time.

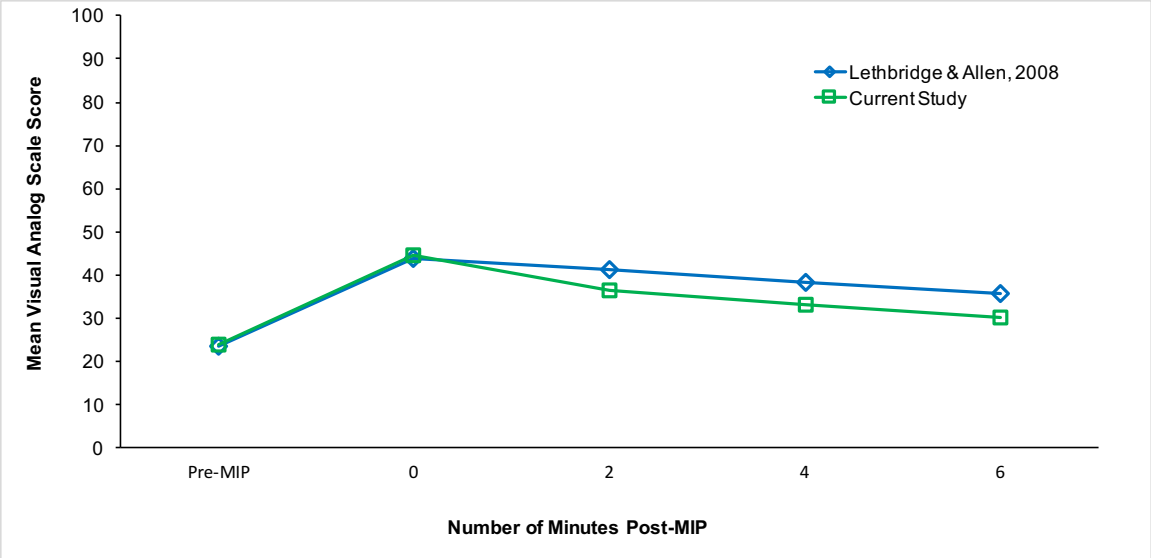

Figure 3. Observed mean sad mood ratings as measured by the visual analog scale (VAS) of participants in the music+memory condition in the current study, overlaid on the extrapolated mean VAS scores (estimated from Figure 1 [p. 1146]) from Lethbridge and Allen's (2008) study.

As can be seen from Figure 3, the trajectory from the current study and the estimated/extrapolated trajectory from the Lethbridge and Allen study are strikingly similar. This similarity provides support for the robustness of the current study's findings.

In summary, the memory MIP and the music+memory MIP both produced substantial changes in mood for a moderate proportion of participants. This induced sad mood, however, quickly abated—a finding consistent with the limited research that exists (e.g., Lethbridge & Allen, 2008; Kuijsters et al., 2016). This has important conceptual implications because many measures of cognitive vulnerability (e.g., DAS-A, Implicit Association Task, Self-Referent Encoding Task) may take longer to complete than the duration of an MIP-induced sad mood because many researchers use more than one measure or task to assess cognitive vulnerability (e.g., Gemar et al., 2001).

Strengths and Limitations

Each decision about the current study's methodology was specifically made to maximize the validity and the generalizability of the findings. This resulted in a considerable number of strengths of the study, but also in a few limitations.

MIPs. One strength of the current study was the selection of the experimental MIPs. The musical and memory MIPs, and their combination, are the most commonly used in the research literature. The choice of these MIPs not only afforded the examination of the individual trajectories of the music MIP and the memory MIP but also provided a comparison of the relative influence of each on the trajectory of the combined MIP. Additionally, selecting three of the most commonly used MIPs that have been used in recent years maximizes the applicability of the findings of this study to a number of influential studies in the literature.

Unfortunately, practical considerations (i.e., recruiting a sufficient sample size) precluded the ability to include additional classes of MIPs (e.g., the Velten) and to manipulate additional MIP characteristics (e.g., using additional musical selections). Although no research has yet demonstrated how factors such as the type of MIP or the specific musical selection can affect the *trajectory* of an MIP-induced mood effect, research has indicated that such factors can influence the strength of the mood effect immediately post-MIP (e.g., Westermann et al., 1996). As a result, the findings from this study do not provide insight into whether *sad music* is not an effective MIP, or whether *RUTMY*, specifically, is not effective as a sad MIP. Therefore, these results (regarding the musical MIP) cannot be generalized to all musical MIPs.

VAS mood measurements. Given that they are frequently used in cognitive vulnerability research, the use of VASs was an additional strength of this study. The inclusion of VASs renders the results as generalizable as possible and allows for the mood changes observed in the current study to be directly and easily compared to the changes evinced in other studies. To further enhance the generalizability and comparability of these findings, however, future studies should include variations of the VAS used in the current study (e.g., bipolar as well as unipolar scales) and other mood measures (e.g., the Positive and Negative Affect Schedule [PANAS], the Mood Adjective Checklist [MACL]).

The use of many VASs within the 10-min post-MIP time period allowed the trajectory of participants' mood to be tracked closely. This was a particularly important strength, given the rapid abatement of the mood effects. Additionally, since most sad MIP designs in cognitive vulnerability research do not include multiple mood measurements, a concern was that the repeated measurement of mood could artificially increase levels of sad mood. Thus, the inclusion of three control neutral-MIP conditions allowed us to rule out this possibility, which thus constituted another major strength of the study. Repeated assessment of mood could, however, have had a potential re-priming effect for participants in sad memory conditions, thus artificially inflating the trajectories. Additionally, regression to the mean could have artificially attenuated the trajectories of participants in the sad MIP conditions who reported larger initial increases in mood. Although it was not feasible to do so in the current study, future studies should include manipulations of the number of and intervals between mood measurements for the sad MIP conditions to test for the presence of re-priming or retest effects.

Undergraduate student population. An undergraduate student population was selected for two reasons: First, a large number of readily available participants was needed to have sufficient power to conduct the analyses. Second, much MIP research is conducted with undergraduate students (and non-vulnerable groups are often used in control conditions to compare to groups of vulnerable participants). Consequently, results of the study can be appropriately compared to much of the extant literature and used to inform the design of future studies conducted by researchers who use these populations in their work.

The use of such a population, while a strength, is also a limitation. As previously discussed, the purpose of employing MIPs in cognitive vulnerability research is to investigate whether the activation of latent cognitive structures and processes thought to be present in certain vulnerable individuals puts them at risk for depression. ANTs would dictate that successful induction of a sad mood would activate an individual's sad mood node within their cognitive structure. Consequently, among vulnerable individuals, this activation would spread to strongly associated negative memories, cognitions, and beliefs. If indirectly activated above a certain threshold, these other activated memories, cognitions, and beliefs can become conscious, which could cause the individual to think or ruminate about them. This, in turn, would result in direct activation of these nodes, which would be strongly associated with the sadness node, thus feeding activation back into the sadness node in a sort of vicious cycle that would maintain the sad mood.

According to cognitive vulnerability models of depression, this process would, of course, occur only if there were closely and strongly interconnected negative cognitive structures, and would thus occur only in vulnerable (and not in non-vulnerable)

individuals. This specificity raises the possibility that vulnerable and non-vulnerable individuals may display similar initial changes in sad mood, but that the induced sad mood may be more persistent in vulnerable individuals. Therefore, the mood effects of the trajectories found in the current study may not replicate in a sample of vulnerable participants. Thus, investigating the trajectories of the effects of MIPs in vulnerable samples and comparing these trajectories to those of non-vulnerable samples is necessary for a comprehensive evaluation of the validity and utility of using MIPs to study cognitive vulnerability to depression.

Implications

The results of this study constitute an important first step in validating the use of MIPs in cognitive vulnerability research and provide researchers with useful information regarding certain study design decisions. For example, until more research is available on the efficacy of various musical MIPs for inducing a sad mood, the findings of the current study support the recommendation of instead using an autobiographical memory MIP. Additionally, these study findings support the recommendation of using short (> 4 min) measures of cognitive vulnerability and additional post-MIP measures of mood to maximize the validity of the measure of cognitive vulnerability and so that participants who do not display an effective and persistent sad mood can be excluded from analyses.

Additionally, and more importantly, the results of this study allow for the critical examination of findings from studies that have used similar methodologies. For example, as previously discussed, a relatively recent study investigated cognitive reactivity in participants who had been successfully treated with cognitive therapy (Jarrett et al., 2012). Contrary to their predictions and in spite of the fact that they deemed the MIP to

have significantly induced a sad mood, the researchers did not find that the MIP significantly increased cognitive reactivity. As a result, the authors asserted that their findings suggest that restructuring dysfunctional attitudes can help prevent relapse and recurrence in depression by reducing cognitive reactivity. They also use their findings to question whether MIPs are in fact necessary in order to use measures of dysfunctional attitudes as predictors of depressive relapse.

The authors did not, however, appear to consider the possibility that, even though the MIP successfully induced a sad mood pre- to post-MIP, that induced sad mood may not have persisted for the entire time it took participants to complete the measure of dysfunctional attitudes. The time it took participants in the current study to complete 40 DAS items ranged from approximately 1.5 min to more than 10 min (with an average of about 5 min). Jarrett et al. used the criterion of a significant difference of $p < .001$ between pre- and post-MIP VAS scores to operationally define a successfully induced sad mood. In the current study, the music+memory MIP successfully induced a sad mood using the same criterion as did Jarrett et al. up to 4 min post-MIP. However, only about 34% of participants in the music+memory MIP condition in the current study had completed 40 DAS items within 4 min. Assuming the participants in Jarrett et al.'s (2008) study took roughly the same amount of time to complete the 40 DAS items as the participants in the music+memory condition in the current study, and assuming that the trajectory of the mood effect following the music+memory MIP was similar in the Jarrett et al. study, this would suggest that up to 66% of the participants in the Jarrett et al. study may not have been in a sad mood state while completing all DAS items.

To reiterate, the main premise of cognitive vulnerability research is that depressogenic cognitive structures remain latent unless activated by a sad mood or stressful life event. Therefore, the fact that 66% of participants may not have been in a sad mood state while completing all of their DAS items means that a large proportion of participants would likely not have had sufficient sadness to activate latent negative structures (including dysfunctional attitudes) for the entirety of the DAS. The total post-MIP DAS scores of such participants would thus likely have been attenuated by scores on items completed while no longer in a sad mood state. Consequently, mean total post-MIP DAS scores may have failed to indicate the presence of cognitive reactivity because of attenuated total DAS scores, rather than because of a lack of cognitive reactivity. If this hypothetical 66% of Jarrett et al.'s sample had instead remained persistently sad for the duration of the DAS, it is entirely possible that cognitive reactivity may have been observed.

This is just one example of one study that illustrates how results of cognitive vulnerability research employing MIPs may be biased because of the assumption that an MIP-induced mood has persisted for the entirety of a task or measure (or multiple tasks or measures). Given that it is not uncommon for cognitive vulnerability to depression researchers to make this assumption, it is quite possible that the current theories of cognitive vulnerability to depression that are based on such research are thus also biased themselves.

Future Directions

Given the general consistency of our findings with those of Kuijsters et al. (2016), as well as the striking similarity of our findings with those of Lethbridge and Allen

(2008), there is support that the findings from the current study are not simply a chance occurrence. More research is needed, however, to ensure that these findings are robust and generalizable. For example, future studies should replicate the current methodology, while extending it to include experimental conditions that use alternative musical selections as well as additional measures of mood, so that the findings can be used to evaluate the validity of the results (and of the interpretations of the results) of past studies that have employed such varied methodology. Additionally, future studies should also use samples that include vulnerable individuals (e.g., past depression) to determine whether MIP trajectories differ based on this factor. Finally, additional conditions that vary the number and spacing of mood measurements should be included to assess for the presence of retest or re-priming effects as well as for regression to the mean.

The findings of this study challenge the validity of the critical assumption that MIPs commonly used in depression research induce sad moods that persist for the entirety of the tasks or measures of interest. This is not, however, the only implied assumption that is frequently made in MIP cognitive vulnerability research. For example, many researchers appear to assume that, to study cognitive vulnerability, it does not matter *how* a participant is made to be sad (e.g., using a musical rather than a memory MIP; using an MIP rather than a different procedure entirely, such as tryptophan depletion, social rejection paradigms, or self-focused attention), it matters only *that* they become sad.

A related major assumption of MIP cognitive vulnerability research is that the way researchers operationally define a successful mood induction—whether that be a significant difference or minimum absolute score change on a VAS (or another measure

of sad mood)—is a valid method for measuring effectiveness of activation of the sadness node and, consequently, a valid method for measuring effectiveness of the activation of the negative cognitive structure and depressogenic processes. Finally, a third fundamental assumption is that (a) the activation of sad mood from an MIP—and the resultant presumed activation of negative cognitive structures—is representative of activation in real life and therefore (b) research that employs sad MIPs to study cognitive vulnerability to depression provides useful information about how we understand and treat the disorder.

As previously stated, the findings of this study indicate that one major and almost universally accepted assumption underlying sad MIP cognitive vulnerability research—that is, that an MIP-induced sad mood is sufficiently persistent—is not valid. Consequently, once the findings of the current study have been replicated (to demonstrate the robustness of the findings) and extended with other sad musical pieces, future research must therefore also test the validity of the remaining assumptions that underlie sad MIP cognitive vulnerability research.

Conclusion

In summary, this study constitutes an important first step in validating the use of MIPs in cognitive vulnerability research and provides researchers with more information on how to design future studies. Most important, however, the results of this study allow for the critical examination of findings from cognitive vulnerability studies that have used methodologies similar to the one used in the current study. Initial examinations of such findings indicate that some recent empirical evidence is likely biased by the use of MIPs that induce sadness that does not persist for a sufficient amount of time. Consequently,

the findings of this study indicate that there is a real possibility that current theories of cognitive vulnerability to depression have been modified according to biased empirical findings and are thus, themselves, also biased. That current theories of cognitive vulnerability to depression are likely biased has profound implications for the validity of current conceptualizations of depression and recommendations for treatment of the disorder.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

Bates, G. W., Thompson, J. C., & Flanagan, C. (1999). The effectiveness of individual versus group induction of depressed mood. *The Journal of Psychology, 133*(3), 245–242.

Beck, A. T. (1967). *Depression: Causes and treatment.* Philadelphia: University of Pennsylvania Press.

Beck, A. T., Rush, A. J., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy of depression.* New York: Guilford Press.

Beck, A. T., Steer, R. A., & Brown, G. (1996). *Manual for the Beck Depression Inventory-II.* San Antonia, TX: Psychological Corporation.

Beevers, C. G., Ellis, A. J., & Reid, R. M. (2011). Heart rate variability predicts cognitive reactivity to a sad mood provocation. *Cognitive Therapy and Research, 35*, 395–403.

Beevers, C. G., & Meyer, B. (2008). I feel fine but the glass is still half empty: Thought suppression biases information processing despite recovery from a dysphoric mood state. *Cognitive Therapy and Research, 32*, 323–332.

Beevers, C. G., Scott, W. D., McGeary, C., & McGeary, J. E. (2009). Negative cognitive response to a sad mood induction: Associations with polymorphisms of the serotonin transporter (5-HTTLPR) gene. *Cognition and Emotion, 23*, 726–738.

Beevers, C. G., Strong, D. R., Meyer, B., Pilkonis, P. A., & Miller, I. W. (2007). Efficiently assessing negative cognition in depression: An item response theory

analysis of the dysfunctional attitude scale. *Psychological Assessment, 19*, 199–209.

Berna, C., Leknes, S., Holmes, E. A., Edwards, R. R., Goodwin, G. M., & Tracey, I. (2010). Induction of depressed mood disrupts emotion regulation neurocircuitry and enhances pain unpleasantness. *Biological Psychiatry, 67*, 1083–1090.

Bower, G. H. (1981). Mood and memory. *American Psychologist, 36*, 129–148.

Choma, B. L., Hodson, G., & Costello, K. (2012). Intergroup disgust sensitivity as a predictor of islamophobia: The modulating effect of fear. *Journal of Experimental Social Psychology, 48*, 499–506.

Chou, K.-L., Lee, T. M. C., & Ho, A. H. Y. (2007). Does mood state change risk taking tendency in older adults? *Psychology and Aging, 22*, 210–318.

Clark, D. M. (1983). On the induction of depressed mood in the laboratory: Evaluation and comparison of the Velten and musical procedures. *Advances in Behavior Research and Therapy, 5*, 27–49.

Clark, D. M., & Teasdale, J. D. (1985). Constraints on the effects of mood on memory. *Journal of Personality and Social Psychology, 48*, 1595–1608.

Clark, D. M., Teasdale, J. D, Broadbent, D. E., & Martin, M. (1983). Effect of mood on lexical decisions. *Bulletin of the Psychonomic Society, 21*, 175–178.

de Graaf, L E., Roelofs, J., & Huibers, M. J. H. (2009). Measuring dysfunctional attitudes in the general population: The Dysfunctional Attitudes Scale (form A) Revised. *Cognitive Therapy and Research, 33*, 345–355.

Dearing, K. F., & Gotlib, I. H. (2009). Interpretation of ambiguous information in girls at risk for depression. *Journal of Abnormal Psychology, 37*, 79–91.

Dozois, D. J. A., & Covin, R. (2004). The Beck Depression Inventory-II (BDI-II), Beck Hopelessness Scale (BHS), and Beck Scale for Suicide Ideation (BSS). In M. Hersen (Series Ed.) and D. L. Segal & Milsenroth (Vol Eds.), Comprehensive handbook of psychological assessment: Vol 2. Personality assessment and psychopathology (pp. 50–69). New York: Wiley.

Dozois, D. J. A., Dobson, K. S., & Ahnberg, J. L. (1998). A psychometric evaluation of the Beck Depression-Inventory-II. *Psychological Assessment, 10*, 83–89.

Dvořák, A. (1983). Symphony No. 9 in E minor, Op. 95 "From The New World" [Recorded by H. von Karajan and the Wiener Philharmoniker]. Vienna, Austria, The Großer Saal des Wiener Musikvereins. (1985).

Forgas, J. P. (2013). Don't worry, be sad! On the cognitive, motivational, and interpersonal benefits of negative mood. *Current Directions in Psychological Science, 22*, 225–232. doi:10.1177/0963721412474458

Frost, R. O., & Green, M. L. (1982). Velten mood induction procedure effects: Duration and postexperimental removal. *Personality and Social Psychology Bulletin, 8*, 341–347.

Gemar, M. C., Segal, Z. V., Sagrati, S., & Kennedy, S. J. (2001). Mood-induced changes on the Implicit Association Test in recovered depressed patients. *Journal of Abnormal Psychology, 110*, 282–289.

Gerrards-Hesse, A., Spies, K., & Hesse, F. W. (1994). Experimental inductions of emotional states and their effectiveness: A review. *British Journal of Psychology, 85*, 55–78.

Gomez, P., Zimmermann, P. G., Guttormsen Schär, S., & Danuser, B. (2009). Valence lasts longer than arousal: Persistence of induced moods as assessed by psychophysiological measures. *Journal of Psychophysiology, 23*, 7–17.

Hammen, C. (1991). Generation of stress in the course of unipolar depression. *Journal of Abnormal Psychology, 100*, 555–561.

Ingram, R. E. (1984) Toward an information-processing analysis of depression. *Cognitive Therapy and Research, 8*, 443–447.

Ingram, R. E., Bernet, C. Z., & McLaughlin, S. C. (1994). Attentional allocation processes in individuals at risk for depression. *Cognitive Therapy and Research, 18*, 317–332.

Ingram, R. E., Miranda, J., & Segal, Z. V. (1998). *Cognitive vulnerability to depression.* New York: Guilford Press.

Ingram, R. E., & Ritter, J. (2000). Vulnerability to depression: Cognitive reactivity and parenting bonding in high-risk individuals. *Journal of Abnormal Psychology, 109*, 588–596.

Jarrett, R. B., Minhajuddin, A., Borman, P. D., Dunlap, L., Segal, Z. V., Kidner, C. L., … Thase, M. E. (2012). Cognitive reactivity, dysfunctional attitudes, and depressive relapse and recurrence in cognitive therapy responders. *Behaviour Research and Therapy, 50*, 280–286.

Kakutani, M., Ogata, S. (Producers), & Hata, M. (Director). (1989). *The Adventures of Milo and Otis* [Motion picture]. Japan: Fujisankei Communications Group, Fuji Television Network, Inc.

Kendler, K. S., Hettema, J. M., Butera, F., Gardner, C. O., & Prescott, C. A. (2003). Life event dimensions of loss, humiliation, entrapment, and danger in the prediction of onsets of major depression and generalized anxiety. *Archives of General Psychiatry, 60*, 789–796.

Kendler, K. S., Thornton, L. M., & Gardner, C. O. (2000). Stressful life events and previous episodes in the etiology of major depression in women: An evaluation of the "kindling" hypothesis. *The American Journal of Psychiatry, 157*, 1243–1251.

Kendler, K. S., Thornton, L. M., & Gardner, C. O. (2001). Genetic risk, number of previous depressive episodes, and stressful life events in predicting onset of major depression. *The American Journal of Psychiatry, 158*, 582–586.

Kliegel, M., Jäger, T., & Phillips, L. H. (2007). Emotional development across adulthood: Differential age-related emotional reactivity and emotion regulation in a negative mood induction procedure. *International Journal of Aging and Human Development, 64*, 217–244.

Kuijsters, A., Redi, J., de Ruyter, B., & Heynderickx, I. (2016). Inducing sadness and anxiousness through visual media: Measurement techniques and persistence. *Frontiers in Psychology,* 7(1141), 1–14.

Lang, P. J., Bradley, M. M., and Cuthbert, B. N. (2008). *International affective picture system (IAPS): Affective ratings of pictures and instruction manual* (Technical Report A-8). Gainesville, FL: University of Florida.

Larsen, J. T., & McGraw, A. P. (2014). The case for mixed emotions. *Social and Personality Psychology Compass, 8*(6), 263–274.

Larsen, J. T., McGraw, A. P., & Cacioppo, J. T. (2001). Can people feel happy and sad at the same time? *Journal of Personality and Social Psychology, 81*,684–696.

Lench, H. C., Flores, S. A., & Bench, S. W. (2011). Discrete emotions predict changes in cognition, judgment, experience, behavior, and physiology: A meta-analysis of experimental emotion elicitations. *Psychological Bulletin, 137*, 834–855.

Lethbridge, R., & Allen, N. B. (2008). Mood induced cognitive and emotional reactivity, life stress, and the prediction of depressive relapse. *Behaviour Research and Therapy, 46*, 1142–1150.

Luria, R. E. (1975). The validity and reliability of the visual analogue mood scale. *Journal of Psychiatric Research, 12*, 51–57.

Martin, M. (1990). On the induction of mood. *Clinical Psychology Review, 10*, 669–697.

Meites, T. M., Deveney, C. M., Steele, K. T., Holmes, A. J., & Pizzagalli, D. A. (2008). Implicit depression and hopelessness in remitted depressed individuals. *Behaviour Research and Therapy, 46*, 1078–1084.

Monroe, S. M., Rohde, P., Seeley, J. R., & Lewinsohn, P. M. (1999). Life events and depression in adolescence: Relationship loss as a prospective risk factor for first onset of major depressive disorder. *Journal of Abnormal Psychology, 108*, 606–614.

Muthén, L. K., & Muthén, B. O. (1998–2011). *Mplus User's Guide* (6th ed.). Los Angeles, CA: Muthén & Muthén.

Nelson, L. D., Stern, S. L., & Cicchetti, D. V. (1992). The Dysfunctional Attitude Scale: How well can it measure depressive thinking? *Journal of Psychopathology and Behavioral Assessment, 14*, 217–223.

Newman, K. R., & Sears, C. R. (2015). Eye gaze tracking reveals different effects of a sad mood induction on the attention of previously depressed and never depressed women. *Cognitive Therapy and Research, 39*, 292–306.

Nezu, A. M., Ronan, G. F., Meadows, E. A., McClure, K. S. (Eds.). (2000). *Practitioner's guide to empirically-based measures of depression.* New York: Kluwer.

Pacheco-Unguetti, A. P., & Parmentier, F. B. R. (2014). Sadness increases distraction by auditory deviant stimuli. *Emotion, 14*, 203–213.

Prokofiev, S. (1934). Russia under the Mongol yoke [Recorded by C. Abbado and the London Symphony Orchestra]. On *Alexander Nevsky* [compact disc]. Hamburg, Germany: Polydor International. (1980).

Scher, C. D., Ingram, R. E., Segal, Z. V. (2005). Cognitive reactivity and vulnerability: Empirical evaluation of construct activation and cognitive diathesis in unipolar depression. *Clinical Psychology Review, 25*, 487–510.

Segal., Z. V., Gemar, M., & Williams, S. (1999). Differential cognitive response to a mood challenge following successful cognitive therapy or pharmacotherapy for unipolar depression. *Journal of Abnormal Psychology, 108*, 3–10.

Segal, Z. V., Kennedy, S., Gemar, M., Hood, K., Pedersen, R., & Buis, T. (2006). Cognitive reactivity to sad mood provocation and the prediction of depressive relapse. *Archives of General Psychiatry, 63*, 749–755.

Simons, A. D., Angell, K. L., Monroe, S. M., & Thase, M. E. (1993). Cognition and life stress in depression: Cognitive factors and the definition, rating, and generation of negative life events. *Journal of Abnormal Psychology, 102*, 584–591.

Singer, A. R., & Dobson, K. S. (2007). An experimental investigation of the cognitive vulnerability to depression. *Behaviour Research and Therapy, 45*, 563–575.

Slyker, J. P., & McNally, R. J. (1991). Experimental induction of anxious and depressed moods: Are Velten and musical procedures necessary? *Cognitive Therapy and Research, 15*, 33– 45.

Stern, R. A. (1997). *Visual Analog Mood Scales: Professional manual.* Odessa, FL: Psychological Assessment Resources.

Storch, E. A., Roberti, J. W., & Roth, D. A. (2004). Factor structure, concurrent validity, and internal consistency of the Beck Depression Inventory-Second Edition in a sample of college students. *Depression and Anxiety, 19*, 187–189.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics, 6th ed.* Boston: Pearson.

Teasdale, J. D. (1983). Negative thinking in depression: Cause, effect, or reciprocal relationship? *Advances in Behaviour Research and Therapy, 5*, 3 – 25.

Teasdale, J. D. (1988). Cognitive vulnerability to persistent depression. *Cognition and Emotion, 2*, 247–274.

Teasdale, J. D., & Fogarty, S. J. (1979). Differential effects of induced mood on retrieval of pleasant and unpleasant events from episodic memory. *Journal of Abnormal Psychology, 88*, 248–257.

Thomsen, D. K. (2006). The association between rumination and negative affect: A review. *Cognition and Emotion, 20*, 1216–1235.

van Strien, T., Cebolla, A., Etchemendy, E., Gutierrez-Maldonado, J., Ferrer-Garcia, M., Botella, C., & Banos, R. (2013). Emotional eating and food intake after sadness and joy. *Appetite, 66*, 20–25.

Weissman, A. N. (1979). The Dysfunctional Attitude Scale: A validation study. *Publicly Accessible Penn Dissertations*. Paper 1182, 1–209.

Westermann, R., Spies, K., Stahl, G., & Hesse, F. W. (1996). Relative effectiveness and validity of mood induction procedures: A meta-analysis. *European Journal of Social Psychology, 26*, 557–580

World Health Organization. (2017). *Depression* [Fact sheet]. Retrieved from http://www.who.int/mediacentre/factsheets/fs369/en/

Yeung, C. A., Dalgleish, T., Golden, A.-M., & Schartau, P. (2005). Reduced specificity of autobiographical memories following a negative mood induction. *Behaviour and Research and Therapy, 44*, 1481–1490.

Appendix A

Mood Induction Procedure (MIP) Scripts

Experimental (Sad) MIPs

Music Only. You are about to listen to a piece of music that is meant to create a temporary sad mood. Music can be a very personal thing and it may affect people differently. To help create a sad mood, however, please try to think about, or notice, the sadness in the music as it plays for the next 7 minutes.

Memory Only. Please recall, as vividly as possible, a sad event that occurred in your life. For the next 3 minutes, try to carefully remember and evoke details about that situation, how you felt, and what your thoughts were at the time. While you are doing this, try to immerse yourself as deeply as possible into the mood that your memories evoke. After this, you will be asked to type in as detailed a description of the event as possible for approximately 4 minutes. Please take the next 3 minutes to think about a sad event or memory from your life.

Music+Memory. You are about to listen to a piece of music that is meant to create a temporary sad mood. Music can be a very personal thing and it may affect people differently. To help create a sad mood, however, please try to think about, or notice, the sadness in the music as it plays for the next 7 minutes. We would also like you to recall as vividly as possible, a sad event that occurred in your life. For the next 3 minutes, try to carefully remember and evoke details about that situation, how you felt, and what your thoughts were at the time. While you are doing this, try to immerse yourself as deeply as possible into the mood that your memories evoke. After this, you will be asked to type in

as detailed a description of the event as possible for approximately 4 minutes. Please take the next 3 minutes to think about a sad event or memory from your life.

Control (Neutral) MIPs

Music Only. You are about to listen to a piece of music. Please try to pay attention to, or notice, the music as it plays for the next 7 minutes.

Memory Only. Please recall, as vividly as possible, an everyday task, errand, or chore that you completed. For the next 3 minutes, try to carefully remember and evoke details about that situation, such as where you went and what exactly you did. After this, you will be asked to type in as detailed a description of the event as possible for approximately 4 minutes. Please take the next 3 minutes to think about an everyday task, errand, or chore that you completed.

Music+Memory. You are about to listen to a piece of music. We would also like you to recall as vividly as possible, an everyday task, errand, or chore that you completed. For the next 3 minutes, try to carefully remember and evoke details about that situation, such as where you went and what exactly you did. After this, you will be asked to type in as detailed a description of the event as possible for approximately 4 minutes. Please take the next 3 minutes to think about an everyday task, errand, or chore that you completed.

Appendix B

Adapted Visual Analog Scale (VAS; Luria, 1975)

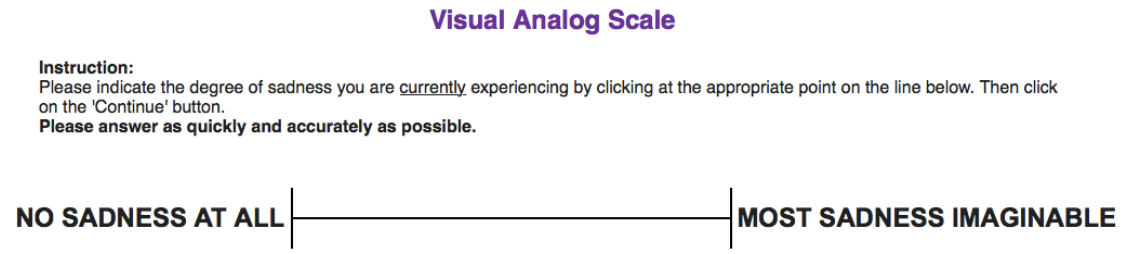

Figure B1. Screenshot of Adapted Visual Analog Scale (VAS; Luria, 1975), prior to reporting of mood. Line is not to scale.

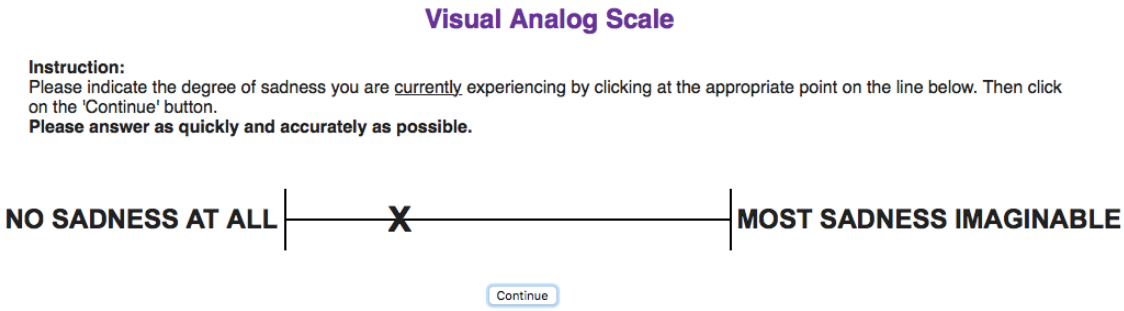

Figure B2. Screenshot of Adapted Visual Analog Scale (VAS; Luria, 1975), following reporting of mood. Line is not to scale.

Appendix C

Demographics Questionnaire

Age: _____

Gender:
Male
Female
Transgender
Prefer not to disclose
Please self-identify: _____

Ethnicity: (main identification(s))
Caucasian
Filipino
Chinese
Latin American
Korean
Black
Arab
Japanese
South Asian (e.g., East Indian, Sri Lankan, etc.)
Southeast Asian (e.g., Vietnamese, Cambodian etc.)
West Asian (e.g., Iranian, Afghan, etc.)
Aboriginal (that is, North American Indian, Métis or Inuit)
Other (please specify): _____
Don't Know

Please indicate the number of years of education you have completed to date (e.g., if you have completed grade 12 you would indicate "12 years," if you have completed one year of undergraduate studies you would indicate "13 years," if you have completed a 4-year undergraduate degree you would indicate "16 years"):_____

Have you **ever** received any therapy or counseling for an emotional or psychological problem? Yes/No
If yes, please describe: _____

Are you **currently** (within the past month) receiving any therapy or counseling for an emotional or psychological problem? Yes/No
If yes, please describe: _____

Have you **ever** taken any medication for an emotional or psychological problem? Yes/No
If yes, please list the name of each medication and what symptoms/disorder it's prescribed for:
_____

Are you **currently** (within the past month) taking any medication for an emotional or psychological problem? Yes/No
If yes, please list the name of each medication and what symptoms/disorder it's prescribed for:
_____

Appendix D

Participant Engagement Measure

Like all responses you have provided so far, **the following questions are completely confidential** and will be associated only with your assigned study ID. That is, your responses will not be associated with your name, student number, or SONA number; **how you respond will not affect your compensation for your participation**; and the researcher(s) you interact with today will not know how you respond. These questions will be used to help us to ensure that the data we use in our analyses are as accurate and representative as possible. Since the results of this study will be used to help researchers study the effects of mood manipulations and will inform our understanding of people suffering from different problems, it will be extremely helpful if you would answer the following questions as **honestly** as possible.[6]

1. Do you have any ideas regarding what the hypotheses of the study are (i.e., what results or effects the experimenters are expecting to find)? _____

2. Earlier in the study, you were supposed to listen to a clip of music.
   - Did you have any trouble hearing the music? Yes/No
     - If yes, please describe: _____
   - What kind of music did you hear?
     - Pop
     - Rock
     - Classical
     - Jazz
     - Other (please describe): _____
     - Don't remember/not sure
   - Would you consider the music to be primarily
     - Positive (e.g., upbeat, joyous)
     - Neutral
     - Negative (e.g., sad, scary)
     - Don't remember/not sure
   - Did the music make you feel (please select all that apply)
     - Afraid
     - Angry
     - Anxious
     - Confused
     - Energetic
     - Happy
     - Sad
     - Tense
     - Tired
     - Don't remember/not sure

[6] This information was presented via video. The second half of the instructions (i.e,. "These questions…" onward) also appeared on screen in text.

[Question 2 appeared for only those assigned to a musical MIP condition]

3. To what extent did you engage in the task of [MIP]?
- I was fully engaged
- I was engaged, but was interrupted by something
- I was somewhat engaged
- I didn't really try to be engaged
- I didn't pay attention at all
- Other (please explain): _____

2. To what extent were your **mood ratings** thoughtful, accurate representations of your mood?
- Thoughtful
  - Very thoughtful
  - Mostly thoughtful
  - Somewhat thoughtful
  - Not thoughtful at all
- Accurate
  - Very accurate
  - Somewhat accurate
  - Somewhat inaccurate
  - Very inaccurate
- Please select any/all that apply
  - I didn't understand the instructions
  - I didn't put much thought into my ratings
  - I just picked ratings randomly
  - I picked the ratings I thought the experimenter would want me to pick
  - Other (please explain): _____

3. To what extent were your answers on the **questionnaires** thoughtful?
- Very thoughtful
- Mostly thoughtful
- Somewhat thoughtful
- Not thoughtful at all

For how you responded to the **questionnaires,** please select any/all that apply
- I didn't understand the instructions
- I didn't put much thought into my responses
- I just picked responses randomly
- I picked the responses I thought the experimenter would want me to pick
- Other (please explain): _____

5. Is there anything else important you feel the researchers should know in regards to your data? _____

Appendix E

Comparisons of Pre- and Post-MIP VAS Scores

Table E1

Paired-Samples t *tests Comparing the Mean Pre-MIP VAS Score to Each Post-MIP Mean VAS Score in the Sad Music Condition*

Time Point	*n*	*M* (SD)	*t*	*df*	*p*
Pre-MIP	97	22.97 (19.60)			
0 min post-MIP	97	33.22 (21.28)	-6.79	96	> .001
2 min post-MIP	97	28.09 (18.90)	-3.76	96	> .001
4 min post-MIP	96	26.59 (18.33)	-2.41	96	.018
6 min post-MIP	96	25.79 (18.19)	-1.86	95	.067
8 min post-MIP	96	24.01 (17.15)	-0.63	95	.528
10 min post-MIP	94	24.17 (16.59)	-1.05	93	.295

Note. MIP = mood induction procedure. VAS = visual analog scale.

Table E2

Paired-Samples t *tests Comparing the Mean Pre-MIP VAS Score to Each Post-MIP Mean VAS Score in the Sad Memory Condition*

Time Point	*n*	*M* (SD)	*t*	*df*	*p*
Pre-MIP	102	24.28 (21.03)			
0 min post-MIP	102	45.33 (24.55)	-10.85	101	> .001
2 min post-MIP	102	36.85 (21.79)	-8.41	101	> .001
4 min post-MIP	102	33.42 (22.24)	-6.36	101	> .001
6 min post-MIP	102	29.87 (21.35)	-4.31	101	> .001
8 min post-MIP	101	29.05 (21.70)	-3.51	100	.001
10 min post-MIP	100	27.46 (21.21)	-2.61	99	.011

Note. MIP = mood induction procedure. VAS = visual analog scale.

Table E3

Paired-Samples t *tests Comparing the Mean Pre-MIP VAS Score to Each Post-MIP Mean VAS Score in the Sad Music+Memory Condition*

Time Point	*n*	*M* (SD)	*t*	*df*	*p*
Pre-MIP	98	24.07 (20.91)			
0 min post-MIP	98	44.71 (23.17)	-8.59	97	> .001
2 min post-MIP	98	36.43 (22.29)	-5.55	97	> .001
4 min post-MIP	98	33.23 (21.24)	-4.73	97	> .001
6 min post-MIP	98	30.24 (19.89)	-3.33	97	.001
8 min post-MIP	98	29.78 (20.82)	-2.80	97	.006
10 min post-MIP	96	26.02 (19.05)	-1.25	95	.215

Note. MIP = mood induction procedure. VAS = visual analog scale.

Appendix F

Rationale for Combining Three Neutral Conditions

Statistical comparison of each sad MIP condition to its corresponding neutral MIP condition would be problematic because of the significant difference in sample size (each of the sad MIP conditions had approximately 3 times as many participants as their corresponding neutral MIP condition). It was expected that the three neutral conditions would not differ significantly between groups or over time on VAS scores and could thus be collapsed into a single condition that would have approximately the same number of participants as each of the sad MIP conditions. This was supported by the results of a 3(condition: neutral music, neutral memory, neutral music+memory) x 7(time: pre-MIP, and 0-, 2-, 4-, 6-, 8-, and 10-min post-MIP) split-plot factorial ANOVA. The main effect of Time, $F(3.4, 322) = 0.87$, $p = .469$, partial $\eta^2 < .01$; Condition, $F(1, 95) = 1.68$, $p = .192$, partial $\eta^2 = .03$; and the Condition $\times$ Time interaction $F(7, 322) = 0.41$, $p = .894$, partial $\eta^2 < .01$, were not significant. This finding, coupled with the a priori hypothesis that the neutral conditions would not significantly differ, supported the decision to collapse the three neutral conditions to create a single neutral MIP sample.

Appendix G

Comparisons of the VAS Scores of Sad versus Combined Neutral MIP Conditions

Table G1

One-way ANOVAs Comparing Each Sad MIP Condition to the Combined Neutral MIP Condition on 0-min Post-MIP VAS Scores

Condition	*n*	*M*	*SD*	*F*	*df*	*p*	η_p^2	Pwr
Neutral	104	23.42	21.65					
Sad music	97	33.22	21.28	10.44	1, 199	.001	.05	.90
Sad memory	102	45.33	24.55	46.19	1, 204	> .001	.19	1.00
Sad music+memory	102	44.71	23.17	45.59	1, 200	> .001	.19	1.00

Note. MIP = mood induction procedure. VAS = visual analog scale. η_p^2 = partial η^2. Pwr = power.

Table G2

One-way ANOVAs Comparing Each Sad MIP Condition to the Combined Neutral MIP Condition on 2-min Post-MIP VAS Scores

Condition	*n*	*M*	*SD*	*F*	*df*	*p*	η_p^2	Pwr
Neutral	104	23.20	20.17					
Sad music	97	28.09	18.90	2.98	1, 199	.086	.02	.40
Sad memory	102	36.85	21.79	20.86	1, 204	> .001	.09	.99
Sad music+memory	98	36.43	22.29	18.76	1, 200	> .001	.09	.99

Note. MIP = mood induction procedure. VAS = visual analog scale. η_p^2 = partial η^2. Pwr = power.

Table G3

One-way ANOVAs Comparing Each Sad MIP Condition to the Combined Neutral MIP Condition on 4-min Post-MIP VAS Scores

Condition	*n*	*M*	*SD*	*F*	*df*	*p*	η_p^2	Pwr
Neutral	104	24.17	20.80					
Sad music	97	26.59	18.36	0.76	1, 199	.385	> .01	.14
Sad memory	102	33.42	22.24	9.51	1, 204	.002	.05	.87
Sad music+memory	98	33.23	21.24	9.38	1, 200	.002	.05	.86

Note. MIP = mood induction procedure. VAS = visual analog scale. η_p^2 = partial η^2. Pwr = power.

Table G4

One-way ANOVAs Comparing Each Sad MIP Condition to the Combined Neutral MIP Condition on 6-min Post-MIP VAS Scores

Condition	*n*	*M*	*SD*	*F*	*df*	*p*	η_p^2	Pwr
Neutral	104	24.56	21.55					
Sad music	96	25.79	18.19	0.19[a]	1, 198	.663	> .01	.07
Sad memory	102	29.87	21.35	3.16	1, 204	.077	.02	.43
Sad music+memory	98	30.24	19.89	3.79	1, 200	.053	.02	.49

Note. MIP = mood induction procedure. VAS = visual analog scale. η_p^2 = partial η^2. Pwr = power.

[a]The Levene's test for this ANOVA was significant, $p = .027$. ANOVA is, however, robust to violations of the assumption of homogeneity of variance when sample sizes are greater than 30, which, in this analysis, they are.

Table G5

One-way ANOVAs Comparing Each Sad MIP Condition to the Combined Neutral MIP Condition on 8-min Post-MIP VAS Scores

Condition	*n*	*M*	*SD*	*F*	*df*	*p*	η_p^2	Pwr
Neutral	104	24.38	20.52					
Sad music	96	24.01	17.15	0.02[a]	1, 198	.889	> .01	.02
Sad memory	101	29.05	21.70	2.50	1, 203	.115	> .01	.35
Sad music+memory	98	29.78	20.81	3.33	1, 200	.065	.02	.45

Note. MIP = mood induction procedure. VAS = visual analog scale. η_p^2 = partial η^2. Pwr = power.
[a]The Levene's test for this ANOVA was significant, $p = .021$. ANOVA is, however, robust to violations of the assumption of homogeneity of variance when sample sizes are greater than 30, which, in this analysis, they are.

Table G6

One-way ANOVAs Comparing Each Sad MIP Condition to the Combined Neutral MIP Condition on 10-min Post-MIP VAS Scores

Condition	*n*	*M*	*SD*	*F*	*df*	*p*	η_p^2	Pwr
Neutral	98	23.36	20.59					
Sad music	94	34.17	16.59	0.09[a]	1, 190	.764	> .01	.06
Sad memory	100	27.46	21.21	1.91	1, 196	.169	.01	.28
Sad music+memory	96	26.02	19.05	0.87	1, 192	.351	> .01	.15

Note. MIP = mood induction procedure. VAS = visual analog scale. η_p^2 = partial η^2. Pwr = power.
[a]The Levene's test for this ANOVA was significant, $p = .020$. ANOVA is, however, robust to violations of the assumption of homogeneity of variance when sample sizes are greater than 30, which, in this analysis, they are.

Appendix H

Absolute Pre- to Post-MIP VAS Score Changes

To determine whether mean pre- to post-MIP VAS score differences met the criterion of being at least either 10 mm or 20 mm, the mean pre-MIP VAS score was subtracted from each of the six mean post-MIP VAS scores, separately for each sad MIP condition. For each post-MIP time point, if the mean pre-MIP versus post-MIP VAS score difference was ≥ 10 mm, the induced sad mood was deemed to be present, according to the 10-mm criterion. Similarly, for each post-MIP time point, if the mean pre-MIP versus post-MIP VAS score difference was ≥ 20 mm, the induced sad mood was deemed to be present, according to the 20-mm criterion. Mean pre- to post-MIP difference scores for each of the sad MIP conditions are presented for each post-MIP time point in Table H1.

Table H1

Absolute Differences Between the Mean Pre-MIP VAS Score and each Post-MIP VAS Score, for Each Sad MIP Condition

Condition	Minutes Post-MIP					
	0	2	4	6	8	10
Sad music	10.25	5.12	3.62	2.83	1.05	1.60
Sad memory	21.05	12.57	9.14	5.59	4.53	3.20
Sad music+memory	20.64	12.36	9.16	6.17	5.70	2.25

Note. MIP = mood induction procedure. VAS = visual analogue scale.

To determine the percentage of participants who met the 10-mm or 20-mm criterion at each time point following the MIP, six difference scores were first computed for each participant (i.e., each participant's pre-MIP VAS score was subtracted from each of their six post-MIP VAS scores). Next, for each of the six difference scores, frequency

tables were used to identify the percentage of participants who had a difference score ≥ 10-mm, separately for each sad MIP condition. This second step was repeated to determine the percentage of participants who had a difference score ≥ 20-mm.

Appendix I

Comparisons of Post-MIP Estimated (Trajectory) Means

Table I1
Chi-square Difference Tests Comparing the Estimated (Trajectory) Means of 0-min Post-MIP VAS Scores of the Sad MIP Conditions

	χ^2	*df*	χ^2_{diff}
Unforced Model	261.01	57	
Forcing the means be the same for:			
all 3 MIP conditions	284.83	59	23.82***
Music and Memory	271.96	58	10.95**
Music and Music+Memory	281.68	58	20.66***
Memory and Music+Memory	264.07	58	3.05

Note. MIP = mood induction procedure. VAS = visual analog scale. These models included the pre-MIP VAS score as a covariate.
** $p < .01$. *** $p < .001$.

Table I2

Chi-square Difference Tests Comparing the Estimated (Trajectory) Means of 2-, 4-, 6-, 8-, and 10-min Post-MIP VAS Scores of the Sad MIP Conditions

	χ^2	*df*	χ^2_{diff}
Unforced Model	87.21	36	
Forcing the means be the same for:		2 Min Post-MIP	
all 3 MIP conditions	100.69	38	13.48**
Music and Memory	96.33	37	9.12**
Music and Music+Memory	97.62	37	10.42**
Memory and Music+Memory	87.23	37	0.02
		4 Min Post-MIP	
all 3 MIP conditions	95.36	38	8.15*
Music and Memory	92.50	37	5.29*
Music and Music+Memory	93.65	37	6.44*
Memory and Music+Memory	87.23	37	0.03
		6 Min Post-MIP	
all 3 MIP conditions	91.82	38	4.61
		8 Min Post-MIP	
all 3 MIP conditions	89.99	38	2.79
		10 Min Post-MIP	
all 3 MIP conditions	89.20	38	2.00

Note. VAS = visual analog scale. MIP = mood induction procedure. These models did not include the pre-MIP VAS score as a covariate. Follow-up analyses were not conducted when omnibus tests were not significant.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Appendix J

Comparison of Estimated (Trajectory) Slopes

Table J1
Chi-square Difference Tests Comparing the Estimated (Trajectory) Slopes of the Sad MIP Conditions

	χ^2	*df*	χ^2_{diff}
Unforced Model	261.01	57	
Forcing the means be the same for:			
all 3 MIP conditions	268.67	59	7.65*
Music and Memory	268.05	58	7.04**
Music and Music+Memory MIP	264.61	58	3.59
Memory and Music+Memory MIP	261.35	58	0.36

Note. MIP = mood induction procedure. These models included the pre-MIP VAS score as a covariate.
* $p < .05$. ** $p < .01$.

Appendix K

Comparison of Post-MIP VAS Scores Across Sad MIP Conditions, Stratified by Endorsement of Music as Sad

A one-way between-subjects ANOVA was conducted to determine whether it is possible that RUTMY (played at half speed) is not as effective an MIP as the memory or music+memory MIP because many individuals do not experience the musical selection as sad. The between-subjects factor of stratified condition had five levels, namely (a) participants in the music condition who did *not* endorse the music as sad, (b) participants in the music condition who *did* endorse the music as sad, (c) participants in the memory condition, (d) participants in the music+memory condition who did *not* endorse the music as sad, and (e) participants in the music+memory condition who *did* endorse the music as sad. The ANOVA indicated that the groups did significantly differ, $F(4, 291) = 7.81$, $p < .001$, partial $\eta^2 = .10$. (Means and standard deviations are presented in Table K1.)

Table K1
Comparison of 0-Min Post-MIP VAS Scores Across Sad MIP Conditions, Stratified by Participants Who Did and Did Not Endorse Music As Sad

Condition	*n*	*M* (*SD*)
Sad music condition, did not endorse music as sad	45	26.31 (18.81)
Sad music condition, endorsed music as sad	52	39.19 (21.64)
Sad memory condition	102	45.33 (24.55)
Sad music+memory condition, did not endorse music as sad	41	39.00 (24.63)
Sad music+memory condition, endorsed music as sad	56	49.48 (20.93)

Note. MIP = mood induction procedure. VAS = visual analog scale.

Tukey's HSD follow-up tests indicated that participants in the music MIP condition who did not endorse music as sad reported significantly weaker sad moods immediately following the MIP than did participants in the (a) music condition who did endorse the music as sad, $p = .043$, (b) memory condition, $p < .001$, and (c) music+memory condition who endorsed music as sad, $p < .001$. Additionally, when excluding participants who did *not* endorse the music as sad, post-MIP VAS scores did not significantly differ among the three sad MIP groups, $F(2, 207) = 2.75$, $p = .067$, partial $\eta^2 = .03$ (see Table K1).

Appendix L

Letter of Information & Consent

Western
UNIVERSITY · CANADA

Letter of Information

Project Title: PrimeTime 1

Principal Investigator: Dr. David Dozois, PhD, Western University

Co-Investigator: Jennifer Gillies, MSc candidate, Western University

1. **Invitation to Participate**
   This study explores the links between memory, music, and mood. You have been invited to participate in one in-lab session lasting approximately 1 hour. You will be compensated with 1 research credit per hour toward Psych 1000 for participating in this study. If you are enrolled in a course other than Psych 1000, your compensation will be based on your course outline. If you have any questions about the time or compensation, please feel free to contact the investigators before you consider signing the consent form.

2. **Purpose of the Letter**
   The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this research.

3. **Purpose of this Study**
   The purpose of this study is to examine how memory and music is related to people's mood. This will help us to better understand the link between mood and various forms of human functioning.

4. **Inclusion Criteria**
   Individuals who are undergraduate students at Western University are eligible to participate in this study.

5. **Exclusion Criteria**
   Individuals who are not students at Western University are not eligible to participate in this study. Additionally, individuals who have previously completed the Mood Lab study entitled "The Effects of Thinking on Mood and Mood on Thinking" are not eligible to participate in this study.

6. **Study Procedures**
   This study will consist of one in-lab session conducted in the Mood Lab at Western University. During this session, you will be asked to complete a series of tasks and questionnaires. You will be asked to rate your mood throughout the study and also to answer questions relating to your personality, your mood, symptoms you may have been experiencing, how you think about yourself, and your demographics (e.g., age, gender). One of the tasks involves undergoing a priming procedure during which you may be asked to listen to some music and/or to think and write about a particular time in your life. After the session, you will be debriefed by the researcher. The entire session, including debriefing, will take no more than 1 hour. You may withdraw from the study at any time should you decide you would no longer like to participate, without any loss in compensation for the session. Similarly, refusal to answer questions will not result in loss of compensation. That is, after beginning the study procedures, you will still receive 1.0 (or as otherwise stated) course credits should you choose not to answer certain questions and/or you choose to terminate your participation early in this study.

Western
UNIVERSITY · CANADA

7. **Possible Risks and Harms**
You may experience some mild discomfort when completing the questionnaires and/or tasks, but this should be transient. As part of the study, we may or may not be inducing a mood state; however, research shows that such states are temporary in nature (e.g., Isen & Gorglione, 1983; Segal & Ingram, 1994). Further, you will be provided with a debriefing form at the end of your participation that provides resources on campus and in the community, which you can use if you are distressed.

8. **Possible Benefits**
The benefits of participating in this study are likely to outweigh the risks. Participants will be afforded an opportunity to gain greater insight into their own personal beliefs about themselves. Additionally, information gathered may provide benefits to society as a whole, including learning more about the course of depression and its associated risk factors. Finally, this study gives you the opportunity to learn more about how psychological research is conducted.

9. **Compensation**
You will be compensated with 1 research credit per hour toward Psych 1000 for participating in this study. If you are enrolled in a course other than Psych 1000, your compensation will be based on your course outline. If you have any questions about the time or compensation, please feel free to contact the investigators before you consider signing the consent form.

10. **Voluntary Participation**
Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions, or withdraw from the study at any time with no effect on your academic status or relationship to the university. If you refuse to participate partway through the study, any data collected will not be used. You do not waive any legal right by consenting to this study.

11. **Confidentiality**
All data collected will remain confidential and accessible only to the investigators of this study. While we do our best to protect your information, there is no guarantee that we will be able to do so; if data collected during the project include information that we may be required to report by law, we have a duty to report. Additionally, representatives of the University of Western Ontario's Non-Medical Research Ethics Board may require access to your study-related records to monitor the conduct of the research. Data is stored by Western University Psychology Department's secure server and all forms are stored in locked filing cabinets. If the results are published, your name will not be used. If you choose to withdraw from this study, your data will be removed and destroyed from our database. All data will be destroyed 5 years after study completion.

12. **Contacts for Further Information**
If you require any further information regarding this research project or your participation in the study you may contact the Principal Investigators: Dr. David Dozois ([redacted] email: [redacted] or Jennifer Gillies[redacted]email[redacted]If you have any questions about your rights as a research participant or the conduct of this study, you may contact The Office of Human Research Ethics[redacted]: [redacted]

13. **Publication**
If the results of the study are published, your name will not be used. If you would like to receive a copy of any potential study results, please contact Jennifer Gillies at[redacted]email: [redacted]

This letter is yours to keep for future reference.

Western
UNIVERSITY · CANADA

Consent Form

Project Title: PrimeTime 1

Principal Investigator: Dr. David Dozois, PhD, Western University

Co-Investigator: Jennifer Gillies, MSc candidate, Western University

I have read the Letter of Information, have had the nature of the study explained to me, and I agree to participate. All questions have been answered to my satisfaction.

Participant's Name (please print): _____

Participant's Signature: _____

Date: _____

Person Obtaining
Informed Consent (please print): _____

Signature: _____

Date: _____

Appendix M

Debriefing Form

Western
UNIVERSITY · CANADA

Debriefing

Project Title: PrimeTime 1

Thank you for your participation in this study, which has helped to contribute to knowledge in the field of psychology. Numerous studies have shown that mood affects countless psychological processes, such as the way we think, behave, and navigate personal relationships. Having an effective and valid way of inducing, or "putting someone into," a specific mood is therefore crucial if we want to be able to properly study the ways different moods affect different things. *Mood Induction Procedures* (MIPs) are currently used by researchers across many research areas to do exactly this. Although researchers have demonstrated that MIPs are effective in inducing a mood—that is, showing that someone who was not sad before an MIP is sad after it, for example—not many researchers have looked at how long this mood effect lasts. This is important to know, since researchers who use MIPs often assume that an induced mood state lasts long enough for participants to complete the tasks of interest.

The goal of this study is therefore to determine how long the mood effects of different types of MIPs last. During the study, you were assigned to one of six conditions—to one of three experimental conditions, in which you were exposed to a commonly used sad-MIPs, **or** to one of three matched-control, neutral-MIP conditions. If you were in an experimental condition, you would have listened to a sad piece of music, recalled a sad personal memory, or both. If you were in a control condition, you would have listened to a mood-neutral piece of music, recalled a neutral personal memory, or both. You were also asked to rate your current mood before and after your specific MIP. This will allow us to determine how long an MIP-induced mood state lasts, what the trajectory of the mood effect looks like, and whether this differs according to the type of MIP that is used. The items regarding dysfunctional attitudes that you rated will allow us to investigate whether mood influences the activation of dysfunctional attitudes. Finally, you completed questionnaires measuring rumination, personality traits, demographic characteristics, and symptoms of depression, which will be used to determine whether certain mood responses to MIPs can be predicted from these individual characteristics.

Considering the number of researchers who use MIPs, answering these questions will have a significant impact on the way we understand and study mood and its effects on human functioning. More specifically, it is hoped that this study will contribute to a better understanding of research on mood vulnerability factors that influence the development and maintenance of depression. This information will also add to the existing literature regarding how our thoughts influence the development of depression, as well as potentially inform future clinical practice.

Please be assured that your responses are anonymous and will be used for research purposes only. Your name will not be recorded on your questionnaires or associated with your answers. To reduce the possibility that other participants will be biased by preconceptions about this study, we would greatly appreciate if you would not discuss the details of this study with your fellow students.

Thank you again for your participation in this study.

Sincerely,

Jennifer Gillies, M.Sc. candidate

Should you have any questions or concerns about this study, or would like additional information about accessing psychological resources, please contact:
Principal Investigators: Dr. David Dozois [redacted] email: [redacted] or Jennifer Gillies [redacted], email [redacted]

If you have any questions about your rights as a research participant, please contact:

The Office of Human Research Ethics [redacted], email [redacted].

Below are a variety of resources if you are interested in learning more about depression, how you can help yourself, or how you can arrange for professional help.

Self-Help References:
If you would like to look up some good self-help books on changing negative thinking, please see:

- Burns, D. D. (1980). *Feeling good.* New York: Penguin.
- Burns, D. D. (1989). *The feeling good handbook*. New York: Penguin.
- Greenberger, D., & Padesky, C. A. (2015). *Mind over mood: Change the way you feel by changing the way you think, 2nd edition.* Guilford Press.
- Wright, J. H., & McCray, L. W. (2011). *Breaking free from depression: Pathways to wellness.* Guilford Press

Available Services

There are several ways in which individuals can access psychological or psychiatric help both on campus and within the City of London, Ontario. If you are feeling depressed or anxious or feel that you could benefit from some individual assistance, the following information may be of use to you.

The Student Development Centre at the University of Western Ontario
- Individual appointments are available for students. To make an appointment you can call **(519) 661-3031**, or you can make an appointment in person at the Reception Desk, Room 4100 of the Western Student Services Building.
- Psychological Services Staff will make every effort to respond as quickly as possible when an individual student requires an emergency appointment.
- Psychological Services Staff can help you deal with a variety of issues including those related to traumatic events, sexual or physical assault, date rape, interpersonal violence, and gay, lesbian, bisexual, or transgender issues.
- More information about the services offered at SDC can be found at **http://www.sdc.uwo.ca/**

London Crisis Centres
Psychological Services Staff will make every effort to respond as quickly as possible when an individual requires an emergency appointment. If you are in crisis when the office is closed please call one of the numbers listed below.
- **Mental Health Crisis Centre**: 519-433-2023
- **Sexual Assault Centre London Crisis Line**: 519-438-2272
  - Also 24 hour support line for sex trade workers: 519-438-2272
- **Women's Community House Help Line**: 519-642-3000
  - Out-of-Town calls: 1-800-265-1576
- **Zhaawanong (Atenlos) Shelter**: 519-438-0068
  - Outside of the London area code: 1-800-605-7477
  - 24 hour crisis line: 519-432-0122
- **St. Joseph's Sexual Assault and Domestic Violence Centre**: 519-646-6100 ext 64224

Student Health Services Counselling Centre
- SHS is located in **Room 11, (Lower Level) University Community Centre**, U.W.O. Main telephone line: (519) 661-3030.
- The Student Health Services Counselling Centre provides individual counselling for students. The Counselling Centre can be reached at (519) **661-3771**.
- The Counselling Centre's Hours of Operation are as follows: Monday to Friday 8:30 a.m.- 4:30 p.m. (Please note the Counselling Centre will be closed when the university is closed.)

Canadian Mental Health Association – Middlesex (including London)

- CMHA offers a variety of services to residents of London and the wider Middlesex County; for more information about programs offered visit http://cmhamiddlesex.ca/programs/
- The London site is located at 648 Huron Street, telephone number: **519-434-9191**
- Hours of operation at the London site are 8:30am to 4:30pm, Monday to Friday

Emergencies After Hours

- If you are in distress during an after-hours time, please go to the **nearest hospital emergency room**.
- **On Campus:** University Hospital: 519-663-3197, 339 Windermere Rd.
- **South London:** Victoria Hospital: 519-685-8141, 800 Commissioners Rd. East
- **North London:** St. Joseph's Hospital: 519-646-6100, 268 Grosvenor Rd.

Referrals to Other Resources

- Family physicians can provide you with counselling services, and can make referrals to other community resources as needed.
- Specialized services for emotional and interpersonal problems are available, however, a referral from a physician is often necessary.

We hope that this information is helpful to those who need it.
If you are suffering from distress, we encourage you to seek help from an appropriately qualified individual or service centre. Please contact a University or Community Agency that can help you, or to speak with a physician who can refer you to the appropriate resource.

Appendix N

Ethics Board Approval Letter

Western Research

Research Ethics

Western University Non-Medical Research Ethics Board
NMREB Delegated Initial Approval Notice

Principal Investigator: Prof. David Dozois
Department & Institution: Social Science\Psychology,Western University

NMREB File Number: 108962
Study Title: PrimeTime 1

NMREB Initial Approval Date: March 10, 2017
NMREB Expiry Date: March 10, 2018

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Advertisement	Advertisement to go on the SONA system.	2016/09/19
Advertisement	Poster advertisement to be put up on campus.	2016/12/20
Advertisement	Advertisement to be posted on UWO Facebook groups.	2016/09/19
Instruments	Participant Engagement Measure. Received January 25, 2017	
Instruments	Visual Analogue Scale (VAS) - Mood Measurement. Received January 25, 2017	
Instruments	Complete list of all 100 items from the Dysfunctional Attitudes Scale (Weissman, 1979), including items from the DAS-SF1 and DAS-SF2. Received January 25, 2017	
Instruments	NEO - Five Factor Inventory (Self-Report, College Age). Received January 25, 2017.	
Instruments	Ruminative Responses Scale. Received January 25, 2017.	
Instruments	Dysfunctional Attitudes Scale Short Forms 1 & 2. Received January 25, 2017.	
Western University Protocol	Received February 23, 2017.	
Instruments	Demographics	2017/02/23
Advertisement	PowerPoint slide for use as an advertisement in classrooms for paid participation in the study.	2017/02/23
Letter of Information & Consent	For participants receiving money as compensation (Version 3).	2017/02/23
Letter of Information & Consent	For participants receiving SONA credit (Version 2).	2017/02/23

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the above named study, as of the NMREB Initial Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

[redacted]

Western University, Research, [redacted]

Curriculum Vitae

Name:	Jennifer C. P. Gillies
Post-secondary Education and Degrees:	Western University London, Ontario, Canada 2016–2018 MSc
	Queen's University Kingston, Ontario, Canada 2009–2014 BA (Hons)
Honours and Awards:	Ontario Graduate Scholarship 2017–2018 (Declined); 2018–2019
	Social Science and Humanities Research Council (SSHRC) Canada Graduate Scholarship 2017–2018
	Queen's University Dean's Honour List with Distinction 2011, 2013, 2014
	Queen's University Dean's Special Award 2011, 2013
	Queen's University Excellence Scholarship 2009
Related Work Experience:	Teaching Assistant Western University 2016–2018

Publications and Presentations:

Gillies, J. C. P., & Dozois, D. J. A. (June 2018). *Relative effectiveness of three commonly used sad mood induction procedures (MIPs).* Presented at the 2018 International Congress of Applied Psychology, Palais des Congrès de Montréal, Montréal, QC.

Gillies, J. C. P., Szota, L., Wilde, J. L., Dozois, D. J. A., & Martin, R. A. (June, 2017). *Examining the structure of the Young Schema Questionnaire-Short Form in a non-psychiatric undergraduate sample.* Presented at the 2017 meeting of the Canadian Psychological Association, Fairmont Royal York Conference Centre, Toronto, ON.

Wilde, J. L., Gillies, J. C. P., Szota, L., Dozois, D. J. A., & Martin, R. A. (June, 2017). *The role of emotional intelligence and self-criticism in depressive symptoms.*

Presented at the 2017 meeting of the Canadian Psychological Association, Fairmont Royal York Conference Centre, Toronto, ON.

Szota, L., Wilde, J. L., Gillies, J. C. P., Dozois, D. J. A., & Hayden, E. P. (June, 2017). *Maternal transmission of cognitive vulnerability to depression.* Presented at the 2017 meeting of the Canadian Psychological Association, Fairmont Royal York Conference Centre, Toronto, ON.

Chiarella, J., Schumann, L., Fahim, C., Thunem, J., Khalid-Khan, S., Szyf, M., Peter, A., Blaney, B., Gillies, J., Harkness, K. L., & Booij, L. (2015, June). *Frontal-limbic brain development in depressed adolescents with various levels of childhood abuse: A preliminary study.* Poster presentation at the Canadian College of Neuropsychopharmacology Conference, Ottawa, ON.

Schumann, L., Chiarella, J., Fahim, C., Khalid-Khan, S., Peter, A., Blaney, B., Gupta, D., Gillies, J., Harkness, K. L., & Booij, L. (2015). Morphological and functional brain development in depressed adolescents with various levels of childhood abuse: A preliminary study. *Biological Psychiatry, 77*(9, Suppl.), 241.

Gillies, J. C., & Harkness, K. L. (2013, March). *Differences in the clinical profile of adolescents and young adults with major depressive disorder across parental history groups*. Oral presentation at the Inquiry@Queen's Undergraduate Research Conference, Kingston, ON.

Gillies, J. C., & Harkness, K. L. (2013, May). *Associations among parental history of depression, parenting style, and clinical profile in depressed adolescents and young adults*. Oral presentation at the 43rd Annual Ontario Undergraduate Psychology Thesis Conference, Toronto, ON.