LITERATURE REVIEW: Mind Wandering and Anhedonia: A Systematic Review

EMPIRICAL PAPER: An Experience Sampling Study: Does Mind Wandering Mediate the link between Depression and Anhedonia?

Submitted by Joanna Diana (Jodi) Pitt, to the University of Exeter

as a thesis for the degree of Doctor of Clinical Psychology, May 2016

Signature: 

Table of Contents

List of Tables

Literature review

Empirical paper

List of Figures

Literature review

Empirical Paper

SCHOOL OF PSYCHOLOGY

DOCTORATE IN CLINICAL PSYCHOLOGY

LITERATURE REVIEW

Mind Wandering and Anhedonia: A Systematic Review

Trainee Name:	**Joanna Diana (Jodi) Pitt**
Primary Research Supervisor:	**Dr Barney Dunn**
	University of Exeter, Mood Disorders Centre
Secondary Research Supervisor:	**Dr Nick Moberly**
	University of Exeter, Mood Disorders Centre
Target Journal:	Emotion
Word Count:	3934 words (excluding abstract, table of contents, list of figures, references, footnotes, appendices)

Submitted in partial fulfilment of requirements for the Doctorate Degree in Clinical Psychology, University of Exeter

Abstract

Background: There is increasing theoretical interest in the idea that a greater tendency for the mind to wander may reduce positive emotion experience, with specific interest in clinical conditions such as depression that are characterised by reduced pleasure experience (anhedonia). However, it is unclear to what degree these claims are empirically supported.

Objective: A systematic review was conducted to examine the evidence regarding the association between mind wandering and positive emotion experience.

Method**:** The Cochrane library, MEDLINE, PsycINFO, and Web of Knowledge databases were searched. A narrative discussion considered both the pattern of findings and the methodological approaches utilised in this literature.

Results**:** 879 studies were identified and 21 relevant papers were fully reviewed, consisting of cross-sectional, prospective and manipulation studies.

Conclusions**:** Fourteen out of 15 cross-sectional studies supported the claim that increased mind wandering was related to decreased pleasure experience. One prospective study indicated that mind wandering generally preceded but was not subsequent to reductions in positive mood. There were six studies that manipulated mind wandering experimentally, four of which found that inducing greater mind wandering led to reduced positive affect and two of which found null results. Overall, this literature supports the claim that greater mind wandering is related to reduced positive affect. However, very few studies examined this relationship in the context of depression and therefore it remains to be established if these findings generalise to clinical populations.

Keywords*:* Mind wandering, positive affect, anhedonia

Introduction

Major Depressive Disorder (MDD) is defined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) as a cluster of symptoms including depressed mood and/or loss of pleasure and interest that results in functional impairment lasting at least two weeks (American Psychiatric Association, 2013). MDD is a highly prevalent condition that frequently has a chronic, relapsing prognosis. Point prevalence in the UK is estimated at 2.6% (McManus, Meltzer, Brugha, Bebbington, & Jenkins, 2009), with a lifetime prevalence of 30-40% (Kruijshaar et al. 2005). Current treatments are only partially effective, with 40% experiencing MDD classified as “treatment-resistant” (Al-Harbi, 2012). In addition, 60% of those responding to treatment, half will relapse within two years (Geddes et al., 2003). As a result, MDD has a huge impact on work productivity and absenteeism, wider society and the healthcare system. In the UK, MDD has been estimated to cost the economy approximately £12 billion per year (Layard, 2006). There is therefore a need to improve clinical outcomes. One way to do so is to focus on prognostically important but clinically neglected features of MDD. With better understanding of what causes and maintains features, we can then target these systematically. This could be applied to treating previously neglected areas of MDD.

One such feature is anhedonia. Anhedonia is a core symptom of MDD, defined as a “loss of interest and pleasurable feelings” and “capacity for enjoyment, interest, and concentration is reduced” (F32, The World Health Organisation [WHO], 2010). Anhedonia can be seen as a deficit in positive affect. The systems that regulate positive affect have been argued to be at least partly orthogonal to those that control negative affect (Watson, Clark & Tellegen, 1988). Therefore, existing treatments that focus primarily on reducing negative affect are unlikely to

be effective in building positive affect, as it is likely that different mechanisms may underpin the positive and negative affect symptoms of MDD (Dunn, 2012). Prolonged symptoms of anhedonia are significant predictors of a poor course of MDD and sub-optimal treatment outcome (Morris, Bylsma, & Rottenberg, 2009; Spijker, Bijl, De Graaf, & Nolen, 2001; Vrieze et al., 2014). If treatments can better repair anhedonia, this may, therefore, result in improved MDD outcomes. To repair positive affect deficits in MDD, it is first necessary to characterise the psychological mechanisms which underpin anhedonia so that these can be targeted in therapy.

One candidate mechanism linked to reduced pleasure generally (and anhedonia specifically in the context of MDD) is mind wandering (MW). MW is a "shift in the focus of attention away from the here and now, towards one's private thoughts and feelings" (pp.818, Smallwood, O'Connor, Sudbery, & Obonsawin, 2007). MW is similar to daydreaming and is also known as "mind pops", "off-task thinking", "task-unrelated thoughts", "images" or "zone outs" (Schooler et al., 2002). MW is the inverse of present moment awareness that aims to be cultivated in mindfulness practices (Kabat-Zinn, 2009; Mrazek, Smallwood, & Schooler, 2012).

The theoretical claim has been made that a greater tendency to mind wander is linked to reduced positive affect experience (Killingsworth & Gilbert, 2010; Ottaviani et al. 2015; Stawarczyk, Majerus, Van der Linden, & D'Argembeau, 2012), but how well this claim is empirically supported remains to be established. This review will examine the evidence in support of this claim, considering both the pattern of findings observed and what methodologies underpin these findings. To robustly establish MW as a mechanism reducing positive affect, it is important to show: i) greater MW correlates with reduced positive affect (cross-sectional evidence); ii) greater MW at time one predicts reduced positive affect at time two

when controlling for positive affect at time one (prospective evidence); and iii) that experimentally manipulating MW leads to altered positive affect (causal evidence). This review will consider whether these three strands of evidence are in place. Moreover, the review seeks to highlight whether any evidence exists that specifically links MW and reduced positive affect in clinical conditions such as MDD.

Methods

The Preferred Reporting Items for Systematic reviews and Meta Analyses (PRISMA) checklists were used as a guideline for this systemic review (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009).

Inclusion and Exclusion Criteria

The inclusion criterion for the study sample were adults aged from 17-65 (including both clinical and non-clinical studies). We excluded samples with adults aged over 65 or children aged under 17, given evidence that MW is a slightly different phenomenon across the life span and that depression presents in different ways in early and later life (Alexopoulos; 2005, Giambra, 1974; Radloff, 1991).

Studies had to include a validated measure of positive affect/anhedonia and a validated measure of MW (or a related construct such as daydreaming or present moment awareness). The one exception to this was studies using experience-sampling methodologies, for which we allowed non-validated measures of MW and positive affect to be reported. We excluded studies that reported eudaimonic measures of wellbeing (i.e., meaning and purpose) because the focus of interest here was specifically positive affect experience. As one of the aims of the review was to explore what kinds of methods have been used to assess the associations between MW and positive affect, any study design was eligible. Studies were not

selected if they were: (a) a review article; (b) not published in English; (c) not available in full text; and (d) non-peer reviewed. See appendix A for further inclusion criteria information.

Information sources

The following databases were used for computerised searches: Cochrane library (1972-present), Web of Knowledge (1900-present), Healthcare databases advanced search (HDAS) which incorporates MEDLINE (1966-present) and PsycINFO (1800-present). Furthermore, reference lists of pertinent review articles and chapters (e.g., Killingsworth & Gilbert, 2010; Schooler et al. 2014) were reviewed for relevant publications between January 2016 and March 2016.

Search Strategy

The exact search terms (including wild cards) are reported in Appendix B. We searched for MW and related concepts (self-generated thought, daydreaming, absent-mindedness, task unrelated thought or stimulus independent thought). We also searched for widely used measures of MW, including low scores on the Acting With Awareness facet of the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer & Toney, 2006) and the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003). All articles had to have at least one such definitional term or commonly used measure of MW in the title or abstract.

We also searched for positive affect and related concepts (including anhedonia) and commonly used measures including the Positive and Negative Affect Schedule (PANAS; Watson, Clark & Tellegen, 1988) and the Temporal Experience of Pleasure Scale (TEPS; Gard, Gard, Kring, & John, 2006). All articles had to have at least one commonly used measure of positive affect in the title or

abstract. If studies relied on a clinical measure of positive affect (e.g., anhedonia) this needed to be in the context of MDD.

Study Selection

The titles and abstracts that met the inclusion criteria were selected. A more detailed review of the full article was then conducted to determine if a study was eligible to be included in the review.

Evaluating Study Quality

The Cochrane Collaboration tool for assessing risk of bias was used to assess bias in any randomised control trials (RCTs) included in the review (Higgins et al, 2011). The Critical Appraisal Skills Programme (2013) guidelines were drawn upon to evaluate the quality of studies.

Results

Initial searches produced 879 potentially relevant articles. After applying inclusion and exclusion criteria to the titles, 85 articles remained. Forty-two duplicates of other records were then removed, leaving 65 articles. Of these remaining 65 articles, 21 were subsequently rejected as data extraction processes revealed that the full paper did not meet eligibility criteria (a majority failed to include validated measures of positive affect and/or MW). Figure 1 presents this information in flow diagram format. See Appendix C for the title of studies not included in the review and justification of why they were rejected. Of the 21 studies remaining, these used a wide range of measures of MW and positive affect (summarised in Table 1). Table 2 details study characteristics, outcomes and risk of bias of studies included in the review.

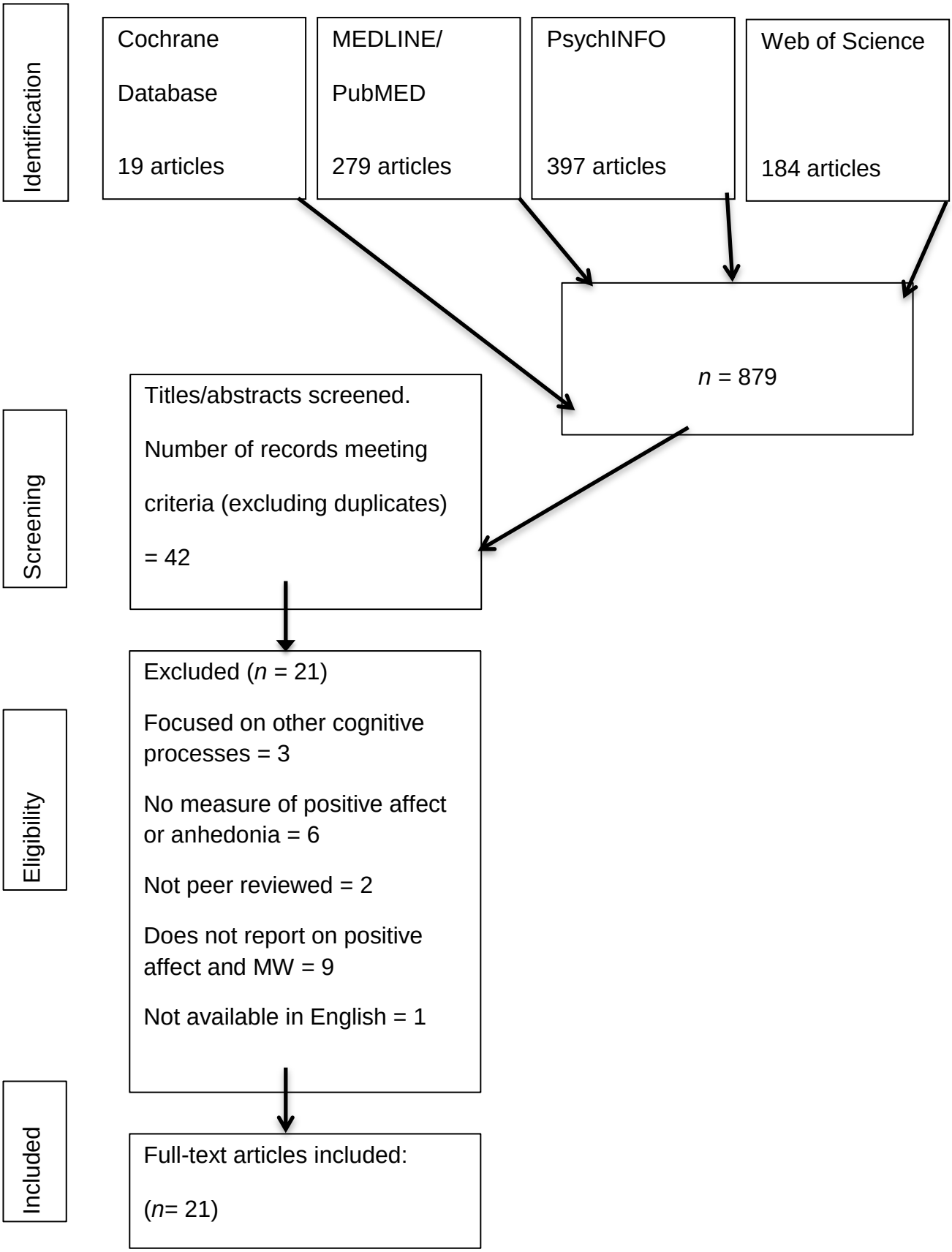


Figure 1. Process of identification, screening, eligibility and inclusion for review and search strategy.

Table 1

Table of measures

Construct measured	Measure	Acronym	Description
Mind wandering	Acting With Awareness, within the Five Facet Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006)	FFMQ-AWA	Eight-item measure of trait tendency to show present moment awareness (the inverse of MW), as part of broader mindfulness measure. Five response options from 1 (never or rarely true) to 5 (very often or always true). Internal consistency for this facet has been rated as α = .91
Mind wandering	Daydream Frequency (DF) and Mind Wandering (MW) subscales within the Imaginal Process Inventory (Singer & Antrobus 1972)	IPI-DF; IPI-MW	Twelve-item measure of trait MW; 12-item measure of trait daydream frequency. The MW and DF subscales are related constructs but can be distinguished from one another. It has been suggested the MW subscale may indicate frequent shifts in attention generally, while the DF subscale may refer to shifts in attention directed towards an internal focus (Mrazek, Phillips, Franklin, Broadway, Schooler, 2013). Each subscale has five response options, and a possible score range of 12–60. Internal consistency of trait MW rated as α = .85
Mind wandering	Present Moment Focus item on Emotion Regulation Profile – revised (Nelis, Quoidbach, Hansenne, & Mikolajczak, 2011)	ERS-PMF	One-item from a 15-scenario instrument measuring “up regulation” (responding in a way that enhances positive emotion) and “down regulation” (responding in a way that enhances negative emotion). Low scores indicate trait MW. Cannot conclude on internal consistency of a single item

Mind wandering	Experience sampling methodology thought probes	ESM	One-item or more to measure momentary or retrospective experience. An example of MW probes might be “are you thinking about something other than what you are currently doing?” (yes/no response), “Were these thoughts, pleasant, unpleasant or neutral?” Reliability in ESM is derived from repeated assessment rather than number of items/Cronbach’s alpha. This justifies small numbers of face valid items to assess a construct
Mind wandering	Mindful Attention Awareness Scale (Brown & Ryan, 2003)	MAAS	Fifteen-item scale measuring mindful-attention traits (the inverse of MW). Participants rate on a scale from 1 (almost always) to 6 (almost never). Low scores indicate trait MW. Internal consistency for this instrument has been rated above $\alpha = .80$
Mind wandering	Sustained Attention to Response Task (Robertson, Manley, Andrade, Baddeley & Yiend, 1997)	SART	Computer task measuring attention lapses and uses online probes. Performance on this test is stable over time. Low scores indicate momentary MW
Positive affect	Experience sampling methodology (ESM) thought probes	ESM	One-item or more to measure momentary or retrospective experience of PA. An example item of PA might be “how positive is your mood at the moment?” (Rating on a Likert scale, e.g. 1 (not at all) to 7 (extremely), or “how did you feel before/after your daydream?”
Positive affect	Positive affect (PA) subscale from the Positive and Negative Affect Schedule (PANAS; Watson, Clark	PANAS-PA	Ten-item scale to measure positive mood at state or trait level. The PANAS-PA uses a 5-point scale that ranges from 1 (very slightly or not at all) to 5

	& Tellegen, 1988)		(extremely) Internal consistency for this facet has been rated as α = .88
Positive affect	Pleasant affect scale (Diener & Emmons, 1984)	PAS	Nine-item scale to measure daily positive mood descriptions. Participants use a 7-point scale from 1 (not at all) to 7 (extremely). Internal consistency rated between α = .78-.94
Positive affect	Positive States of Mind (Horowitz, Adler & Kegeles, 1988)	POMS	Seven-item instrument to measure pleasure experience on a 4-point scale. Participants rate from 0 (inability to achieve this state) to 3 (full attainment). Internal consistency for this instrument has been rated as reasonable α = .77
Positive affect	Anhedonic depression (AD) subscale within the Mood and Anxiety Symptom Questionnaire (Watson & Clark, 1991)	MASQ-AD	Twenty-two-item instrument with subscales that reverse score positive affect and measures loss of interest. Each item is rated on a 1 (not at all) to 5 (extremely) Likert-type scale. Good internal consistency has been found for this subscale, rated as α = .78 to .92. (Watson et al., 1995)
Positive affect	Subjective Happiness Scale (Lyubomirsky & Lepper; 1999)	SHS	Four-item instrument to measure trait happiness on a 7-point scale ranging from 1 (not a happy person) to 7 (a very happy person). Internal consistency for this instrument has been rated as α =.86
Positive affect	Positive affect subscale within Subjective well-being Scale (Albuquerque & Tróccoli, 2004)	SWS-PA	Twenty-two-item facet to measure well-being on 5-point scale ranging from 1 (not at all) to 5 (extremely). Good internal consistency (α = .95). Original validation of measure not available in English

Table 2

Study characteristics, outcomes and risk of bias of studies included in the review

Author(s)	Aims	Method/design	Sample	Measure of PA	Measure of MW	Main findings (with *r, p,* β, *d, b* and η^2 values)	Evaluation	Risk of bias
Atanes et al. (2015)	Explore associations between mindfulness, stress and subjective well-being	Correlational cross-sectional questionnaire design	Non-clinical. 450 Primary healthcare professionals mean age = 36.7 (*SD* = 9.1), 94% females	SWS-PA	MAAS	MAAS was positively correlated with SWS-PA *r* = .45, *p* < .001	**Strengths:** Large sample size **Limitations:** Possibility of social desirability bias due to work setting	Unclear
Black, Semple, Pokhrel & Grenard (2011)	Explore associations between mindfulness, self-control, and working memory	Correlational cross-sectional questionnaire design	Non-clinical. 31 medical students, *M age* = 24.5, *SD* = 3.2. 50% females	PANAS-PA	MAAS	No significant correlation between PANAS-PA and present moment awareness *r* =	**Strengths:** Explorative study into executive functioning **Limitations:** Low sample	Unclear

						.01	size. Skewed distributions	
Branstrom, Duncan, & Moskowitz, (2011)	Explore the associations between psychological functioning and mindfulness	Correlational cross-sectional questionnaire design	Non-clinical.1,000 individuals contacted in general population, 282 responded aged 18–60 years, 59% females	PSOM	FFMQ-AWA	FFMQ-AWA was positively correlated with PSOM, r =.42, p < .001	**Strengths:** Good sample size **Limitations:** Skewed sample of highly educated women. Potential for social desirability bias	Unclear
Brown & Ryan (2003, Study 1)	Explore associations between MAAS and well-being measures	Correlational cross-sectional questionnaire design	Non-clinical. Undergraduate students and community adults took part. 5 samples N = 1,253, age range 17-62 years	PANAS-PA, PAS	MAAS	MAAS was positively correlated with PANAS-PA r = .30 - .39, p < .0001, in all 3 samples where PANAS-PA was measured	**Strengths:** Good sample sizes. **Limitations:** Self-report may produce social desirability response (MAAS was	Unclear

						and in all 5 samples where PAS was measured, *r* = .16-.40, *p* < .01 (for 2 samples; *p* < .0001 for 3 samples)	also moderately correlated with a social desirability measure also included in the study)	
Carciofo, Du, Song & Zhang (2014)	Study 3: Explore associations between sleep quality, MW and affect	Correlational cross-sectional questionnaire design	Non-clinical. *N* = 270 Chinese students aged 18-21 years. Mean age = 18.9 years, *SD* = .79, 72.5% females	PANAS-PA (Chinese version)	IPI-DF, IPI-MW (Chinese version);	IPI-DF (*r* = -.33) and IPI-MW (*r* = -.38) (significant at *p* < .0005 level) were negatively correlated with PANAS-PA	**Strengths:** Large sample size. **Limitations:** Homogenous sample used	Unclear
Deng et al. (2012)	Explore validity and reliability of MAAS	Correlational cross-sectional questionnaire design	Non-clinical. 263 Chinese students mean age = 20.5 years, *SD* = 1.0, 21.3% females	PANAS-PA	MAAS (Chinese version)	MAAS was positively correlated with PANAS-PA, *r* =.23, *p* < .001	**Strengths:** Large sample size. **Limitations:** Homogenous sample used	Unclear

Desrosiers, Klemanski, Nolen-Hoeksema (2013)	Explore associations between mindfulness facets and anxiety and depression	Correlational questionnaire cross-sectional design	Clinical sample.187 treatment for anxiety and depression seeking adults mean age = 38 years, *SD* = 14.2, 64.6% females	MASQ-AD	FFMQ-AWA	Anhedonia and trait AWA were significantly negatively correlated in a path analysis model, β =.28, p < .01. However, in a more parsimonious validation model, AWA was no longer significantly related to AD, β = .23	**Strengths:** Large sample size, parsimonious model used. **Limitations:** Subject to self-presentation biases	Unclear
Quoidbach, Berry, Hansenne, & Mikolajczak, (2010)	Explore associations between savouring and positive emotion	Correlational cross-sectional questionnaire design	Non-clinical. 282 university students and staff mean age = 33.6 years, *SD* = 13.9, 73% females	PANAS-PA; SHS	ERS-PMF	PANAS-PA was positively associated with being present (r = .29, p < .01)	**Strengths:** Large sample size, exploratory study investigating savouring strategies. **Limitations:** Homogenous	Unclear

							group sample. SHS scale not reported on	
Zvolensky et al. (2006)	Explore associations between mindful-attention and mood, anxiety and health	Correlational cross-sectional questionnaire design	Non-clinical. 170 young adults mean age = 22.2 years, *SD* = 7.6, 55.8% females	MASQ-AD, PANAS-PA	MAAS	MAAS was positively correlated with PANAS-PA (r = .17, p < .05) and negatively correlated with MASQ-AD (r =. 31, p < .01)	**Strengths:** Large sample size. **Limitations:** Homogenous group used	Unclear
Brown & Ryan (2003, Study 4)	Explore trait and state mindfulness and day-to-day well-being.	Correlational ESM design	Non-clinical. Undergraduate students and community adults took part. 2 samples *N* = 166, age range 18-62 years	PAS, ESM probe "how did you feel during this activity?"	MAAS; ESM probe: "to what degree were you having these experiences? " (Items from MAAS presented)	MAAS scores were unrelated to day-to-day pleasant affect. ESM MW probes were negatively related to PAS r =	**Strengths:** Good ecological validity. Combination of trait and state measures to measure construct **Limitations:** Unknown	Unclear

						.25, p < .0001	time delays as participants completed paper forms and recorded time lag from pager signal, which may or may not be accurate	
Franklin et al. (2013)	Explore associations between MW content and mood	Correlational ESM design	Non-clinical.105 participants *M age* = 23.1 years, *SD* = 7.4, 67.6% females	ESM probe "how positive is your mood at the moment?"	ESM probe "were you off-task?" (Yes/no) If yes, participants also answered on how useful and interesting these thoughts were from 1 (not at all) to 5 (extremely)	Positive mood had higher rating for on-task thoughts in comparison to off-task thoughts, b = .16, p < .0001. Positive MW content was also associated with increased PA for	**Strengths:** Good ecological validity **Limitations:** Homogenous sample used. No effect sizes reported	Unclear

						interest, *b* = .136, *p* = .02, but not for usefulness, *p* = .78		
Killingsworth & Gilbert (2010)	Explore associations between MW, mood and daily activities	ESM/prospective design	Non-clinical. 2250 adults, mean age = 34 years, 58.8% males	ESM probe "How are you feeling right now?" (on a continuum from good to bad)	ESM probe: "Are you thinking about something other than what you are currently doing?" with one of four response options: no; yes, something pleasant; yes, something neutral; or yes, something unpleasant	Greater MW was associated with less PA, slope *b* = –8.79, *p* < 0.001. MW explained 10.8% of within-person variance in happiness and 17.7% of between-person variance in PA. Time lag analyses revealed a significant relationship	**Strengths:** Good ecological validity. Large sample. **Limitations:** Single self-report for MW and PA	Unclear

						were MW preceded but was not subsequent to reductions in PA (b = -1.34, p < .001)		
McVay, Kane, Kwapil (2009)	Explore associations between MW in the laboratory and in everyday life and task performance	ESM; Laboratory design	Non-clinical. 72 students, aged between 18-35 years	ESM probe: "I feel happy right now" (on a 1-7 scale)	SART; ESM probe via PDA asked if "current thoughts had wandered from their activity? (1 yes; 0 no)	MW in the laboratory was associated with MW in everyday life, b = 1.29. Subjects with high PA in everyday life reduced MW differences between subjects with high versus low laboratory MW rates,	**Strengths:** Good use of dual design of experimental and ecological valid methods **Limitations:** PA not measured in the laboratory	Unclear

						b = −.6		
Poerio, Totterdell, Emerson, Miles (2015)	Explore daydreaming content and influence on positive mood	Correlational ESM design	Non-clinical.101 people, mean age = 22.3 years, *SD* = 5.2, 80.1% females	ESM probe: "How did you feel before/after your daydream?"	ESM probe to report on most recent daydreams	Daydream type "social" relative to "non-social" type was associated with increased happiness, $p < .05$ (for two out of five PA items), $p < .001$ (for three out of five items). Participants already "high" in PA did not increase post-social MW. Those low in PA significantly increased in PA after social	**Strengths:** High ecological validity **Limitations:** Possibility for demand characteristics. Reliance on retrospective reports	Unclear

						daydreams $p < .001$, $d = -.71$		
Poerio, Totterdell, Emerson, Miles (2016)	Explore function of social daydreaming during a life transition	Correlational ESM design	Non-clinical.103 students, mean age = 19.3 years, *SD* = 2.3, 72.8% females	ESM probe: a single item measuring positive feelings in response to a daydream	ESM probe: "Right before you were signaled, were you daydreaming ?" ("Yes" = 1, "No" = 0). If no, "Please think about your last daydream that involved another person or people"	Social daydreams were not associated with feeling more positive over time for "late starters" in the study ($B = .006$, $p = .17$). When considering whole sampling period, social daydreams were associated with increases in PA, $B = .007$, $p <$	**Strengths:** High ecological validity **Limitations:** Participants commenced the study at different time points. Some reliance on retrospective reports	Unclear

						.001		
Bränström, Kvillemo, Brandberg & Moskowitz (2010)	Explore the effects of mindfulness training on psychological well-being	Randomisation design to intervention group or a wait-list control group	Clinical sample (health seeking). 71 people with a previous cancer diagnosis. Mean age = 51.8 years, *SD* = 9.86. 99% females	PSOM	FFMQ-AWA	Significant change in PSOM, *d* =.50 and MW FFMQ-AWA, *d* =.37 following mindfulness intervention, based on the difference between the group means at baseline and follow-up change scores. Correlation of MW and PA were negatively correlated, r = .32, *p* < .01	**Strengths:** Power calculated **Limitations:** No blinding of group assignment	High

Brooker et al. (2012)	Explore the impact of occupational mindfulness intervention on wellbeing	Longitudinal observation design	Non-clinical. 34 participants mean age = 42.9 years, *SD* = 9.6, 59% females	PANAS-PA	FFMQ-AWA	Significant increase in PANAS-PA post intervention, *d* = .33. No significant difference for FFMQ-AWA score from pre to post intervention, *d* = −.04	**Strengths:** Exploratory study using adapted mindfulness intervention **Limitations:** Small sample size. No control group. Manipulation check unsuccessful	Unclear

Hanley, Warner, Dehilii, Canto, Garland (2015)	Explore link between brief mindfulness intervention, attention and affect	RCT. Participants engaged in either a mindful or control dishwashing practice	Non-clinical. 51 students, mean age = 20.24 years, *SD* = 2.2, 65% females	PANAS-PA	FFMQ	Sig. increase in PANAS-PA facet "inspired", but not for other PA facets from pre to post intervention for experimental group, *d* = .42. State mindfulness (total FFMQ) increase post intervention relative to control arm β = .43, *p* < .002. FFMQ total positively associated with higher levels of positive affect *r* = 31, *p* < .001	**Strengths:** Control group used **Limitations:** Weak measure of MW	Unclear

Perez-Blasco, Viguer, Rodrigo (2013)	Explore effects of a mindfulness intervention on well-being	RCT. Participants were assigned to either a mindfulness intervention condition or no control (no intervention, but offered mindfulness session post follow up)	Clinical sample (health seeking). 26 breast-feeding mothers mean age = 34.3 years, *SD* = 4.72	SHS	FFMQ-AWA	There was a greater increase in FFMQ-AWA for those in the mindfulness group than those in the control group (η^2 = .42), but there was no significant difference between groups for change in SHS pre to post intervention (η^2 = .07)	**Strengths:** Control group used, effect sizes calculated **Limitations:** Small sample size	Unclear
Smallwood, Fitzgerald, Miles & Phillips (2009)	Explore effect of positive, negative and neutral mood states on MW	Experimental design (where mood was induced and then examined what impact this had on frequency of MW)	Non-clinical. 59 undergraduates *M age* = 21.7 years, *SD* = 2.0, 42.4% males	PANAS-PA	Behavioural incidences on SART Thinking Content component	Negative mood was associated with increases in thought unrelated topic and task related interference	**Strengths:** Study design allows for causal inferences of mood on attention. **Limitations:** Reliance on	High

						relative to positive mood, η^2 = .10	retrospective reports	
Marchetti, Koster, De Raedt (2012)	Explore direct and indirect relationship between MW and accessibility to negative thoughts	Laboratory design (where mood and accessibility to negative cognitions was measured prior to and post probes during a SART task)	Non-clinical. 79 undergraduates mean age = 20.3 years, SD = 2.6, 75.9% females	PANAS-PA	SART	MW was associated with reduced positive mood from t1 to t2, *d* = 1.05	**Strengths:** Adequate sample size **Limitations:** Low ecological validity	Unclear

Note. PA = positive affect; SGT = Self generated thought; SART = Sustained Attention Response Task; PDA = Personal Digital Assistant; Sig = significant. Non-clinical samples were defined as populations including students, the general population and staff. Clinical samples were defined as samples that were seeking treatment. Clinical samples were then sub grouped to include clinical health-seeking samples, such as breast-feeding mothers or those with a previous cancer diagnosis and mental health clinical samples seeking treatment for depression and anxiety.

Critical Evaluation

Risk of bias

Table 2 highlights risk of bias estimation for reported studies. One study was considered to have high risk of bias due to the authors declaring that the students may have deduced the purpose of the study, influencing the results (Smallwood, Fitzgerald, Miles & Phillips, 2009). One study described no blinding procedure (Branstrom, Kvillemo, Brandberg & Moskowitz, 2010), in the context of a RCT. All other studies were considered to have an unclear bias, due to a lack of information as to whether participants guessed the hypotheses of the study, and lack of information regarding missing data. Sequence and randomisation information, omission or relevant outcomes pertinent to study aims that were unreported, or reported elsewhere additionally led to an unclear bias classification.

Cross-sectional studies

Nine questionnaire studies included analyses of the relationship between anhedonia/positive mood and MW/mindful attention. Eight of these studies found more MW was linked to less positive affect. The consistent negative association between positive affect and MW was found across a diverse range of samples, including health professionals (Atanes et al., 2015), students (Carciofo, Du, Song, & Zhang, 2014; Deng et al., 2012; Quoidbach, Berry, Hansenne, & Mikolajczak, 2010), treatment seeking adults with mood disorders (Desrosiers, Klemankski, & Nolen-Hoeksema, 2013) and the general population (Brown & Ryan, 2003, Study 1; Branstrom, Duncan, & Mokowitz, 2011 Zvolensky et al., 2006).

Most studies reported moderate to large effect sizes, using Cohen’s (1998) conventions. Two non-clinical sample studies (Deng et al., 2012; Zvolensky et al.,

2006) revealed small effect sizes. One study reported no association between positive affect and MW (Black, Semple, Pokhrel, & Grenard, 2011). This is likely to be due to the small and homogenous sample used, with potential range restriction effects in both MW and positive affect in this study.

Zvolensky et al.'s (2006) study found moderate negative associations when considering anhedonic depression in relation to mindful-attention in a sample selected from the general population. Desrosiers, Klemanski and Nolen-Hoeksema (2013) similarly found moderate effects between anhedonia and mindful-attention in a treatment seeking clinical sample for anxiety and depression. When using a more parsimonious model, where results from an initial path analysis were used to create a parsimonious model of the relationships between facets of MW and anhedonia, this relationship became non-significant. The authors suggest that the "acting with awareness" (p. 11) aspect of mindfulness may be stronger when there is an interaction between MW and other facets of mindfulness (e.g., observing, non-judging, describing etc), in order to predict positive affect.

Limitations within these studies include the validity of measures used. The SWS-PA (Albuquerque & Tróccoli, 2004) was developed in Brazil and validation of this measure in English is not available. Therefore, the results of Atanes et al.'s (2015) study using a health professional sample should be considered with caution. The results overall from questionnaire studies suggests there is a moderate negative relationship between positive affect and MW.

Six studies used a correlational ESM design; one of these included a prospective design (discussed later). All studies consistently found a significant relationship between MW and positive affect. ESM has been found to be less influenced by memory biases than retrospective questionnaires (Scollon, Prieto, &

Diener, 2009). Two non-clinical sample studies with correlational ESM designs found that present moment focus, or on-task thoughts were associated with increased positive affect (Brown & Ryan, 2003; Franklin et al., 2013). Similarly, two studies used ESM with a non-clinical sample and found that, within-subjects, occasions of MW (i.e., the inverse of present moment focus) were associated with less positive affect (Killingsworth & Gilbert, 2010; McVay, Kane, & Kwapil, 2009).

However, two non-clinical ESM design studies found that greater MW was associated with increased positive affect when the content of the MW was of a social nature, for example, when picturing others with whom the daydreamer had a noteworthy relationship with, or daydreams were about an imaginary person or people (Poerio, Totterdell, Emerson, & Miles, 2015; Poerio, Totterdell, Emerson, & Miles, 2016). This suggests that MW may not be problematic per se and that the content of MW may be an important determinant of the affective consequences. Although high in ecological validity, these studies rely on self-report and may be subject to demand characteristics.

In conclusion, the questionnaire and ESM cross-sectional studies generally reveal a negative relationship between MW and positive affect (where greater MW is linked to less positive affect). It is imperative to note, however, that causal inferences cannot be made based on correlational questionnaire/ESM study designs. In particular, we cannot infer the direction of the relationship between MW and positive affect, nor can we rule out cofounding variables influencing these observed associations.

Prospective studies

One non-clinical ESM study, however, included a prospective design. Killingsworth & Gilbert (2010) included lagged analyses in their study and found

that MW generally preceded but was not subsequent to reductions of positive affect. We cannot establish causality here, but we can make some inferences about directionality of MW on mood. The reliance on self-report in this study, however should be noted.

Manipulation studies

Four studies manipulated MW (using mindfulness interventions) and examined the impact on positive mood. These studies both used clinical health-seeking samples, such as breast-feeding mothers (Perez-Blasco, Viguer, & Rodrigo, 2013) or previous cancer patients (Branstrom, Kvillemo, Brandberg, & Moskowitz, 2010) as well as non-clinical samples, such as students (Hanley, Warner, Dehili, Canot, & Garland, 2015) and staff (Brooker et al., 2012). Two of these studies found mindfulness training was linked to increased positive mood, with small-medium effect sizes relative to pre-intervention scores and the control group (Branstrom, Kvillemo, Brandberg, & Moskowitz, 2010; Hanley, Warner, Dehili, Canot, & Garland, 2015). Two reported null results (Brooker et al., 2012; Perez-Blasco, Viguer, & Rodrigo, 2013)

Two studies (Branstrom, Kvillemo, Brandberg, & Moskowitz, 2010; Perez-Blasco, Viguer, & Rodrigo, 2013) used randomised controlled trial designs which involved randomly allocating participants to either receive a mindfulness intervention (such as an eight week course), or to a control group (wait list for intervention or receive no intervention). Manipulation checks were completed for both of these studies pre and post the intervention to assess change in MW. One study (Perez-Blasco, Viguer, & Rodrigo, 2013), despite a significant MW manipulation check and improvement in MW post intervention, found no significant

difference between the experimental and control group for positive affect following a mindfulness intervention.

One study, by Hanley, Warner, Dehili, Canot and Garland (2015) randomly allocated participants to a mindful or control (following descriptive instructions) dishwashing exercise in the laboratory to determine whether condition (intervention versus control) could predict increases in positive affect. This was the case for only one facet of positive affect (“inspired”) and not the four other facets (“alert”, “determined”, “attentive”, and “active”).

An exploratory study by Brooker et al. (2012) adapted a mindfulness intervention and used an open trial to observe the effects of mindfulness in occupational settings. An increase in positive mood was found post group relative to pre intervention scores, with modest effect sizes. There was no control group, however, and a small sample size was used. A manipulation check was conducted to see if MW had reduced after the intervention. There was no significant difference between MW pre and post the intervention. Therefore, we cannot conclude that MW relates to positive mood change here.

There are some limitations to these findings, such as low sample sizes (Brooker et al., 2012) and no blinding of group assignment (Branstrom, Kvillemo, Brandberg, & Moskowitz, 2010). Mindfulness training is also potentially a weak measurement of MW in relation to the posed research questions, as this potentially includes training in a combination of mechanisms such as non-reactivity and non-judging which may or may not overlap with MW.Investigating whether people whose mindfulness scores increased most showed largest increase in positive affect (i.e., using mediation analyses) may give better insight into the relationship between mindfulness training and positive mood.

Laboratory designs. Two studies invited participants to complete a SART (Sustained Attention to Response Task) that measured attention lapses and can use online probes to measure MW and mood (Marchetti, Koster, & De Raedt 2012; Smallwood, Fitzgerald, Miles, & Phillips, 2009). Marchetti, Koster and De Raedt (2012) measured mood and accessibility to negative cognitions prior and following a SART task. Where negative valence of MW increased, positive mood reduced from T1 to T2, evidenced by large effect sizes. Smallwood, Fitzgerald, Miles and Phillips (2009) induced mood and then examined what impact this had on MW frequency. Positive affect was associated with fewer incidences of MW, relative to negative mood. Furthermore, the authors suggest causal inferences can be made from this study. Although these laboratory studies can be critiqued for low ecological validity, research indicates behavioural markers of MW in the laboratory are comparable to self-reports (McVay & Kane, 2009).

These manipulation studies show a similar trend to findings across cross-sectional studies, with a relationship found between anhedonia/positive affect and MW with small to large effects. Those that have not found this relationship could be attributed to a flawed study design, homogenous samples (such as breastfeeding mothers), and weak measurement of MW due to reliance on a mindfulness intervention or lack of control group. Further research is required.

Discussion

Generally, studies found that increased MW is associated with reduced positive affect. This was revealed using questionnaire data, experience-sampling methods, randomised control trials, intervention studies and laboratory research.

Cross-sectional studies revealed an association between increases in MW and reduced positive affect with small to moderate effect sizes (Atanes et al. 2015;

Branstrom, Duncan, & Mokowitz, 2011; Brown & Ryan, 2003), and three studies showed the reverse, with increases in positive affect associated with reduced MW with moderate effect sizes (Carciofo, Du, Song, & Zhang, 2014; Desrosiers, Klemankski, & Nolen-Hoeksema; 2013 and Zvolensky et al., 2006). All ESM studies included found a relationship between positive affect and MW. These designs are generally more highly powered than a person-level design due to the high number of occasions measured. Some studies showed that those who mind wandered to pleasant events or social content also reported increased positive affect (Franklin et al., 2013; Poerio, Totterdell, Emerson, & Miles, 2015; Poerio, Totterdell, Emerson, & Miles, 2016). This may be subject to particular conditions, for example, MW rated high for “interest” increased positive affect, but in the same sample MW rated high in “usefulness” did not (Franklin et al., 2013). It is unknown whether enhancing present-moment focus or reducing MW experience is key to increasing positive affect or whether valence of thought is more important. These mechanisms potentially tap into different cognitive processes and further research is required in this domain.

One prospective study has made claims that MW may be the cause, and not the consequence, of low positive affect (Killingsworth & Gilbert, 2010). These conclusions should be interpreted with caution, given that they are based on one self-report study. This ESM study indicates that MW predicted unhappiness, but is inconclusive as to whether this increased negative mood or reduced positive mood. Furthermore, this study did not include a clinical sample, required for treatment progression.

A few studies have manipulated MW. Perez-Blasco, Viguer and Rodrigo (2013) found no significant difference between groups in positive affect following a

mindfulness intervention, which trained participants to shift attention towards the present moment without judgement but did see improvement in acting with awareness trait scores (Kabat-Zinn, 2009). This suggests first, that mindfulness training increases FFMQ-AWA, adding accountability to using this as a measure of MW for this review. The findings, however, suggest that training and a decrease in MW traits do not necessarily lead to increased positive affect. It should be noted this study has limitations, including a homogenous pool of participants and small sample size. In the other manipulation studies, it seems that positive affect may reduce incidences of MW (Smallwood, Fitzgerald, Miles, & Phillips, 2009), and mindfulness interventions report increased positive affect relative to controls (Hanley, Warner, Dehili, Canto, & Garland, 2015; Brooker et al., 2012). This suggests that as MW reduces positive affect and vice versa, the relationship may be bi-directional. More research on this possibility is required.

The clinical implications of this review are limited as few studies testing the link between MW and positive affect in clinical populations were retrieved. Further research is required into the association between MW and positive affect in clinical samples.

Limitations

Studies in this review all used different measures of MW and it is unclear if these are equally sensitive and, indeed, whether they all measure the same construct. For example, daydreaming may not be identical to MW (Mrazek, Phillips, Franklin, Broadway, & Schooler, 2013). Instruments used to assess MW often have weak face validity, measuring related facets that are difficult to distinguish from one another, such as behavioural markers of MW in the laboratory or daydreaming (Mrazek, Phillips, Franklin, Broadway, & Schooler, 2013).

It was also assumed that MW is a construct that is negatively related to mindful-awareness (Mrazek, Smallwood, & Schooler, 2012). Given that there is much debate on how to adequately measure mindfulness (Grossman & Van Dam, 2011) and how to define this concept (Mrazek, Smallwood, & Schooler, 2012) this should be considered as a further limitation. One study found that acting with awareness, known as trait MW, was no longer significantly related to positive affect when included in a more parsimonious validation model. It may be that present-moment focus is more complex than just “acting with awareness”. For example, we know that mindfulness measures can consider four additional factors: including observing, describing, non-judging and non-reactivity as other attributes that enhance this experience (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). The MAAS theoretically taps into present-moment awareness only and these selected studies in this review revealed only moderate effects. There is similarly some debate on the face validity of the MAAS, as it measures meta-awareness and self-reflective ability as well as pre-occupation without deviation from a primary task (Mrazek, Phillips, Franklin, Broadway & Schooler, 2013). This lowers the robustness of presented findings somewhat. CASP (2013) guidelines indicate the strongest evidence would come from studies that triangulate multiple behavioural and self-report measures of MW with robust measures of positive affect.

Measures vary as to whether they assess state or trait variables. A trait measure can be considered as how a person tends to act generally, and a state measure taps into how this may vary moment by moment (Brown & Ryan, 2003). Moreover, state and trait effects could conceivably differ. Retrospective self-reports do not always accurately represent what occurs on a day-to-day basis for individuals (Schwartz & Stone, 1998). Retrospective reports are also subject to potential memory biases that can reduce measurement sensitivity (Scollon, Prieto

& Diener, 2009). This review suggests the link between positive affect and MW has been found at both state and trait level, however, reducing these potential limitations.

These findings suggest there is some evidence that there is an association between increased MW and reduced positive affect. The central aim of this systematic review was to examine empirical support for whether the greater tendency for the mind to wander reduces positive experience. This theoretical claim was framed with the view to see whether future depression treatments should aim to correct MW in order to repair anhedonia. However, given that only one study was identified that included depressed participants, it is premature to draw any strong clinical implications from the current findings as to whether psychological therapies for depression would be improved by more explicitly targeting mind wandering. Further research needs to be done to test these claims.

It may be worth considering the possibility that there could be boundary effects on the association observed in the relationships between MW and positive affect. For example, content of MW may moderate results. For instance, positive affect was also associated with valence of thought in some studies (Franklin et al., 2013; Marchetti, Koster & De Raedt, 2012; Poerio, Totterdell, Emerson, & Miles, 2015; Poerio, Totterdell, Emerson, & Miles, 2016). This suggests it may not be MW per se that influences positive affect, rather the valence of thought. Furthermore, we need to examine relationships between MW and negative affect. Further research needs to establish if MW is uniquely linked to positive affect or extends to affective experience generally. Finally, it has yet to be established in any studies whether MW mediates the link between depression and reduced positive affect. This is an important area to research given the pressing need to develop treatments for anhedonia highlighted in the introduction.

Conclusion

In summary, this review provides preliminary evidence that there is a negative relationship between MW and positive affect. There has been a heavy reliance on cross-sectional methods in these results. Further research is required to address whether MW mediates the link between depression and reduced positive affect. Does positive mood reduce MW, or does present-moment focus enhance positive mood? The benefits of present focus and shortfalls of the wandering mind are yet to be fully established. Should future treatments aim to correct MW in order to repair anhedonia in depression? Further research is required to replicate these findings in the context of depression symptoms.

References

Adler, M. G., & Fagley, N. S. (2005). Appreciation: Individual differences in finding value and meaning as a unique predictor of subjective well‐being. *Journal of Personality*, *73*, 79-114. doi: 10.1111/j.1467-6494.2004.00305.x.

Al-Harbi, K. S. (2012). Treatment-resistant depression: therapeutic trends, challenges, and future directions. *Journal of Patient Preference and Adherence*, *6*, 369-388. doi:10.2147/PPA.S29716.

Albuquerque, A. S., & Tróccoli, B. T. (2004). Desenvolvimento de uma escala de bem-estar subjetivo. *Psicologia: teoria e pesquisa*, *20*, 153-164.

Alexopoulos, G. S. (2005). Depression in the elderly. *Lancet*, *365*, 1961-1970. doi:10.1016/S0140-6736(05)66665-2.

American Psychiatric Association (2013). *Diagnostic and Statistical Manual of Mental Disorders, (5th ed.). (DSM-V).* Washington. DC: American Psychiatric Association.

Atanes, A. C., Andreoni, S., Hirayama, M. S., Montero-Marin, J., Barros, V. V., Ronzani, T. M., ... & Demarzo, M. M. (2015). Mindfulness, perceived stress, and subjective well-being: a correlational study in primary care health professionals. *Biomedical Central Complementary and Alternative Medicine*, *15*, 303. doi:10.1186/s12906-015-0823-0.

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, *13*, 27-45. doi:10.1177/1073191105283504.

Black, D. S., Semple, R. J., Pokhrel, P., & Grenard, J. L. (2011). Component processes of executive function—mindfulness, self-control, and working memory—and their relationships with mental and behavioral health. *Mindfulness*, *2*, 179-185. doi:10.1007/s12671-011-0057-2.

Bränström, R., Duncan, L. G., & Moskowitz, J. T. (2011). The association between dispositional mindfulness, psychological well-being, and perceived health in a Swedish population-based sample. *British Journal of Health Psychology*, *16*, 300-316. doi: 10.1348/135910710X501683.

Bränström, R., Kvillemo, P., Brandberg, Y., & Moskowitz, J. T. (2010). Self-report mindfulness as a mediator of psychological well-being in a stress reduction intervention for cancer patients—a randomized study. *Annals of Behavioral Medicine*, *39*, 151-161. doi: 10.1007/s12160-010-91686.

Brooker, J., Julian, J., Webber, L., Chan, J., Shawyer, F., & Meadows, G. (2013). Evaluation of an occupational mindfulness program for staff employed in the disability sector in Australia. *Mindfulness*, *4*, 122-136. doi:10.1007/s12671-012-0112-7.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, *84*, 822-848. doi: 10.1037/0022-3514.84.4.822.

Carciofo, R., Du, F., Song, N., & Zhang, K. (2014). Mind wandering, sleep quality, affect and chronotype: An exploratory study. *Public Library of Science One*, *9*, e91285. doi:10.1371/journal.pone.0091285.

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology*, *100*, 316-336. doi.org/10.1037/0021-843X.100.3.316.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Critical Appraisal Skills Programme (2013). *Critical Appraisal Skills Programme Checklists.* Retrieved from http://www.casp-uk.net/#!casp-tools-checklists/c18f8.

Deng, Y. Q., Li, S., Tang, Y. Y., Zhu, L. H., Ryan, R., & Brown, K. (2012). Psychometric properties of the Chinese translation of the Mindful Attention Awareness Scale (MAAS). *Mindfulness*, *3*, 10-14. doi: 10.1007/s12671-011-0074-1.

Desrosiers, A., Klemanski, D. H., & Nolen-Hoeksema, S. (2013). Mapping mindfulness facets onto dimensions of anxiety and depression. *Behavior Therapy*, *44*, 373-384. doi:10.1016/j.beth.2013.02.001.

Diener, E., & Emmons, R. A. (1984). The independence of negative and positive affect. *Journal of Personality and Social Psychology*, *47*, 1105-1117.

Dunn, B. D. (2012). Helping depressed clients reconnect to positive emotion experience: current insights and future directions. *Clinical Psychology and Psychotherapy*, *19*, 326-340. doi: 10.1002/cpp.1799.

Franklin, M. S., Mrazek, M. D., Anderson, C. L., Smallwood, J., Kingstone, A., & Schooler, J. W. (2013). The silver lining of a mind in the clouds: interesting musings are associated with positive mood while mind-wandering. *Frontiers in Psychology*, *4*. doi:10.3389/fpsyg.2013.0058.

Gard, D. E., Gard, M. G., Kring, A. M., & John, O. P. (2006). Anticipatory and consummatory components of the experience of pleasure: a scale development study. *Journal of Research in Personality*, *40*, 1086-1102. doi: 10.1016/j.jrp.2005.11.001.

Geddes, J. R., Carney, S. M., Davies, C., Furukawa, T. A., Kupfer, D. J., Frank, E., & Goodwin, G. M. (2003). Relapse prevention with antidepressant drug treatment in depressive disorders: a systematic review. *Lancet*, *361*, 653-661. doi:10.1016/S0140-6736(03)12599-8.

Giambra, L. M. (1974). Daydreaming across the life span: Late adolescent to senior citizen. *The International Journal of Aging and Human Development*, *5*, 115-140. doi:10.2190/7AEJ-T3MA-QLGD-CCF5.

Grossman, P., & Van Dam, N. T. (2011). Mindfulness, by any other name: trials and tribulations of sati in western psychology and science. *Contemporary Buddhism*, *12*, 219-239. doi:10.1080/14639947.2011.564841.

Hanley, A. W., Warner, A. R., Dehilii, V. M., Canto, A. I., & Garland, E. L. (2015). Washing dishes to wash the dishes: Brief instruction in an informal mindfulness practice. *Mindfulness*, *6*, 1095-1103. doi:10.1007/s12671-014-0360-9.

Higgins, J. P., Altman, D. G., Gøtzsche, P. C., Jüni, P., Moher, D., Oxman, A. D., ... & Sterne, J. A. (2011). The Cochrane Collaboration's tool for

assessing risk of bias in randomised trials. *British Medical Journal*, 343, d5928.

Horowitz, M. A. R. D. I., Adler, N., & Kegeles, S. (1988). A scale for measuring the occurrence of positive states of mind: a preliminary report. *Psychosomatic Medicine*, *50*, 477-483.

Kabat-Zinn, J. (2009). *Wherever you go, there you are: Mindfulness meditation in everyday life.* London: Hachette Books.

Killingsworth, M. A., & Gilbert, D. T. (2010). A wandering mind is an unhappy mind. *Science*, *330*, 932-932. doi: 10.1126/science.1192439.

Kruijshaar, M. E., Barendregt, J., Vos, T., de Graaf, R., Spijker, J., & Andrews, G. (2005). Lifetime prevalence estimates of major depression: an indirect estimation method and a quantification of recall bias. *European Journal of Epidemiology*, *20*, 103-111. doi: 10.1007/s10654-004-1009-0.

Layard, R. (2006). *Centre for Economic Performance's Mental Health Policy Group. The depression report—a new deal for depression and anxiety disorders.* London: London School of Economics and Political Science.

Lyubomirsky, S., & Lepper, H. S. (1999). A measure of subjective happiness: Preliminary reliability and construct validation. *Social Indicators Research*, *46*, 137-155. doi:10.1023/A:1006824100041.

Marchetti, I., Koster, E. H., & De Raedt, R. (2012). Mindwandering heightens the accessibility of negative relative to positive thought. *Consciousness and Cognition*, *21*, 1517-1525. doi:10.1016/j.concog.2012.05.013.

McManus, S., Meltzer, H., Brugha, T. S., Bebbington, P. E., & Jenkins, R. (2009). *Adult psychiatric morbidity in England, 2009: results of a household survey.* London, England: NHS Information Centre for Health and Social Care 2009.

McVay, J. C., Kane, M. J., & Kwapil, T. R. (2009). Tracking the train of thought from the laboratory into everyday life: An experience-sampling study of mind wandering across controlled and ecological contexts. *Psychonomic Bulletin and Review*, *16*, 857-863. doi:10.3758/PBR.16.5.857.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA Statement. *Public Library of Science Medicine, 6*, e1000097. doi:10.1371/journal.pmed.1000097.

Morris, B. H., Bylsma, L. M., & Rottenberg, J. (2009). Does emotion predict the course of major depressive disorder? A review of prospective studies. *British Journal of Clinical Psychology*, *48*, 255-273. doi: 10.1348/014466508X396549.

Mrazek, M. D., Phillips, D. T., Franklin, M. S., Broadway, J. M., & Schooler, J. W. (2012). Young and restless: validation of the Mind-Wandering Questionnaire (MWQ) reveals disruptive impact of mind-wandering for youth. *Frontiers in Psychology*, *4*, 560-560. doi: 10.3389/fpsyg.2013.00560.

Mrazek, M. D., Smallwood, J., & Schooler, J. W. (2012). Mindfulness and mind-wandering: finding convergence through opposing constructs. *Emotion*, *12*, 442-448. doi: 0.1037/a0026678.

Nelis, D., Quoidbach, J., Hansenne, M., & Mikolajczak, M. (2011). Measuring individual differences in emotion regulation: The emotion regulation profile-revised (ERP-R). *Psychologica Belgica*, *51*, 49–91.

Ottaviani, C., Shahabi, L., Tarvainen, M., Cook, I., Abrams, M., & Shapiro, D. (2015). Cognitive, behavioral, and autonomic correlates of mind wandering and perseverative cognition in major depression. *Frontiers in Neuroscience*, *8*, 433. doi: 10.3389/fnins.2014.00433.

Perez-Blasco, J., Viguer, P., & Rodrigo, M. F. (2013). Effects of a mindfulness-based intervention on psychological distress, well-being, and maternal self-efficacy in breast-feeding mothers: results of a pilot study. *Archives of Women's Mental Health*, *16*, 227-236. doi:10.1007/s00737-013-0337-z.

Poerio, G. L., Totterdell, P., Emerson, L. M., & Miles, E. (2015). Love is the triumph of the imagination: Daydreams about significant others are associated with increased happiness, love and connection. *Consciousness and Cognition*, *33*, 135-144. doi:10.1016/j.concog.2014.12.011.

Poerio, G. L., Totterdell, P., Emerson, L. M., & Miles, E. (2016). Social daydreaming and adjustment: An experience-sampling study of socio-emotional adaptation during a life transition. *Frontiers in Psychology*, *7*, 13. doi:10.3389/fpsyg.2016.00013.

Quoidbach, J., Berry, E. V., Hansenne, M., & Mikolajczak, M. (2010). Positive emotion regulation and well-being: Comparing the impact of eight savoring and dampening strategies. *Personality and Individual Differences*, *49*, 368-373. doi:10.1016/j.paid.2010.03.048.

Radloff, L. S. (1991). The use of the Center for Epidemiologic Studies Depression Scale in adolescents and young adults. *Journal of Youth and Adolescence*, *20*, 149-166. doi:10.1007/BF01537606.

Robertson, I. H., Manly, T., Andrade, J., Baddeley, B. T., & Yiend, J. (1997). Oops!: performance correlates of everyday attentional failures in traumatic brain injured and normal subjects. *Neuropsychologia*, *35*, 747-758. doi:10.1016/S0028-3932(97)00015-8.Schooler, J. W., Mrazek, M. D., Franklin, M. S., Baird, B., Mooneyham, B. W., Zedelius, C., & Broadway, J. M. (2014). *The middle way: Finding the balance between mindfulness and mind-wandering.* In B. Ross (Ed.), Psychology of learning and motivation (pp. 1–33). Burlington VT: Academic Press.

Schwartz, J. E., & Stone, A. A. (1998). Strategies for analyzing ecological momentary assessment data. *Health Psychology*, *17*, 6. doi.org/10.1037/0278-6133.17.1.6.

Scollon, C. N., Prieto, C. K., & Diener, E. (2009). *Experience sampling: promises and pitfalls, strength and weaknesses.* In E.Diener (Ed.), Assessing well-being (pp.157-180). Netherlands: Springer.

Shamseer, L., Moher, D., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., ... & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation.

British Medical Journal, *349*, g7647. doi: http://dx.doi.org/10.1136/bmj.g7647.

Singer, J. L., & Antrobus, J. S. (1972). Daydreaming, imaginal processes, and personality: A normative study. *The Function and Nature of Imagery*, 175-202.

Smallwood, J., Fitzgerald, A., Miles, L. K., & Phillips, L. H. (2009). Shifting moods, wandering minds: negative moods lead the mind to wander. *Emotion*, *9*, 271-276. doi.org/10.1037/a0014855.

Smallwood, J., O'Connor, R. C., Sudbery, M. V., & Obonsawin, M. (2007). Mind-wandering and dysphoria. *Cognition and Emotion*, *21*, 816-842. doi: 10.1080/02699930600911531.

Spijker, J., Bijl, R. V., De Graaf, R., & Nolen, W. A. (2001). Determinants of poor 1-year outcome of DSM-III-R major depression in the general population: The Netherlands Mental Health Survey and Incidence Study (NEMESIS). *Acta Psychiatrica Scandinavica*, *103*, 122-130. doi: 10.1034/j.1600-0447.2001.103002122.x.

Stawarczyk, D., Majerus, S., Van der Linden, M., & D'Argembeau, A. (2012). Using the daydreaming frequency scale to investigate the relationships between mind-wandering, psychological well-being, and present-moment awareness. *Frontiers in Psychology*, *3*, 1-15. doi:10.3389/fpsyg.2012.00363.

Vrieze, E., Demyttenaere, K., Bruffaerts, R., Hermans, D., Pizzagalli, D. A., Sienaert, P., ... & Claes, S. (2014). Dimensions in major depressive

disorder and their relevance for treatment outcome. *Journal of Affective Disorders*, *155*, 35-41.doi:10.1016/j.jad.2013.10.020.

Watson, D., & Clark, L. A. (1991). The mood and anxiety symptom questionnaire. *Unpublished manuscript, University of Iowa, Department of Psychology, Iowa City*.

Watson, D., Clark, L.A., Tellegen, A. (1988) Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063-1070. doi: 10.1037/0022-3514.54.6.1063.

World Health Organization. (1992*). ICD-10: International Statistical Classification of Diseases and Related Health Problems.* World Health Organization: Geneva.

Zvolensky, M. J., Solomon, S. E., McLeish, A. C., Cassidy, D., Bernstein, A., Bowman, C. J., & Yartz, A. R. (2006). Incremental validity of mindfulness‐based attention in relation to the concurrent prediction of anxiety and depressive symptomatology and perceptions of health. *Cognitive Behaviour Therapy*, *35*, 148-158. doi:10.1080/16506070600674087.

Appendix A: PICO inclusion criteria

PICO (Participant, Intervention, Comparator and Outcome) and study design (Shamseer et al., 2015) were used to identify study characteristics as criteria for eligibility, see Table 3. Studies of MW as mechanisms associated with positive mood and/or anhedonia were selected for review according to the criteria below. Assumptions and simplifications were made to deem comparators as not applicable to the research question, to examine evidence that mind wandering is linked to PA.

Table 3

PICO study characteristics

Study Characteristics	Description	Rationale
Population	Adults; students; depressed; non-depressed; males; females; age 17-65	Clinical and non-clinical adult populations included.
Intervention	Positive affect, mood, anhedonia	Terms associated with positive mood
Comparator	Not Applicable	Not relevant for research questions
Outcome	MW; daydreaming; off-task thoughts; self-generated thought; stimulus independent thought, task unrelated thought.	Terms associated with MW
Study design	Experimental designs involving manipulation; cross-sectional, where MW is correlated with affect; prospective longitudinal studies that measured MW and anhedonia at different time points. RCTs, controlled trials, cohort studies, case series, case reports and any naturalistic design were included if identified.	Most appropriate designs to measure research questions.

Appendix B: Search terms

To ensure MW was fully encapsulated in the literature search, common alternative terms (see below) were included with a primary focus in relation to positive affect. The search terms were: “mind wandering*” OR “day dream*” OR “task unrelated thought” OR “self-generated* thought” OR “stimulus-independent* thought” OR “absent-mindedness*” OR “present-moment* focus” OR “acting with awareness” OR “Five Facet Mindfulness Questionnaire” OR “Mindful Attention Awareness Scale”) AND (“positive affect” OR “positive mood” OR “positive emotion” OR “pleasure*” OR “anhedonia” OR “enjoyment” OR “happiness” OR “Snaith Hamilton Pleasure Scale” OR “Temporal Experience of Pleasure Scale” OR “Mood and Anxiety Symptoms Questionnaire” OR “Fawcett-Clark Pleasure Capacity Scale” OR “Chapman Physical Anhedonia Scale”).

Appendix C: Excluded Studies

Table 4.

Table of title of the studies excluded and justification

Title of study	Authors and year	Justification for exclusion
Appreciation: individual differences in finding value and meaning as a unique predictor of subjective well-being.	Adler & Fagley (2005)	Appreciation concept different to present-moment focus/MW continuum
Validation of the Spanish version of the Multidimensional State Boredom Scale (MSBS).	Alda, Minguez, Montero-Marin, Gili, Puebla-Guedea, Herrera-Mercadal, Navarro-Gil, Garcia-Campayo (2015)	Boredom conceptually different to MW
Development of Mindfulness for Pregnant Women (MPW) Program and its Psychological Efficacy	An, Kab, Kim et al. (year unknown)	Available in Korean. Not available in English
A penny for your thoughts: dimensions of self-generated thought content and relationships with individual differences in emotional wellbeing.	Andrews-Hanna, Kaiser, Turner, Reineberg, Godinez, Dimidjian, Banich (2013)	Did not include raw MASQ-AD score in analyses
Effectiveness of a mindfulness education program in primary health care professionals: a pragmatic controlled trial.	Asuero, Queraltó, Pujol-Ribera, Berenguera, Rodriguez-Blanco & Epstein (2014)	Measure used for PA was not hedonic indicator
Savoring beliefs inventory (SBI): A scale for measuring beliefs	Bryant (2003)	“Savouring” potentially tapping into different construct to MW

about savouring.

Factor Analysis of the Five Facet Mindfulness Questionnaire in a Heterogeneous Clinical Sample	Curtiss & Klemansk (2014)	Did not include raw MASQ-AD score in analyses
Dissociation between the cognitive and interoceptive components of mindfulness in the treatment of chronic worry.	Delgado-Pastor, Ciria, Blanca, Mata, Vera & Vila, (2015).	PA not reported on in analyses
Is mindfulness associated with insomnia after menopause?	Garcia, Pompéia, Hachul, Kozasa, de Souza, Tufik, Mello (2014)	"Attentiveness" considered as PA construct, deemed too similar to MW.
Mindfulness training increases momentary positive emotions and reward experience in adults vulnerable to depression: a randomized controlled trial.	Geschwind, Peeters, Drukker, van Os & Wichers (2011).	Does not include measure of MW
Intrinsic Enjoyment and Boredom Coping scales: Validation with personality, evoked potential and attention measures.	Hamilton, Haier & Buchsbaum (1984)	Boredom and coping measure used to infer MW, potentially tapping into different psychological mechanism.
Rasch Analysis of the Spanish version of the Mindful Attention Awareness Scale (MAAS) in a clinical sample	Inchausti, Prieto & Delgado (2014)	Did not report on MASQ-AD in analyses.
Effects of dispositional mindfulness on the self-	Kee & Liu (2011)	Intrinsic motivation does not seem the same as

controlled learning of a novel motor task		PA.
Thinking Back about a Positive Event: The Impact of Processing Style on Positive Affect.	Nelis, Holmes, Palmieri, Bellelli & Raes (2015)	Addresses processing mode not MW.
Effects of mindfulness meditation on self-rated stress related measures: Improvements in neuroticism and ecological momentary assessment of stress.	Oken, Miller, Goodrich & Wahbeh (2014)	Poster presentation without peer review, so excluded.
A Controlled Evaluation of Mindfulness-Based Cognitive Therapy for Patients with Coronary Heart Disease and Depression	O'Doherty, Carr , McGrann, O'Neill, Dinan, Graham, Maher (2015)	PA measured by profile of mental states, doesn't tap into PA as separate dimension.
How self-generated thought shapes mood--the relation between mind-wandering and mood depends on the socio-temporal content of thoughts.	Ruby, Smallwood, Engen, Singer (2013).	Does not measure PA precisely
Mindfulness, psychological well-being, and rock climbing: An exploration of mindfulness in rock climbers and the potential for psychological benefit.	Steinberg (2012)	Dissertation, not peer-reviewed.
Imprisoned by the past: unhappy moods lead to a retrospective bias to mind wandering.	Smallwood &O'Connor (2011)	No measure of PA

Emotions in sport: Perceived effects on attention, concentration, and performance	Vast, Young & Thomas (2010)	No validated measure of PA
Being a grump only makes things worse: a transactional account of acute stress on mind wandering.	Vinski & Watter (2013)	No measure of PA

Appendix D: Preparation and Submission Requirements for Target Journal

Emotion

Scope of the Journal

Emotion ® publishes significant contributions to the study of emotion from a wide range of theoretical traditions and research domains. The journal includes articles that advance knowledge and theory about all aspects of emotional processes, including reports of substantial empirical studies, scholarly reviews, and major theoretical articles.

Submissions from all domains of emotion research are encouraged, including studies focusing on cultural, social, temperament and personality, cognitive, developmental, health, or biological variables that affect or are affected by emotional functioning. Both laboratory and field studies are appropriate for the journal, as are neuroimaging studies of emotional processes. Studies of psychopathology contributing to the understanding of the role of emotional processes in affective and behavioral disorders are also welcome. Reports of work at the animal and molecular levels will be considered if they help to elucidate fundamental mechanisms of emotion.

Submitting manuscripts

Submit manuscripts electronically through the Manuscript Submission Portal in Word Document format (.doc). All tables and figures should be included in the manuscript file. David DeSteno , Northeastern University, Boston, MA 02115, General correspondence may be directed to the Editor's Office.

Masked Review Policy

Masked reviews are optional, and authors who wish masked reviews must specifically request them when they submit their manuscripts.For masked reviews, the manuscript must include a separate title page with the authors' names and affiliations, and these ought not to appear anywhere else in the manuscript. Footnotes that identify the authors must be typed on a separate page. Authors are to make every effort to see that the manuscript itself contains no clues to their identities. If your manuscript was mask reviewed, please ensure that the final version for production includes a byline and full author note for typesetting.

Manuscript Submission Guideline

In addition to addresses and phone numbers, authors should supply email addresses and fax numbers for use by the editorial office and later by the production office. The majority of correspondence between the editorial office and authors is handled by email, so a valid email address is important to the timely flow of communication during the editorial process. Authors should provide email addresses in their cover letters and should keep a copy of the manuscript to guard against loss. Manuscripts are not returned. Manuscripts for *Emotion*® can vary in length; typically they will range from 10 to 40 double-spaced manuscript pages. Manuscripts should be of sufficient length to ensure theoretical and methodological competence.

Most of the articles published in *Emotion* will be reports of original research, but other types of articles are acceptable. Case studies from either a clinical setting or a laboratory will be considered if they raise or illustrate important questions that go beyond the single case and have heuristic value. Articles that present or discuss theoretical formulations of emotion and related affective phenomena

that evaluate competing theoretical perspectives, or that offer innovative commentary or analysis on timely topics of inquiry may also be accepted. Comprehensive reviews of the empirical literature in an area of study are acceptable if they contain a meta-analysis and/or present novel theoretical or methodological perspectives. Comments on articles published in the journal will be considered. To facilitate a more complete understanding of the reported results, submissions based on empirical findings must report effect sizes and 95% confidence intervals for the primary findings in each study.

Manuscript Preparation

Prepare manuscripts according to the *Publication Manual of the American Psychological Association* (6th edition). Manuscripts may be copyedited for bias-free language (see Chapter 3 of the *Publication Manual*). Review APA's Checklist for Manuscript Submission before submitting your article. Double-space all copy. Other formatting instructions, as well as instructions on preparing tables, figures, references, metrics, and abstracts, appear in the *Manual*. Additional guidance on APA Style is available on the APA Style website. Below are additional instructions regarding the preparation of display equations, computer code, and tables.

Tables

Use Word's Insert Table function when you create tables. Using spaces or tabs in your table will create problems when the table is typeset and may result in errors.

Submitting Supplemental Materials

APA can place supplemental materials online, available via the published article in the PsycARTICLES® database. Please see Supplementing Your Article With Online Material for more details.

Abstract and Keywords

All manuscripts must include an abstract containing a maximum of 250 words typed on a separate page. After the abstract, please supply up to five keywords or brief phrases.

References

List references in alphabetical order. Each listed reference should be cited in text, and each text citation should be listed in the References section.

Figures

Graphics files are welcome if supplied as Tiff or EPS files. Multipanel figures (i.e., figures with parts labeled a, b, c, d, etc.) should be assembled into one file. The minimum line weight for line art is 0.5 point for optimal printing.

For more information about acceptable resolutions, fonts, sizing, and other figure issues, please see the general guidelines. When possible, please place symbol legends below the figure instead of to the side. APA offers authors the option to publish their figures online in color without the costs associated with print publication of color figures.

The same caption will appear on both the online (color) and print (black and white) versions. To ensure that the figure can be understood in both formats, authors should add alternative wording (e.g., "the red (dark gray) bars represent") as needed.

Permissions

Authors of accepted papers must obtain and provide to the editor on final acceptance all necessary permissions to reproduce in print and electronic form any copyrighted work, including test materials (or portions thereof), photographs, and other graphic images (including those used as stimuli in experiments).On advice of counsel, APA may decline to publish any image whose copyright status is unknown.

Publication Policies

APA policy prohibits an author from submitting the same manuscript for concurrent consideration by two or more publications. APA requires authors to reveal any possible conflict of interest in the conduct and reporting of research (e.g., financial interests in a test or procedure, funding by pharmaceutical companies for drug research). In light of changing patterns of scientific knowledge dissemination, APA requires authors to provide information on prior dissemination of the data and narrative interpretations of the data/research appearing in the manuscript (e.g., if some or all were presented at a conference or meeting, posted on a listserv, shared on a website, including academic social networks like ResearchGate, etc.). This information (2–4 sentences) must be provided as part of the Author Note. Authors of accepted manuscripts are required to transfer the copyright to APA.

Ethical Principles

It is a violation of APA Ethical Principles to publish "as original data, data that have been previously published" (Standard 8.13). In addition, APA Ethical Principles specify that "after research results are published, psychologists do

not withhold the data on which their conclusions are based from other competent professionals who seek to verify the substantive claims through reanalysis and who intend to use such data only for that purpose, provided that the confidentiality of the participants can be protected and unless legal rights concerning proprietary data preclude their release" (Standard 8.14). APA expects authors to adhere to these standards. Specifically, APA expects authors to have their data available throughout the editorial review process and for at least 5 years after the date of publication. Authors are required to state in writing that they have complied with APA ethical standards in the treatment of their sample, human or animal, or to describe the details of treatment. The APA Ethics Office provides the full Ethical Principles of Psychologists and Code of Conduct electronically on its website in HTML, PDF, and Word format. You may also request a copy by emailing or calling the APA Ethics Office (202-336-5930). You may also read "Ethical Principles," December 1992, *American Psychologist*, Vol. 47, pp. 1597–1611.

SCHOOL OF PSYCHOLOGY

DOCTORATE IN CLINICAL PSYCHOLOGY

EMPIRICAL PAPER

An experience sampling study: Does mind wandering mediate the link between depression and anhedonia?

Trainee Name:	**Joanna Diana (Jodi) Pitt**
Primary Research Supervisor:	**Dr Barney Dunn**
	University of Exeter, Mood Disorders Centre
Secondary Research Supervisor:	**Dr Nick Moberly**
	University of Exeter, Mood Disorders Centre
Target Journal:	Emotion
Word Count:	7814 words (excluding abstract, table of contents, list of figures, references, footnotes, appendices)

Submitted in partial fulfilment of requirements for the Doctorate Degree in Clinical Psychology, University of Exeter

Acknowledgements

I would like to thank and acknowledge all the individuals that took the time to take part in my research. Also thanks to my supervisors Barney and Nick for all their support and feedback. Finally, to James Brien – in loving memory – thank you for all the love on the bad days. I couldn't have done it without you.

Abstract

Previous research has established that greater levels of mind wandering are associated with reduced positive affect (PA) in the general population. The present study aims to examine whether this mechanism may mediate the relationship between depression and reduced PA (anhedonia). A community sample (*N* = 69) with differing levels of depression severity took part. Using experience sampling methodology, we measured mind wandering and PA during everyday life and when completing a few scheduled positive activities. To examine if mind wandering specifically influenced PA or emotion experience more generally, we additionally measured levels of negative affect (NA). Across both contexts, both greater mind wandering and greater depression severity were independently associated with reduced PA and increased NA. Greater depression severity was associated with increasing levels of mind wandering in everyday life, but not during scheduled positive activities. Mind wandering did not mediate the link between depression and reduced PA/increased NA. Exploratory analyses did however reveal that a greater tendency for the mind wander to negative rather than positive themes did mediate the link between depression and reduced PA in everyday life. We replicated previous findings that increased mind wandering is related to reduced PA and increased NA but there was no evidence that this mediated the relationship between depression and altered affective experience. However, the greater tendency for the mind to wander to negative themes may mediate the link between depression and affect. If depression treatment approaches are to target mind wandering this suggests they should therefore focus on mind wandering valence in addition to extent.

Keywords: Anhedonia; Depression; Mind wandering; Positive Affect

Introduction

Major Depressive Disorder (MDD) is a highly prevalent and debilitating mental health disorder that often follows a chronic, relapsing course (National Institute for Health and Care Excellence, NICE, 2009). MDD features low mood and significant impairment according to the Diagnostic Statistical Manual V (DSM-V) (American Psychiatric Association, 2013). It is anticipated to become the second most common cause of deficit in disability-adjusted life years (DALYs) in the world by 2020 (World Bank, 1993). Prevalence at any one time in the UK was last estimated as 2.6 in every 100 people (McManus, Meltzer, Brugha, Bebbington, & Jenkins, 2009). This disorder has a huge impact on work productivity and absenteeism, wider society and the healthcare system. In England, treatment costs are estimated at £370 million per year, of which 84% is attributable to antidepressant medication (NICE, 2009). Furthermore, current treatments are only partially effective, with only 60% obtaining "remission" (Al-Harbi, 2012). Of those who do remit, over half of these will relapse within two years (Geddes et al., 2003). Given these suboptimal treatment outcomes, there is a pressing need to develop improved treatments.

Targeting prognostically important but clinically neglected features of depression is one way forward. By identifying what mechanisms drive these features and then developing interventions to alter these mechanisms, treatment efficacy can be improved. Such an approach has been successfully followed in the anxiety disorders (e.g., Clark, 1999). For example, safety seeking behaviours have been identified in basic research as a maintaining feature in a range of anxiety disorders and are now systematically targeted in treatment. This has led to an improved capacity to reduce anxiety symptomatology. A similar approach has also started to be followed to better

understand and treat depression. For example, rumination (repetitive negative thought about the causes, meanings and consequences of depression) has been identified as key mechanism driving heightened negative affect in depression (e.g. Watkins, 2008) and is now explicitly targeted in recent adaptation of CBT for depression (e.g. rumination focused Cognitive Behaviour Therapy (CBT); Watkins *et al.* 2011).

However, a number of other important clinical features of depression have been neglected to date, including anhedonia (a loss of interest or pleasure in previously enjoyable activities) (see World Health Organisation, 2010). Anhedonia can be characterised as low levels of positive affect defined as “the extent to which a person feels enthusiastic, active, and alert" (PA; Clark & Watson, 1991). High PA is a state of high energy, full concentration, and pleasurable engagement, whereas low PA features sadness and lethargy” (p. 1063, Watson & Clark, 1988). Thirty-seven percent of those with a diagnosis of depression experience clinically significant symptoms of anhedonia (Pelizza & Ferrari, 2009).

In laboratory settings, subjective experience of PA during positive mood inductions has been found to be diminished in depression (Dunn, Dalgleish, Lawrence, Cusack, & Ogilvie, 2004; Rottenberg, Gross, & Gotlib, 2005; Pizzagalli, Iosifescu, Hallett, Ratner, & Fava, 2008) although there is some debate to whether this is specific to PA or whether there is a general blunting of all emotion experience (Bylsma, Morris, & Rottenberg, 2008). There is also evidence of reduced reactivity to positive stimuli at the psychophysiological and

neuroimaging level (Beesdo et al. 2009; Sarchiapone et al. 2006; Treadway & Zald, 2011). Experience sampling methods[1] (ESM) have also been used to assess anhedonia in depression. These provide some, albeit less consistent, evidence of reduced reactivity to positive stimuli in depression (Barge-Schaapveld, Nicolson, & Berkhof 1999; Bylsma, Taylor-Clift, & Rottenberg, 2011; Thompson et al., 2012).

Prolonged symptoms of anhedonia have been found to predict a poor depression course and sub-optimal treatment outcome in MDD (Morris, Bylsma, & Rottenberg, 2009; Spijker, Bijl, De Graaf, & Nolen, 2001; Vrieze et al. 2014), over and above elevations in negative affect.

Despite the prognostic importance of anhedonia, it has been relatively neglected in existing treatment approaches (see Dunn, 2012). For example, although cognitive-behavioural therapy (CBT) is recommended by NICE (2009) for the treatment of depression, CBT is weighted towards targeting negative thoughts that sustain heightened negative mood (Beck, Rush, Shaw, & Emery, 1979). Research suggests outcomes for CBT primarily show a reduction in NA rather than an improvement in PA (Dunn, German, Hollon & DeRubeis, 2016; Kring, Persons, & Thomas, 2007). Behavioural activation (BA) is another NICE recommended treatment that primarily focuses on overcoming avoidance to help clients behaviourally re-engage with potentially rewarding activities (Cuijpers, Van Straten, & Warmerdam, 2007; Treadwell & Zald, 2011).

---

[1] In ESM thoughts and feelings in the moment are recorded at frequent moments in everyday life using smartphones or diaries; see Christensen, Barrett, Bliss-Moreau, Lebo & Kaschub, 2003)

However, BA does not then go on to target the range of psychological mechanisms that can blunt pleasure experience once an individual is engaging with a positive activity. Therefore, BA is also unlikely to fully repair anhedonic symptoms of depression (Bylsma, Morris, & Rottenberg, 2008). Novel treatment approaches are needed that specifically target these underlying pleasure blocking mechanisms (Dunn, German, Hollon & DeRubeis, 2016).

One psychological mechanism that may disrupt PA experience is mind wandering (MW)[2]. Conceptually, MW overlaps with a range of other concepts introduced in the psychological literature over the past 30 years, including daydreaming, off-task thinking, task-unrelated thought (TUT), task-unrelated images, stimulus-independent thought, mind pops and zone outs (Schooler, 2002). MW can be seen as the inverse of the present moment awareness that mindfulness practices aim to cultivate (Stawarczyk, Majerus, Van der Linden, & D'Argembeau, 2012). MW is a highly prevalent phenomenon, with one study finding that on average we spend between 30-50% of our daily lives doing just this (Killingsworth & Gilbert, 2010).

MW has been theoretically linked to depression (Teasdale, 1989). People with higher depression severity scores tend to report more MW on self-report trait questionnaires (e.g., Carriere, Cheyne, & Smilek, 2008; Ottaviani et al., 2015; Stawarczyk, Majerus, Van der Linden, & D'Argembeau, 2012). Moreover, dysphoric individuals exhibit more MW than non-dysphoric

[2] MW is a "shift in the focus of attention away from the here and now, towards one's private thoughts and feelings" (p. 818, Smallwood, O'Connor, Sudbery, & Obonsawin, 2007).

individuals during sustained attention to response tasks (SART) or reading tasks in the laboratory (Smallwood, Fishman, & Schooler, 2007).

MW has been linked to altered emotion experience. This has been found in the laboratory with large effect sizes where negative mood reduced attention to task and shifted attention to task unrelated internal concerns (Smallwood, Fitzgerald, Miles, & Phillips, 2009). Most famously demonstrated, however, was in a large scale (*N* = 2,250) ESM study in the general population (Killingsworth & Gilbert, 2010). Adults were asked to rate their mood, MW status, and whether content of MW was pleasant, unpleasant or neutral at random intervals throughout their daily lives. In general, the more an individual mind wandered, the less happiness they experienced in everyday life. Killingsworth and Gilbert (2010) additionally included time lag analyses in their study and concluded that MW was generally the antecedent and not the consequence of reduced PA. This implies that MW during pleasurable activities may lead them to become less enjoyable. Furthermore, participants were no happier if the content of MW was pleasant and were significantly unhappier if the content of MW was neutral or unpleasant, relative to on-task thinking.

Given the elevated rates of MW in depression, it is therefore conceivable that this partly accounts for why depressed individuals struggle to experience positive emotions. However, this possibility has yet to be systematically tested. There is preliminary evidence that reduced present moment awareness is related to greater anhedonic experience in a treatment seeking sample at the trait level (e.g. Desrosiers, Klemanski, & Nolen-Hoeksema, 2013). However, it was unclear whether the measure of anhedonia used (the Anhedonic Depression subscale within the Mood and Anxiety Symptom Questionnaire

[MASQ], Watson & Clark, 1991) measures anhedonia distinct from overall depression severity. As far as we are aware, there has been no examination of this relationship at the state level (i.e., are depressed individuals more likely to MW in a given moment and does this then account for reduced PA experience in that moment). In statistical terms, this is a mediation relationship. A mediating variable represents a mechanism through which a primary independent variable is able to relate to the dependent variable of interest (Baron & Kenny, 1986). In this context, it is proposed that the influence of the independent variable (depression severity) on the dependent variable (PA) will be at least be partially mediated by MW.

ESM is an ecologically valid way to explore psychological mechanisms in real time, unrestricted by laboratory settings or retrospective reports (Telford, McCarthy-Jones, Corcoran, & Rowse' 2012). ESM has provided further theoretical and clinical insight into MDD (Telford, McCarthy-Jones, Corcoran, & Rowse' 2012). In line with Clark's (1999) approach to develop clinical treatments and given the promising findings in ESM studies (Brown & Ryan, 2003; Geschwind, Peeters, Drukker, van Os, & Wichers, 2011; Killingsworth & Gilbert, 2010) there is a rationale to use ESM to test the relationship between MW and anhedonia. The focus of the present study is therefore to use a mediation design to see if MW mediates the relationship between depression and PA across different contexts.

A combination of both signal[3] and event[4] contingent protocols may be useful to do this. To be consistent with Killingworth and Gilbert's (2010) study a signal-contingent procedure will be used to see if MW increases in a depressed population. However, it is conceivable that links between depression, PA and MW may only be observed when individuals are actively engaged in a potentially positive activity. We therefore decided to additionally use an event-contingent protocol, which requires participants to report on their experience of a positive event, immediately or closely after completion. This method is appropriate to capture data that can be less commonly accessed via signal-contingent procedures alone (Christensen, Barrett, Bliss-Moreau, Lebo, & Kaschub, 2003). We asked participants to plan to complete a series of positive activities (akin to positive activity scheduling techniques used in CBT and BA) and to rate their affective experience and levels of MW immediately afterwards.

There is some debate to whether elevated MW is uniquely related to reduced PA or is also linked to increased negative affect. Negative affect (NA) is a subjective level of distress relating to unpleasurable engagement, aversive mood states, including jitteriness, disgust, anger and fear. It has been proposed that PA and NA do not simply lie at either end of a valence continuum, but instead are at least partly orthogonal constructs (with PA emerging from the behavioural activation system and NA emerging from the behavioural inhibition system; Gray, 1982; Watson, 1988). NA and PA will therefore be considered

---

[3] Signal-contingent procedures rely on participants completing reports in response to a signal immediately that occurs randomly at different time points during the day.

[4] Event-contingent procedures measure general recall of subjective experience from an activity, rather than a momentary response as measured during signal-contingent procedures (Christensen, Barrett, Bliss-Moreau, Lebo, & Kaschub, 2003).

separately in this study, to see if relationships are specific to PA, or to affect generally.

So far, we have proposed that it is simply the extent to which individuals' MW that may alter affective experience in depression. However, recent theorists propose that the style of MW is also important, with some styles of MW being associated with negative outcomes and other styles of MW being linked to positive outcomes (Schooler et al., 2014). One key aspect of MW style that may influence affective experience is whether the mind wanders to positive or negative themes (MW valence). In particular, when depressed individuals mind wander, this may be to less positive themes (potentially reducing PA experience) and/or more negative themes (potentially elevating NA experience). As far as we are aware, this possibility has yet to be empirically tested. This is a secondary, exploratory aim of the present study.

In summary, the present study will use ESM to examine if elevated MW mediates the relationship between depression severity and reduced PA/increased NA experience at random moments in everyday life (signal-contingent design) and when completing scheduled positive activities (event-contingent design). Exploratory analyses will examine if it is the valence of MW that influences any observed associations.

We predict the following (tested in turn for signal-contingent and event-contingent data):

- ESM state measures of MW will correlate with trait measures of MW (Five Facet Mindfulness Questionnaire - Acting with Awareness; FFMQ-AWA) (H1).

- Greater levels of MW will correlate with reduced PA (H2) and elevated NA (H3) at the within-person level.
- Greater depression will correlate with greater MW (H4), reduced PA (H5) and elevated NA (H6) at the between-person level.
- Greater MW will partially mediate the between-person relationship between depression and reduced PA (H7) and elevated NA (H8).

Additional exploratory analyses will be included to investigate if style of MW (valence) mediates the link between depression and affect.

Method

Design

We used a mixed signal-contingent and event-contingent ESM design to examine the association between depression severity (measured at the between subjects level) and levels of valence of MW, and PA and NA (these were measured at the within-subject level but can also be aggregated to the between-subject level). PRO-diary watches were used to prompt participants to complete these ratings and store their answers (see Appendix A for protocol of questions).

Signal-contingent: Participants responded to a random signal to initiate reports in response to how they were feeling, what they were doing and what they were thinking about (eight beeps at random intervals each day over six days).

Event-contingent: Participants responded to questions during a scheduled event and after its completion. Participants were requested to

complete a minimum of three positive activities over the six days and were encouraged to do more (e.g. one a day).

Participants

Seventy-four people (11 males, 62 females, 1 transgender) from Exeter community took part in the study. Posters advertising the study were placed around University of Exeter campus, on an online psychology research participant system (which invites people to sign up to take part in research at the University of Exeter), throughout the psychology department and locally based social media websites. We sought to recruit participants with a range of depression severity, from asymptomatic to clinically depressed. To help recruit the depressed end of the distribution, advertisements mentioned that we were particularly interested in individuals currently suffering with low mood. We also sent out e-mails to individuals on a volunteer database of the University of Exeter Mood Disorders Centre who had reported being previously depressed.

Participants' ages ranged from 18-51 years (M = 22.8, SD = 7.0). The sample was predominantly white British (63.8%). All participants were fluent English speakers. 19.1% of participants had completed GCSE/A-levels or equivalent only, 54.4% were currently pursuing or had completed a degree, 1.5% were completing a postgraduate certificate in education, 8.7% were pursuing a master's degree and 16.2% a PhD. Participants either received an honorarium of £5 or course credits (if they were currently an Exeter psychology student) for taking part.

Power Analysis

ESM analyses required multilevel modelling (MLM) where power varies as a function of higher-level (i.e., number of people) and lower level (i.e.,

number of beeps) units. It has been suggested that a small number of participants (< 50) may be susceptible to a biased estimation of standard errors (Maas & Hox, 2005). In order to be powered to detect a medium effect size of *r* = .3 (Cohen, 1969), the minimum sample size requirement was 68 participants.

Ethics

Ethical approval for the study was given by the University of Exeter Research Ethics Committee. All participants gave electronic informed consent.

Inclusion and Exclusion Criteria

Inclusion criteria for the study were that participants must be native English speakers, given that the procedures could only be explained in English. Participants had to be able to use a diary watch to be able to take part in both the signal and event contingent aspects of the study. Finally, they had to agree to be signalled randomly for six days.

Exclusion criteria for the study were that participants were not currently reporting high levels of suicide ideation.

Materials and Measures

Patient Health Questionnaire-9 (PHQ-9). In order to assess depression severity, the PHQ-9 was used. The PHQ-9 has nine items including measures of sleep, concentration, appetite, mood and anhedonia. Rating scales range from “not at all” (0) “to nearly every day” (3) to indicate the severity of symptoms in the past two weeks, with a maximum possible score of 27. A PHQ-9 score ≥10 predicts a diagnosis of depression with a specificity of 88% and a sensitivity of 88%. PHQ-9 scores of 5, 10, 15, and 20 represent mild, moderate, moderately severe, and severe depression, respectively (Kroenke, Spitzer, &

Williams, 2001). The PHQ-9 has been found to have excellent internal reliability in previous research (α = .89; Kroenke, Spitzer, & Williams, 2001). Internal consistency was α = .89 in the present sample.

FFMQ-AWA. The AWA subscale of the FFMQ has 8 items that measure dispositional MW (e.g., “I find myself doing things without paying attention"). Participants rate whether each item generally describes them on a 5-point scale ranging from "never true or rarely true" (1) to "very often or always true" (5). These are reverse scored items; lower scores indicate greater MW (i.e. lower present moment awareness). Reliability of the AWA has been found to be satisfactory in previous research (α = .91; Baer, Smith, Hopkins, Krietemeyer & Toney, 2006) and was also satisfactory in the present sample (α = .88).

The Snaith Hamilton Pleasure Scale (SHAPS; Snaith, Hamilton, Morley, Humayan, Hargreaves, & Trigwell, 1995) and Mood and Anxiety Symptom Questionnaire (MASQ; Watson & Clark, 1991) were also collected but not included in the analyses due to restricted range on these variables precluding any meaningful analyses. See appendix B for full details of these measures.

ESM tasks. Participants were provided with a pre-programmed PRO-diary watch (Cambridge Neurotechnology, UK). For signal-contingent procedures, this prompted participants to complete reports via a beeping signal at eight pseudo-random times per day. These beeps occurred approximately every two hours throughout the day, but there was random jitter around this two-hour interval. The default setting was for beep-signals to be scheduled between the hours of 8am-9pm. However, we adjusted these intervals if participants requested it. Each participant was signalled 48 times over the

duration of the study. At each time point, participants were asked about current status of MW, mood and activity (for specific details of probes, see below). Questions took no longer than 2-3 minutes to complete for each signal. If the time was not convenient, participants could chose not to respond to the signal. Participants were instructed that they could also turn the beep off at times when it would be inconvenient.

For event-contingent procedures, participants were asked to schedule at least three pleasurable activities during that week (lasting a minimum of 20 minutes each). Participants activated the watch before beginning a positive activity to select the type of activity they were about to begin (see details of list of options in appendix A). Before beginning the activity, participants were also asked to set a 10-minute timer before commencing. When the timer alarmed, participants then initiated a questionnaire on the watch to answer questions about MW status and mood (see below for details of specific thought probes). Following completion of the midpoint questionnaire, participants were then instructed to return to their positive activity. At the end of the positive activity, participants were asked to initiate a further questionnaire on the watch. Participants were asked to complete this before the next signal-contingent beep (within a maximum of two hours). If this rating was not completed within two hours, this event was omitted from analyses to minimize the confounding effects of memory bias. The final questionnaire at the end of the positive activity required participants to retrospectively report on MW experience generally, and mood during their completed positive activity overall.

Across the sample participants activated the watch to report on positive activities 283 times in total, including incomplete reports (*M* = 4.1 per

participant). Although data were collected both during and after positive activities, only data collected after positive events were analysed to add a conceptually different component in addition to the signal-contingent data. The latter retrospective event-contingent data measures general recall of subjective experience after the activity, rather than a momentary response. These are potentially two different mechanisms, which may capture anhedonic experience.

Complete details of all ESM probes for both signal and event-contingent procedures are in Appendix A. Delespaul (1992) suggest that respondents who do not respond to at least a third of ESM signals should be excluded from analyses, therefore this recommendation informed our data cleaning protocol.

ESM MW and Affect Probes. ESM probes were based on the Killingsworth and Gilbert (2010) study. For signal-contingent procedures, participants first indicated if they were thinking about what they were doing via a "yes/no" option where "no" indicated MW. If they indicated they were MW, they then indicated the valence of MW on a scale of 1 (very unpleasant) to 7 (very pleasant). All participants (MW or not MW) then rated their affect on a scale of 1 (not at all) to 7 (extremely) for four positive and negative adjectives (selecting two of each to be high and low arousal).

At the end of a positive activity, following event-contingent procedures, participants first indicated MW status by recording to what extent they were generally thinking about what they were doing over the whole positive activity on a scale from 1 (not at all) to 7 (extremely). If participants reported MW during the activity they then reported on general valence of MW over the activity on a scale of 1 (very unpleasant) to 7 (very pleasant). All participants (MW or not MW) then rated their general affect during the positive activity on a scale of 1

(not at all) to 7 (extremely) for four positive and negative adjectives (selecting two of each to be high and low arousal).

Procedure

Participants attended a short training session at the Washington Singer Laboratories at the University of Exeter. Participants read the information sheet and gave consent to take part in the study. Participants completed questionnaires regarding demographics, education, the PHQ-9, SHAPS, MASQ-62 and FFMQ. Information on how to access psychological support was offered to those that then scored above 10 on the PHQ-9. Participants were trained in how to use the electronic watch so they could rate their mood experience and MW over the coming week. Participants were also asked to schedule at least three pleasurable activities during that week (lasting a minimum of 20 minutes each) and to rate mood and MW during and after each activity. At the end of the week participants returned the watch and received a final debrief about the experiment. Contact details on how to receive on-going support were also provided at debrief.

Results

Alpha was set at .05 and the results of two-tailed tests are reported throughout. Given the higher power of ESM designs, we did not interpret non-significant trends in the data to avoid making type I errors.

Missing data. In line with Delespaul (1992) guidelines, participants that did not respond to at least a third of signals were excluded (n = 5). A total of 3312 signals were responded to in total, across all participants (71.0%) and 1352 missing responses (29%). This is in line with Christensen, Barrett, Bliss-Moreau, Lebo and Kaschub's (2003) report on average response rates for

signal-contingent protocols (ranging from 50% to 70% across studies). There were 89 missing data entries for event-contingent data (24% of overall events), where participants had activated the watch to report on positive activities but had not fully completed questionnaires.

Data cleaning. Residuals for all momentary models were reviewed and were approximately normally distributed. While there was a slight positive skew in the NA and PHQ-9 scores, these were within acceptable limits so no steps were taken to transform variables.

Descriptive Statistics. Table 1 summarises the descriptive statistics for the participant level measures of depression (PHQ-9) and MW (FFMQ-AAW). There was a sufficient range in depression severity scores (27.9% mild, 13% moderate, 10.1%, moderate severe and 5.8% within a severely depressed range), meaning range restriction effects are unlikely to influence the results.

Table 1.

Descriptive information for baseline measures between subjects

Measure	Range	M	SD
PHQ-9	0-21	7.20	6.14
FFMQ AAW	9-32	20.23	4.97

Note. PHQ-9 = Patient Health Questionnaire; FFMQ-AWA = Five Facet Mindfulness Questionnaire, Acting with Awareness.

Table 2 presents the Pearson correlation coefficients between each momentary variable and the intraclass correlations for the momentary variables

reported in relation to the beep-signal. The intraclass correlations indicate the proportion of variance in each variable that was between-person relative to within-person. The intraclass correlation calculations indicated that 13% of the variance in MW was between-person and 87% was within-person. This indicates that individual differences in MW were small compared to the variability from occasion to occasion within people. The NA intraclass correlation indicate a roughly equal proportion of variability in NA between participants and between beep-signals within participants.

Table 2.

Table of correlations within and between subjects for signal-contingent data

	MW	PA	NA	V	PHQ-9	FFMQ-AAW	Descriptive statistics	Intraclass correlation
MW	-	-.34**	.27**	.29	.43**	-.35**	*M* = .34, *SD* = .40	.13
PA	-.20**	-	-.46**	.31*	-.55**	.28*	*M* = 15.6, *SD* = 4.1	.29
NA	.20**	-53**	-	-28*	.63**	-.43**	*M* = 7.4, *SD* = 3.1	.48
Valence	-	.52**	-.42**	-	-.24	.17	*M* = 4.0, *SD* = 1.2	.11
PHQ-9	-	-	-	-	-	-.48**	-	-

Note. MW = momentary mind wandering; PA = momentary positive affect; NA = momentary negative affect; V= thought valence on "mind wandering only" occasions. PHQ-9 = Patient Health Questionnaire-9; FFMQ-AWA = Five Facet Mindfulness Questionnaire-Acting with Awareness. ** Correlation significant at .01 level *Correlation significant at .05 level.

Correlations above the diagonal are between-person and correlations below the diagonal are within-person.

The descriptive mean for MW indicates that participants were MW 34% of the time on average.

Signal-contingent analyses

Data were analysed using MLM due to the nested data structure. This included level one units as momentary occasions (beep level), level two units as days, and level three units as the person level. All person-level variables were grand-mean centred and all beep-level variables were person-mean centred (within person), which cleanly separates between-person and within-person effects (Enders & Tofighi, 2007). These analyses were computed using MLwiN (Rasbash et al., 2000).

H1: Does trait mindfulness predict momentary MW?

A random-intercepts three-level MLM was constructed, predicting momentary MW using trait FFMQ-AWA entered as a single person-level predictor. Consistent with H1, higher trait “acting with awareness” as measured by the FFMQ-AWA was associated with significantly less MW across the experience-sampling phase, B = -.013, $SE(B)$ = .004, z = 2.93, p = .003.

Within-person analyses

Does momentary MW predict momentary PA/NA (H2 and H3)?

To replicate Killingsworth and Gilbert's study (2010) we first examined H2 and H3 at a within-person level, to see if an individual experiences less PA/more NA in moments when their mind wanders. We constructed two random-intercepts MLM and entered (person-centred) momentary MW as a

predictor of momentary PA in the first model and momentary NA in the second model. In the first model, momentary MW was associated with lower levels of PA, B = -1.89, $SE(B)$ = .220, z = 8.57, p < .001, consistent with H2. In the second model, momentary MW was associated with greater levels of NA, consistent with H3, B = 1.400, $SE(B)$ = .168, z = 8.30, p < .001.

Mediation analysis

To investigate whether MW mediates the link between depression and anhedonic experience, we followed the stepwise approach recommended by Baron and Kenny (1986). The proposed between-person mediation model we will test is displayed in Figure 1.

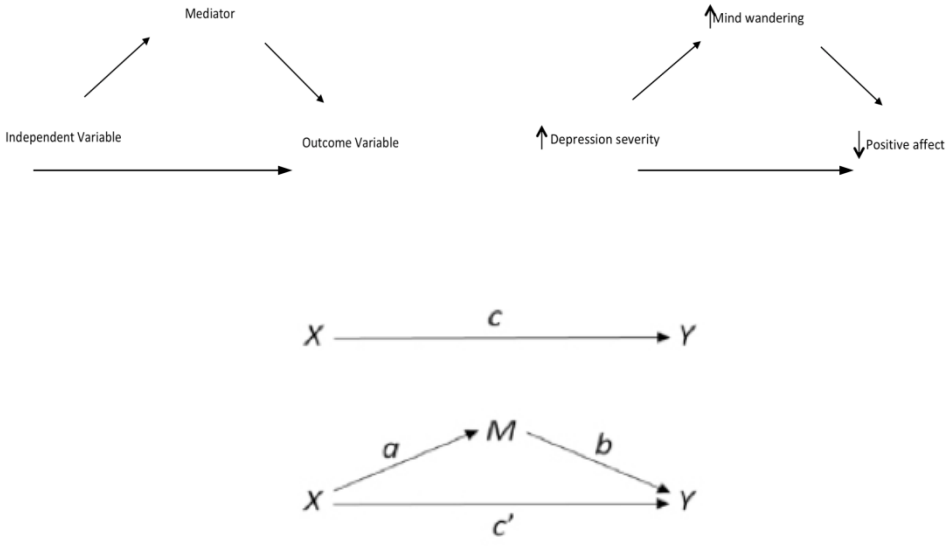


Figure 1. A proposed mediation model (Baron & Kenny, 1986) between depression severity, MW and PA.

Note: Figure presents a three-variable diagram with two causal paths. This illustrates the direct influence of the independent variable (depression severity) on the mediator (MW; path a) and the influence of the mediator on the

outcome variable (reduced PA; path b). There is also a pathway between increased depression severity and reduced PA (path c'), which is not mediated by MW. It is anticipated that the relationship between depression and reduced PA will be partially (rather than fully) mediated by MW. This is due to additional symptoms within depression, such as fatigue, concentration and energy levels that may also contribute to the relationship between depression and reduced PA. In this model, the indirect effect refers to the influence of depression on PA that is mediated by MW. It is expected that there will be a significant indirect effect (indicating partial mediation), but that depression will remain a significant predictor of PA after controlling for MW.

To test the mediation model, we moved from within-person analyses to between-person analyses (using mean levels of momentary variables that were centred around the grand mean). We first examined whether depression predicts mean levels of MW (path a in Figure 1). Second, we determined whether there is a relationship between depression and mean levels of PA (path c in Figure 1). Third, we assessed whether MW predicts mean levels of PA (path b in Figure 1) when controlling for depressive symptoms. Fourth, we tested whether any observed association between depressive symptoms and mean levels of PA completely disappears (full mediation) or reduces in magnitude when controlling for MW. If all of the previous steps were supported, the significance of the indirect effect was tested using the Sobel test. Similar analyses were conducted for NA.

Step 1 (path a): Does depression severity predict mean levels of momentary MW (H4)?

We constructed a random-intercepts MLM to predict mean levels of momentary MW predicted by PHQ-9 score. Greater depressive symptoms were associated with significantly greater mean MW across the experience-sampling phase, $B = .014$, $SE(B) = .003$, $z = 16.83$, $p < .001$, consistent with H4.

Step 2 (path c): Does depression severity predict mean levels of PA/NA (H5 and H6)?

Two random-intercepts MLM were constructed to predict mean levels of PA and NA respectively, across the signal-contingent experience-sampling phase. PHQ-9 score was the single person-level predictor in each model. In the first model, greater depressive symptoms were significantly associated with lower mean levels of PA, B = -.262, $SE(B)$ = .049, z = 5.35, p < .001. In the second model, greater depressive symptoms were significantly associated with greater mean levels of NA, B = .301, $SE(B)$ = .044, z = 6.84, p < .001 (supporting H5 and H6).

Step 3 (path b): Does mean level of momentary MW predict mean PA/NA when controlling for depression severity (H7 and H8)?

We added mean MW (at the person level) to each of the models constructed in Step 2 to examine whether mean MW predicts mean PA/NA when controlling for depressive symptoms. In the first model, mean MW was not a significant predictor of mean levels of PA, B = -2.073, $SE(B)$ = 1.730, z = 1.20, p = .23. In the second model, mean MW was not a significant predictor of mean levels of NA, B = 0.955, $SE(B)$ = 1.542, z = 0.619, p = .53. This did not support H7 and H8, and meant that Baron and Kenny's (1986) conditions for mediation were not met.

Step 4 (path c'): Does depression predict mean levels of affect after controlling for mean MW (H7 and H8)?

In the first model, after controlling for MW, greater depressive symptoms remained a significant predictor of lower mean levels of PA, B = –.235, $SE(B)$ = .054, z = 4.35, p < .001. In the second model, after controlling for MW, greater depressive symptoms remained a significant predictor of higher mean levels of NA, B = .288, $SE(B)$ = .048, z = 6.00, p < .001, indicating that Baron & Kenny

(1986) guidelines were not fulfilled. Furthermore, if either path (a) or (b) are not significant (here path b is not significant), it is statistically impossible for there to be a significant indirect effect. Thus, depressive symptoms predicted higher mean levels of MW, but mean levels of MW were not independently associated with mean levels of PA or NA.

Event-contingent analyses

The data were again analysed using MLM due to the nested data structure, this time using a two-level hierarchy (positive activities nested within individuals). The day level was removed from analyses because there were relatively few days where participants completed more than one positive activity. All person-level variables were grand-mean centred and all activity-level variables were person-mean centred.

Table 3 presents the Pearson correlation coefficients among each of the momentary variables and the intraclass correlations for the momentary variables reported after and in relation to the positive activity. The intraclass correlation calculations indicated that 83% of the variance in MW during positive activities was between-person and 17% was within-person. This indicates relatively large individual differences in MW, with most variability from person to person rather than from activity to activity. PA and NA intraclass correlations indicate a roughly equal proportion of variability in affect between participants and between activities.

Within-person analyses

Does the extent of MW during positive activities predict PA/NA during positive activities (H2 and H3)?

Two within-person MLM were constructed with MW entered as a within-

Table 3.

Within and between subjects correlations for event-contingent variables

Measure	MW	PA	NA	Descriptive statistics	ICC
MW	-	.65**	-.80**	*M* = 4.8 *SD* = 1.5	.83
PA	.47**	-	-.71**	*M* = 17.8 *SD* = 3.9	.49
NA	-.16	-.52**	-	*M* =7.5 *SD* = 2.9	.45

Note: MW = Mind wandering during positive activity (reverse-scored); PA = positive affect during positive activity; NA = negative affect during positive activity; ICC = intraclass correlation. ** Correlation significant at .01 level. Correlations above the diagonal are between-person and correlations below the diagonal are within-person.

person predictor of PA and NA respectively. MW[5] during positive activities was associated with lower levels of PA during positive activities at the within-person level, $B = 1.179$, $SE(B) = .200$, $z = 5.90$, $p < .001$, consistent with H2. In the second model, however, there was no significant association between MW and NA during positive activities, $B = -.264$, $SE(B) = .170$, $z = 1.55$, $p = .12$, inconsistent with H3.

Mediation analyses

To repeat the steps following Baron & Kenny (1986) as for the signal-contingent data, the four steps for mediation analysis were conducted at the between person level for analyses involving positive activities.

Step 1 (path a): Does depression severity predict more retrospective judgments about MW during positive activities (H4)?

First, we constructed a random-intercepts MLM to predict MW during positive activities using PHQ-9 score as the predictor. Depressive symptoms were not significantly associated with greater MW during positive activities, $B = -.024$, $SE(B) = .023$, $z = 1.06$, $p = .29$, failing to support H4.

Step 2 (path c): Does depression severity predict lower mean levels of PA/higher mean levels of NA during positive activities (H5 and H6)?

[5] Note that the directional interpretation of MW is reversed relative to the signal-contingent analyses. This is because the wording of the MW question was reversed in the event- ("To what extent were you generally thinking about what you were doing during the positive activity?") relative to signal-contingent ("Just as the watch beeped, were you thinking about what you were doing?") data. Here, the interpretation of MW coefficients is correct given the directionality of the scale.

Two random-intercepts MLMs were constructed to predict PA and NA respectively during positive activities using PHQ-9 score as the person-level predictor. In the first model, greater depressive symptoms were significantly associated with lower levels of PA during positive activities, B = -.270, $SE(B)$ = .071, z = 3.80, p < .001. In the second model, greater depressive symptoms were significantly associated with higher levels of NA during positive activities, B = .219, $SE(B)$ = .064, z = 3.40, p < .001, consistent with H5 and H6.

Step 3 (path b): Does the mean extent of MW during positive activities predict mean levels of PA/NA during positive activities after controlling for depressive symptoms (H7 and H8)?

We added mean MW as a predictor to the previous models to see whether it predicted mean levels of affect during positive activities after controlling for depressive symptoms. In the first model, mean levels of MW were a significant predictor of lower mean levels of PA during positive activities, B = 1.862, $SE(B)$ = 0.322, z = 5.78, p < .001. In the second model, mean levels of MW were a significant predictor of higher mean levels of NA during positive activities, B = -1.436, $SE(B)$= 0.303, z = 4.27, p < .001. Thus, supporting H7 and H8, mean levels of MW during positive activities retained a significant association with positive and negative affect after controlling depressive symptoms.

Step 4 (path c'): Does depression predict mean levels of affect during positive activities after controlling for mean levels of MW (H7 and H8)?

After the previous step, depressive symptoms continued to be a significant predictor of mean levels of PA after controlling for mean levels of MW in the first model, B = –0.231, $SE(B)$ = .058, z = 4.00, p < .001. Similarly,

depressive symptoms continued to significantly predict mean levels of NA after controlling for mean levels of MW in the second model, B = 0.187, $SE(B)$ = .057, z = 3.28, p = .001. These results confirm that MW did not fully mediate the association between depressive symptoms and affect during positive activities. Furthermore, because depressive symptoms did not significantly predict mean levels of MW during positive activities (path a), there was no significant indirect effect of depressive symptoms on affect during positive activities as mediated through MW. Instead, depressive symptoms and MW independently contribute to PA and NA during positive activities.

Style of MW exploratory hypotheses:

For these hypotheses, data were restricted to 669 signal-contingent occasions when people reported that they were MW.

Within person analyses

Is valence of MW associated with PA/NA within-person?

Two random-intercepts MLM were computed to predict momentary PA and NA on signal-contingent occasions with (person-centred) MW valence as the within-person predictor. In the first model, positive valence of MW was significantly and positively associated with PA within-subjects, B = 1.738, $SE(B)$ = .123, z = 14.07, p < .001. In the second model, positive valence of MW was significantly and negatively associated with NA within-subjects, B = -1.389, $SE(B)$ = .117, z = 11.85, p < .001.

Mediation analyses

We again conducted mediation analyses following the Baron and Kenny (1986) steps, this terms replacing extent of MW with valence of MW.

Step 1 (path a): Are depressive symptoms associated with mean valence of MW?

A random-intercepts MLM was computed to predict mean levels of momentary MW valence using depression symptoms as a person-centred predictor. Depressive symptoms were significantly negatively associated with mean MW valence, B = -.026, $SE(B)$ = .011, z = 2.36, p = .02 (i.e., the more depressed individuals were, the less they mind wandered to positive themes).

Step 2 (path c): Does depression severity predict lower levels of PA/higher levels of NA?

Two MLMs were constructed predicting positive and negative affect during MW respectively. In the first model, depressive symptoms predicted lower mean levels of PA during MW, B = -.254, $SE(B)$ = .057, z = 4.45, p < .001. In the second model, depressive symptoms predicted higher mean levels of NA during MW, B = 0.307, $SE(B)$ = .053, z = 5.79, p < .001.

Step 3 (path b): Does mean MW valence predict mean levels of affect after controlling for depressive symptoms?

We next entered mean MW valence into each of the previous two models as the potential mediator. In the first model, mean MW valence was significantly and positively associated with mean levels of PA after controlling for depressive symptoms, B = 3.071, $SE(B)$ = .433, z = 7.09, p < .001. In the second model, mean MW valence was significantly and negatively associated with mean levels of NA after controlling for depressive symptoms, B = -1.404, $SE(B)$ = .482, z = 2.91, p = .002.

Step 4 (path c'): Do depressive symptoms predict mean levels of affect when controlling for mean MW valence?

In the first model described above, depressive symptoms remained a significant predictor of reduced PA when including mean MW valence, B = -.171, $SE(B)$ = .044, z = 3.88, p < .001. Similarly, in the second model described above, depressive symptoms remained a significant predictor of NA when controlling for mean MW valence, B = .269, $SE(B)$ = .052, z = 5.17, p = .001, indicating that full mediation was not supported.

However, for both the PA and NA model, Baron and Kenny's (1986) steps were fulfilled, suggesting that mean MW valence could partially mediate the relationship between depression and mean PA/NA. Supporting partial mediation, a Sobel test of the significance of the indirect effect confirmed that mean MW valence partially mediated the relationship between depressive symptoms and mean PA during MW, z = 2.22, p = .03. For the second model, the Sobel test revealed that mean MW valence narrowly failed to reach significance as a partial mediator of the relationship between depressive symptoms and mean NA during MW, z = 1.93, p = .054.

Discussion

Previous research has established that greater levels of MW are associated with reduced positive experience in the general population. The present study examined whether this mechanism may mediate the relationship between reduced pleasure experience (anhedonia) and depression.

To check the validity of our state measures of MW, we first established whether trait levels of MW as measured with FFMQ-AWA were correlated with momentary measures of MW during everyday life (signal-contingent data).

Supporting H1 and validating our state measures of MW, there was a robust association between greater state reports of MW and reduced score on FFMQ-AWA (i.e. greater trait levels of MW).

Next, we attempted to replicate the findings of Killingsworth and Gilbert (2010), who found that greater MW was associated with less positive experience at the within-person level. We extended this by looking at both everyday levels of affect (signal-contingent design) and during scheduled positive activities (event-contingent design). Replicating and extending Killingsworth and Gilbert (2010), we found greater MW was linked to less PA in both signal-contingent and event-contingent analyses (supporting H2). This suggests MW is robustly related to PA experience.

To establish if MW is uniquely linked to PA or extends to affective experience generally, we also examined relationships between MW and NA. Partly consistent with H3, we found that greater MW was associated with more NA during everyday life but not during positive activities. This builds upon Killingsworth and Gilbert's (2010) study by showing that MW is not specifically related to happiness and also is associated with NA, at least in the signal-contingent domain.

Next we moved on to test our core depression hypotheses. Depression severity was associated with increasing levels of MW in everyday life but in contrast to predictions, depressive symptoms were not significantly associated with greater MW reports during positive activities. MW for healthy students has been found to decrease with enjoyable tasks generally (McVay, Kane, & Kwapil, 2009). It may be that an enjoyable activity reduces MW for depressed people too.

Finally, our mediation analyses revealed that MW alone did not mediate the link between depression and either anhedonic experience or negative mood in everyday life. There was also no significant mediation for positive activities, as depression did not significantly predict MW during positive activities.

Exploratory analyses showed evidence for MW valence as a significant partial mediator between depression and anhedonia. The greater tendency for the mind to wander to negative themes partly accounted for the association between greater depression levels and reduced PA during everyday MW. MW to negative themes also approached significance as a partial mediator of the association between depression and increased NA during everyday MW.

In the introduction, we proposed a model based on Clark (1999), to better understand depression by identifying what mechanisms maintain features in depression, such as anhedonia, so we can target these systematically. MW was proposed as one such mechanism. This study is the first to my knowledge to address the role of MW in the context of anhedonia. In this study, those reporting greater levels of depression symptoms experienced reduced levels of PA during positive activities. This is in line with previous research that people experiencing depression report pleasant stimuli as less positive compared to non-depressed controls (Dunn, Dalgleish, Lawrence, Cusack, & Ogilvie, 2004).

Alternatively, another explanation is that depressed people were less capable at selecting/predicting positive activities that made them happy. The ecologically valid design in this study means that the activities may not have been matched between more and less depressed people. What our results also revealed though was that depressed people tended to mind wander more in everyday life, and MW was associated with reduced PA. Our findings suggest

that MW valence may have a more central role in the relationship between depression and PA. It may be this mechanism that influences anhedonia. Targeting the valence of MW could therefore be beneficial.

There is growing literature to suggest that there are both benefits and costs to MW, depending on the context. On the one hand, for example, MW about social relationships has been shown to be associated with happiness, connection and love (Poerio, Totterdell, Emerson, & Miles, 2015) and predicts greater life satisfaction (Mar, Mason, & Litvack, 2011). Furthermore, MW content rated as high in interest can lead to an increase in positive mood (Franklin et al., 2013).

On the contrary, MW about past events and about other people has been found to be related to negative mood (Ruby, Smallwood, Engen, & Singer, 2013). Thought content that is categorised as personally significant and negative has been found to be associated with depression and trait NA (Andrews-Hanna et al., 2013). In this study, valence of MW was associated with depressive symptoms, and greater NA and reduced PA. Furthermore, our mediation analysis suggests that MW valence has a more central role in the relationship between depression and PA. A study by Ottaviani, Shapiro and Couyoumdjian (2013) indicates that it is not MW alone that is associated with negative mood, rather when MW content takes a ruminative or worrisome form, coined as perseverative cognition. This further suggests that the content of MW may be key in determining costly or beneficial impacts on mood. Targeting this aspect within BA could also be advantageous.

Given that the present study was conducted on a non-clinical sample, it is premature to draw strong clinical implications from the present findings.

Nevertheless, some tentative clinical implications can be considered. First, consistent with previous findings in laboratory settings (Dunn, Dalgleish, Lawrence, Cusack, & Ogilvie, 2004; Rottenberg, Gross, & Gotlib, 2005; Pizzagalli, Iosifescu, Hallett, Ratner, & Fava, 2008), individuals with greater depressive symptoms experienced less of an increase in positive affect when completing everyday positive activities in the event contingent phase of the study. In the existing treatments such as BA and CBT, the implicit assumption is that is sufficient to simply re-engage clients with potentially rewarding activities and their mood will improve. However, the present findings suggest that treatment also needs to help individuals to engage with these positive activities in such a way that positive affect is most likely to be increased. By additionally identifying and targeting the range of psychological mechanisms that blunt pleasure experience in depression during such activities (potentially including mind wandering), the potency of the use of positive activity scheduling in existing treatments may be enhanced. Second, the present study replicated the finding that greater levels of depression are associated with greater experience of negative affect during positive activities (e.g. Dunn et al., 2004). At first glance, it is paradoxical that individuals should experience increased negative mood during a positive experience. However, one possibility is that mind wandering creates an ideal environment for individuals to start to ruminate rather than to directly experience the activity at hand. In particular, depression has been associated with the tendency to appraise positive emotion experience when it arises in a way that ‘dampens it’ (for example, to think “this is too good to last” or “I don’t deserve this”) (e.g. see Feldman, Joormann, & Johnson, 2008). It may therefore be useful to encourage depressed participants to notice when they start to ‘dampen’ their experience and to redirect their attention back

to the present moment to the positive activity at hand. This preliminary account of why negative affect increases during positive activities now requires empirical evaluation.

Strengths and limitations. There are several limitations to the present study that should be held in mind when interpreting these findings. First, our study included people who were exhibiting high levels of depression severity but were not selected from a clinical population on the basis of a formal MDD diagnosis. It may be that the maladaptive consequences of MW are more apparent in a clinical population, and further research is required to determine this. Second, MW was assessed solely via subjective self-report, which may be vulnerable to response-bias and may lack sensitivity. However, partially mitigating this concern, research indicates that behavioural markers of MW measured in the laboratory produce broadly comparable results to self-report data (McVay & Kane, 2009).

Although a mediation model is based on causal relationships between the predictor and mediator, and mediator and outcome, a key limitation is that the analyses were cross-sectional and we cannot infer causality. Thus, it is possible that the significant MW valence mediation could also occur if depressed affect reduces MW valence rather than (or in addition to) the reverse. Furthermore, this mediation analysis was addressed for our signal-contingent analysis, and not for our event-contingent analysis (due to insufficient data). The event-contingent data were retrospective and may be influenced by memory biases, which could reduce measurement sensitivity (Scollon, Prieto & Diener, 2009). Moreover, signal-contingent and event-contingent ratings are potentially tapping into different processes, such that

event-contingent findings may indicate that MW valence influences negative appraisals after the event rather than momentary experience during it.

Future directions. The current work provides evidence for the valence of MW as an independent contributor to anhedonia. MW alone may not mediate the link between depression and anhedonia but valence of MW may be fundamental to explore in further research. Prior research suggests that distinct types of MW are associated with low mood (Ruby, Smallwood, Engen, & Singer, 2013). This could be explored further such as testing innovative ways to bolster positive or reduce negative themed MW valence whilst using BA.

Additional research suggests that MW can precede negative mood (Killingsworth & Gilbert, 2010; Ruby, Smallwood, Engen, & Singer, 2013). Time lag analyses were not included in this study so we are unable to comment on whether this was also exacerbated in a depressed population. Causal manipulation studies or time lag analyses are needed here.

Conclusion

In conclusion, the results of the study contribute to a growing body of literature exploring potential mechanisms that link MW and mood. To our knowledge, this is the first study that has examined whether MW is implicated in anhedonic symptoms in depression using ESM. The findings of this study support previous research, demonstrating the within-person relationship between MW and mood. Our study has extended this finding to anhedonia specifically. Our key finding is that MW did not mediate the relationship between depression and anhedonia, but valence of MW did. Further research into the role of valence of MW is required.

References

Al-Harbi, K. S. (2012). Treatment-resistant depression: therapeutic trends, challenges, and future directions. *Journal of Patient Preference and Adherence*, *6*, 369-388. doi:10.2147/PPA.S29716.

American Psychiatric Association (2013). *Diagnostic and Statistical Manual of Mental Disorders (5th ed.).* Washington. DC: American Psychiatric Association.

Andrews-Hanna, J. R., Kaiser, R. H., Turner, A. E., Reineberg, A. E., Godinez, D., Dimidjian, S., & Banich, M. T. (2013). A penny for your thoughts: dimensions of self-generated thought content and relationships with individual differences in emotional wellbeing. *Frontiers in Psychology*, *4*, 900. doi:10.3389/fpsyg.2013.00900.

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, *13*, 27-45. doi:10.1177/1073191105283504.

Barge-Schaapveld, D. Q., Nicolson, N. A., & Berkhof, J. (1999). Quality of life in depression: daily life determinants and variability. *Psychiatry Research*, *88*, 173-189. doi:10.1016/S0165-1781(99)00081-5.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173-1182. doi: 10.1037/0022-3514.51.6.1173.

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

Beesdo, K., Lau, J. Y., Guyer, A. E., McClure-Tone, E. B., Monk, C. S., Nelson, E. E., ... & Ernst, M. (2009). Common and distinct amygdala-function perturbations in depressed vs anxious adolescents. *Archives of General Psychiatry*, *66*, 275-285. doi:10.1001/archgenpsychiatry.2008.545.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, *84*, 822-848. doi: 10.1037/0022-3514.84.4.822.

Butler, A. C., Chapman, J. E., Forman, E. M., & Beck, A. T. (2006). The empirical status of cognitive-behavioral therapy: a review of meta-analyses. *Clinical Psychology Review*, *26*, 17-31. doi:10.1016/j.cpr.2005.07.003.

Bylsma, L. M., Morris, B. H., & Rottenberg, J. (2008). A meta-analysis of emotional reactivity in major depressive disorder. *Clinical Psychology Review*, *28*, 676-691. doi: 10.1016/j.cpr.2007.10.001.

Bylsma, L. M., Taylor-Clift, A., & Rottenberg, J. (2011). Emotional reactivity to daily events in major and minor depression. *Journal of Abnormal Psychology*, *120*, 155-167. doi.org/10.1037/a0021662.

Carriere, J. S., Cheyne, J. A., & Smilek, D. (2008). Everyday attention lapses and memory failures: The affective consequences of mindlessness. *Consciousness and Cognition*, *17*, 835-847. doi:10.1016/j.concog.2007.04.008.

Christensen, T. C., Barrett, L. F., Bliss-Moreau, E., Lebo, K., & Kaschub, C. (2003). A practical guide to experience-sampling procedures. *Journal of Happiness Studies*, *4*, 53-78. doi:10.1023/A:1023609306024.

Clark, D. M. (1999). Anxiety disorders: Why they persist and how to treat them. *Behaviour Research and Therapy*, *37*, S5-S27. doi:10.1016/S0005-7967(99)00048-0.

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology*, *100*, 316-336. doi.org/10.1037/0021-843X.100.3.316.

Cohen, J. (1969). *Statistical power analysis for the behavioral sciences (revised edition).* New Jersey: Lawrence Erlbaum Associates.

Cuijpers, P., Van Straten, A., & Warmerdam, L. (2007). Behavioral activation treatments of depression: A meta-analysis. *Clinical Psychology Review*, *27*, 318-326. doi: 10.1016/j.cpr.2006.11.001.

Delespaul, P. (1992). *Technical note: Devices and time-sampling procedures.* In M. W. De Vries and M. Csikszentmihalyi (Eds.) The Experience of Psychopathology: Investigating Mental Disorders in their Natural Settings, (pp. 363-373). Netherlands: Cambridge University Press.

Desrosiers, A., Klemanski, D. H., & Nolen-Hoeksema, S. (2013). Mapping mindfulness facets onto dimensions of anxiety and depression. *Behavior Therapy*, *44*, 373-384. doi:10.1016/j.beth.2013.02.001.

Dunn, B. D., Dalgleish, T., Lawrence, A. D., Cusack, R., & Ogilvie, A. D. (2004). Categorical and dimensional reports of experienced affect to emotion-inducing pictures in depression. *Journal of Abnormal Psychology*, *113*, 654. doi: 10.1037/0021-843X.113.4.654.

Dunn, B. D., German R. E., Hollon, S. D., & DeRubeis, R.J. (2016). Changes in positive and negative affect during Cognitive Therapy versus

Medication for Major Depressive Disorder - a Randomized Controlled Trial. Manuscript submitted for publication.

Enders, C. K., & Tofighi, D. (2007). Centering predictor variables in cross-sectional multilevel models: a new look at an old issue. *Psychological Methods*, *12*, 121-138. doi.org/10.1037/1082-989X.12.2.121.

Feldman, G. C., Joormann, J., & Johnson, S. L. (2008). Responses to positive affect: A self-report measure of rumination and dampening. *Cognitive Therapy and Research*, *32*, 507-525. doi: 10.1007/s10608-006-9083-0.

Franklin, M. S., Mrazek, M. D., Anderson, C. L., Smallwood, J., Kingstone, A., & Schooler, J. W. (2013). The silver lining of a mind in the clouds: interesting musings are associated with positive mood while mind-wandering. *Frontiers in Psychology*, *4*. doi:10.3389/fpsyg.2013.00583.

Geddes, J. R., Carney, S. M., Davies, C., Furukawa, T. A., Kupfer, D. J., Frank, E., & Goodwin, G. M. (2003). Relapse prevention with antidepressant drug treatment in depressive disorders: a systematic review. *Lancet*, *361*, 653-661. doi:10.1016/S0140-6736(03)12599-8.

Geschwind, N., Peeters, F., Drukker, M., van Os, J., & Wichers, M. (2011). Mindfulness training increases momentary positive emotions and reward experience in adults vulnerable to depression: a randomized controlled trial. *Journal of Consulting and Clinical Psychology*, *79*, 618-628. doi: 10.1037/a0024595.

Gotlib, I. H., Krasnoperova, E., Yue, D. N., & Joormann, J. (2004). Attentional biases for negative interpersonal stimuli in clinical depression. *Journal of Abnormal Psychology*, *113*, 127-135. doi.org/10.1037/0021-843X.113.1.121.

Gray, J. A. (1982). On mapping anxiety. *Behavioral and Brain Sciences*, *5*, 506-534. doi: 10.1017/S0140525X00013297.

Killingsworth, M. A., & Gilbert, D. T. (2010). A wandering mind is an unhappy mind. *Science*, *330*, 932-932. doi: 10.1126/science.1192439.

Kring, A. M., Persons, J. B., & Thomas, C. (2007). Changes in affect during treatment for depression and anxiety. *Behaviour Research and Therapy*, *45*, 1753-1764. doi: 10.1016/j.brat.2007.02.001.

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The Patient Health Questionnaire (PHQ-9). *Journal of General Internal Medicine*, *16*, 606-613. doi: 10.1046/j.1525-1497.2001.016009606.x.

Maas, C. J., & Hox, J. J. (2005). Sufficient sample sizes for multilevel modelling. *Methodology: European Journal of Research Methods for the Behavioral and Social Sciences*, *1*, 86-92.

Mar, R. A., Mason, M. F., & Litvack, A. (2012). How daydreaming relates to life satisfaction, loneliness, and social support: the importance of gender and daydream content. *Consciousness and Cognition*, *21*, 401-407. doi:10.1016/j.concog.2011.08.001.

Matthews G., Campbell S. E., Desmond P. A., Huggins J., Falconer S., Joyner A. (1999). Assessment of task-induced state change: Stress, fatigue and workload components. In Scerbo M. (Ed.), *Automation technology and*

human performance: Current research and trends (pp. 199-203) Hillsdale, NJ: Erlbaum.

McManus, S., Meltzer, H., Brugha, T. S., Bebbington, P. E., & Jenkins, R. (2009). *Adult psychiatric morbidity in England, 2009: results of a household survey.* London, England: NHS Information Centre for Health and Social Care 2009.

McVay, J. C., & Kane, M. J. (2009). Conducting the train of thought: working memory capacity, goal neglect, and mind wandering in an executive-control task. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *35*, 196-204. doi: 10.1037/a0014104.

McVay, J. C., Kane, M. J., & Kwapil, T. R. (2009). Tracking the train of thought from the laboratory into everyday life: An experience-sampling study of mind wandering across controlled and ecological contexts. *Psychonomic Bulletin and Review*, *16*, 857-863. doi: 10.3758/PBR.16.5.857.

Morris, B. H., Bylsma, L. M., & Rottenberg, J. (2009). Does emotion predict the course of major depressive disorder? A review of prospective studies. *British Journal of Clinical Psychology*, *48*, 255-273. doi: 10.1348/014466508X396549.

Mrazek, M. D., Smallwood, J., & Schooler, J. W. (2012). Mindfulness and mind-wandering: finding convergence through opposing constructs. *Emotion*, *12*, 442-448. doi: 0.1037/a0026678.

Nakonezny, P. A., Carmody, T. J., Morris, D. W., Kurian, B. T., & Trivedi, M. H. (2010). Psychometric evaluation of the Snaith–Hamilton Pleasure Scale

(SHAPS) in adult outpatients with major depressive disorder. *International Clinical Psychopharmacology*, *25*, 328-333. doi:10.1097/YIC.0b013e32833eb5ee.

National Institute for Health and Care Excellence (2009). Depression in adults: The treatment and management of depression in adults. *NICE Clinical Guideline 90.* Retrieved from: http://www.nice.org.uk/guidance/cg90/resources/guidance-depression-in-adults-pdf.

Ottaviani, C., & Couyoumdjian, A. (2013). Pros and cons of a wandering mind: a prospective study. *Frontiers in Psychology*, *4*, 1-9. doi: 10.3389/fpsyg.2013.00524.

Ottaviani, C., Shahabi, L., Tarvainen, M., Cook, I., Abrams, M., & Shapiro, D. (2015). Cognitive, behavioral, and autonomic correlates of mind wandering and perseverative cognition in major depression. *Frontiers in. Neuroscience*, *8*, 1-9. doi: 10.3389/fnins.2014.00433.

Pelizza, L., & Ferrari, A. (2009). Anhedonia in schizophrenia and major depression: state or trait. *Annals of General Psychiatry*, *8*, 22. doi:10.1186/1744-859X-8-22.

Pizzagalli, D. A., Iosifescu, D., Hallett, L. A., Ratner, K. G., & Fava, M. (2008). Reduced hedonic capacity in major depressive disorder: evidence from a probabilistic reward task. *Journal of Psychiatric Research*, *43*, 76-87. doi:10.1016/j.jpsychires.2008.03.001.

Poerio, G. L., Totterdell, P., Emerson, L. M., & Miles, E. (2015). Love is the triumph of the imagination: Daydreams about significant others are associated with increased happiness, love and connection. *Consciousness and Cognition*, *33*, 135-144. doi:10.1016/j.concog.2014.12.011.

Posner, J., Russell, J. A., Gerber, A., Gorman, D., Colibazzi, T., Yu, S., ... & Peterson, B. S. (2009). The neurophysiological bases of emotion: An fMRI study of the affective circumplex using emotion- denoting words. *Human Brain Mapping*, *30*, 883-895. doi: 10.1002/hbm.20553.

Rasbash, J., Browne, W., Goldstein, H., Yang, M., Plewis, I., Healy, M., ... & Lewis, T. (2000). *A User's Guide to MLwiN, Version 2.1.* London: Institute of Education, University of London.

Rottenberg, J., Gross, J. J., & Gotlib, I. H. (2005). Emotion context insensitivity in major depressive disorder. *Journal of Abnormal Psychology*, *114*, 627. doi:10.1037/0021-843X.114.4.627.

Ruby, F. J., Smallwood, J., Engen, H., & Singer, T. (2013). How self-generated thought shapes mood—the relation between mind-wandering and mood depends on the socio-temporal content of thoughts. *Public Library of Science One*, *8*, e77554. doi: 10.1371/journal.pone.0077554.

Sarchiapone, M., Carli, V., Camardese, G., Cuomo, C., Di Giuda, D., Calcagni, M. L., ... & De Risio, S. (2006). Dopamine transporter binding in depressed patients with anhedonia. *Psychiatry Research: Neuroimaging*, *147*, 243-248. doi.org/10.1016/j.pscychresns.2006.03.001.

Schooler, J. W., Mrazek, M. D., Franklin, M. S., Baird, B., Mooneyham, B. W., Zedelius, C., & Broadway, J. M. (2014). The middle way: Finding the balance between mindfulness and mind-Wandering. *Psychology of Learning and Motivation, 60*, 1-33.

Scollon, C. N., Prieto, C. K., & Diener, E. (2009). *Experience sampling: promises and pitfalls, strength and weaknesses.* In E.Diener (Ed.), Assessing Well-being (pp.157-180). Netherlands: Springer.

Spijker, J., Bijl, R. V., De Graaf, R., & Nolen, W. A. (2001). Determinants of poor 1-year outcome of DSM-III-R major depression in the general population: The Netherlands Mental Health Survey and Incidence Study (NEMESIS). *Acta Psychiatrica Scandinavica*, *103*, 122-130. doi: 10.1034/j.1600-0447.2001.103002122.x.

Smallwood, J., Fishman, D. J., & Schooler, J. W. (2007). Counting the cost of an absent mind: Mind wandering as an underrecognized influence on educational performance. *Psychonomic Bulletin and Review*, *14*, 230-236. doi10.3758/BF03194057.

Smallwood, J., O'Connor, R. C., Sudbery, M. V., & Obonsawin, M. (2007). Mind-wandering and dysphoria. *Cognition and Emotion*, *21*, 816-842. doi: 10.1080/02699930600911531.

Smallwood, J., Fitzgerald, A., Miles, L. K., & Phillips, L. H. (2009). Shifting moods, wandering minds: negative moods lead the mind to wander. *Emotion*, *9*, 271-276. doi: 10.1037/a0014855.

Snaith, R. P., Hamilton, M., Morley, S., Humayan, A., Hargreaves, D., & Trigwell, P. (1995). A scale for the assessment of hedonic tone the

Snaith-Hamilton Pleasure Scale. *The British Journal of Psychiatry*, *167*, 99-103. doi: 10.1192/bjp.167.1.99.

Stawarczyk, D., Majerus, S., Van der Linden, M., & D'Argembeau, A. (2012). Using the daydreaming frequency scale to investigate the relationships between mind-wandering, psychological well-being, and present-moment awareness. *Frontiers in Psychology*, *3*, 1-15. doi:10.3389/fpsyg.2012.00363.

Teasdale, J. D. (1989). Daydreaming, depression and distraction. *The Psychologist*, *2*, 189-190.

Telford, C., McCarthy-Jones, S., Corcoran, R., & Rowse, G. (2012). Experience sampling methodology studies of depression: the state of the art. *Psychological Medicine*, *42*, 1119-1129. doi: http://dx.doi.org/10.1017/S0033291711002200.

Thompson, R. J., Mata, J., Jaeggi, S. M., Buschkuehl, M., Jonides, J., & Gotlib, I. H. (2012). The everyday emotional experience of adults with major depressive disorder: Examining emotional instability, inertia, and reactivity. *Journal of Abnormal Psychology*, *121*, 819. doi.org/10.1037/a0027978.

Treadway, M. T., & Zald, D. H. (2011). Reconsidering anhedonia in depression: lessons from translational neuroscience. *Neuroscience and Biobehavioral Reviews*, *35*, 537-555. doi:10.1016/j.neubiorev.2010.06.006.

Vrieze, E., Demyttenaere, K., Bruffaerts, R., Hermans, D., Pizzagalli, D. A., Sienaert, P., ... & Claes, S. (2014). Dimensions in major depressive

disorder and their relevance for treatment outcome. *Journal of Affective Disorders*, *155*, 35-41.doi: 10.1016/j.jad.2013.10.020.

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin*, *134*, 163-206. doi: http://dx.doi.org/10.1037/0033-2909.134.2.163

Watkins, E. R., Mullan, E., Wingrove, J., Rimes, K., Steiner, H., Bathurst, N., ... & Scott, J. (2011). Rumination-focused cognitive-behavioural therapy for residual depression: phase II randomised controlled trial. *The British Journal of Psychiatry*, *199*(4), 317-322. doi: 10.1192/bjp.bp.110.090282.

Watson, D., & Clark, L. A. (1991). The mood and anxiety symptom questionnaire. *Unpublished manuscript, University of Iowa, Department of Psychology, Iowa City*.

Watson, D. (1988). Intraindividual and interindividual analyses of positive and negative affect: their relation to health complaints, perceived stress, and daily activities. *Journal of Personality and Social Psychology*, *54*, 1020. doi: 10.1037/00223514.54.6.1020.

Watson, D., Clark, L.A., & Tellegen, A. (1988) Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063-1070. doi: 10.1037/0022-3514.54.6.1063.

World Bank (1993) *World development report: Investing in health research development.* Geneva, Switzerland: World Bank.

World Health Organization. (1992*). ICD-10: International statistical classification of diseases and related health problems.* World Health Organization: Geneva.

Appendices

A. ESM thought probes

B. Additional questionnaire measures used but not included in analyses

C. Ethics documentation

D. Dissemination statement

E. Submission Guidelines

Appendix A: Details of Thought Probes

Thought probes (signal-contingent procedure for everyday life):

- Just as the watch beeped were you thinking about what you were doing?
- Where these thoughts about the past, present, future or nothing really?
- Are these thoughts pleasant, neutral or unpleasant? 0 (Very unpleasant) – neutral - 7 (Very pleasant)
- How X do you feel? Several mood adjectives on 7-point Likert scales ranging from 1 (not at all) to 7 (very): happy, sad, nervous, content, relaxed, upset, depressed, excited?

What are were you doing when the watch beeped?[6]

- Rest/Sleep
- Working
- Home computer
- Commuting, travelling
- Grooming, self-care
- Listening to the radio, news
- Doing housework
- Watching television
- Reading
- Relaxing, nothing special
- Taking care of your children
- Shopping, errands
- Preparing food
- Praying/worshipping/meditating
- Eating
- Walking, taking a walk
- Listening to music
- Playing
- Talking, conversation
- Exercising
- Making love
- Other

[6] **ESM Activity probes.** Participants were asked to select what they were doing either as part of the signal-contingent procedure. The activities participants could chose from were based on the daily reconstruction method taken from Killingsworth and Gilbert's (2010) study. This data were collected but not included in analyses.

Thought probes (event-contingent procedure):

Which activity best describes what you are about to right now for your positive activity?

- Rest/Sleep
- Working
- Home computer
- Commuting, travelling
- Grooming, self-care
- Listening to the radio, news
- Doing housework
- Watching television
- Reading
- Relaxing, nothing special
- Taking care of your children
- Shopping, errands
- Preparing food
- Praying/worshipping/meditating
- Eating
- Walking, taking a walk
- Listening to music
- Playing
- Talking, conversation
- Exercising
- Making love
- Other

Please set the timer to alarm in ten minutes time.

Thought probes (during positive activities):

- Just as the alarm went you thinking about what you were doing?
- Where these thoughts about the past, present, future or nothing really?
- Are these thoughts pleasant, neutral or unpleasant? 0 (Very unpleasant) – neutral - 7 (Very pleasant)
- Several mood adjectives happy, sad, nervous, content, relaxed, upset, depressed, excited were probed for participant to respond to separately. For example, how happy do you feel? Responses were rated on a 7-point Likert scales ranging from 1 (not at all) to 7 (very).
- Please return to your positive activity. Don't forget to check back in with the watch when you finish!

Thought probes (after positive activities):

To what extent were you thinking about what you were doing during the positive activity? 1 (not at all) - 7 (very much so)

- Were these thoughts generally about the past, present, future or nothing really?
- Were these thoughts generally pleasant, neutral or unpleasant? (Very unpleasant) – neutral - 7 (Very pleasant)
- How did you feel generally during the positive activity? Several mood adjectives happy, sad, nervous, content, relaxed, upset, depressed, excited were probed for participant to respond to separately. For example, how happy do you feel? Responses were rated on a 7-point Likert scales ranging from 1 (not at all) to 7 (very)

Appendix B: Other measures collected, not used in analyses.

Snaith Hamilton Pleasure Scale (SHAPS). In order to assess hedonic capacity, the 14-item SHAPS was used (Snaith, Hamilton, Morley, Humayan, Hargreaves & Trigwell, 1995). Internal consistency is estimated at .91 suggesting a valid and reliable measure (Nakonezny, Carmody, Morris, Kurian & Trivedi, 2010). Reliability was calculated from the data in this experiment and found adequate internal consistency (α = .86).

MASQ-S (Mood and Anxiety Symptom Questionnaire). This 62-item self-report instrument measures four factors that distinguish between general distress anxiety (GDA), general distress depression (GDD), anxious arousal (AA) and anhedonic depression (AD) (Watson & Clark, 1991). Subscales have good internal consistency and acceptable discriminant and convergent and validity (Watson et al., 1995).

Five Facet Mindfulness Questionnaire (FFMQ). This instrument includes five facets to make up 39 items. These include: observing (OB), describing (DE), acting with awareness (AWA), non-judging of inner experience (NJ), and non-reactivity to inner experience (NR). The FFMQ has adequate convergent and discriminant validity and reliability (Baer et al., 2006). Reliability was calculated from the data in this experiment and found good internal consistency (α = .94).

The measures were all normally distributed, apart from one outlier found in the MASQ-AA (extreme score). This participant was not excluded from analyses.

Table 4.

Table of all descriptive measures

Measure	M	SD
PHQ-9	7.20	6.14
SHAPS	3.54	3.55
MASQ GDA	22.37	8.78
MASQ AA	26.52	9.56
MASQ GDD	26.58	12.23
MASQ AD	62.78	17.14
FFMQ	115.15	22.55
FFMQ OB	24.94	5.14
FFMQ DE	25.93	7.39
FFMQ AAW	20.23	4.97
FFMQ NJ	24.61	7.81
FFMQ NR	19.84	5.16

Table 5.

Table of correlations for all within and between subjects for signal-contingent data

Between subjects	MW	PA	NA	Valence	PHQ-9	SHAPS	MASQ-AD	MASQ-AA	MASQ-GDA	MASQ-GDD	FFMQ-OB	FFMQ-DE	FFMQ-AAW	FFMQ-NJ	FFMQ-NR	FFMQ (TOTAL)	ICC
Within-subjects MW	-	-.34**	.27**	.29	.43**	.42**	.40**	.43**	.46**	.49**	-.21	-.27*	-.35**	-.25*	-.25*	-.36**	.13
Positive affect	-.20**	-	-.46**	.31*	-.55**	-.44**	-.51**	-.42**	-.52**	-51**	.26*	.45**	.28*	.371*	.29*	.46**	.29
Negative affect	.20**	-.53**	-	-28*	.63**	.49**	.53**	.52**	.63**	.62**	-.29*	-.50**	-.43**	.36**	-.25*	-.51**	.48
Valence	-	.52**	-.42**	-	-.24	-.13	-.20	-.90	-.14	-.10	-.04	.08	.17	.18	-.03	.11	.11
PHQ-9	-	-	-	-	-	.73**	.80**	.72**	.84**	.90**	-.36**	-.61**	-.48**	-.46**	.38**	-.64**	-
SHAPS	-	-	-	-	-	-	.66**	.55**	.54**	.65**	-.51**	-.59**	-.39**	-.39**	-24*	-.59**	-
MASQ-AD	-	-	-	-	-	-	-	.54**	.64**	.75**	-.51**	-.70**	-.52**	-.62**	-.47**	-.78**	-
MASQ-AA	-	-	-	-	-	-	-	-	.85**	.66**	-.10	-.45**	-.39**	-.50**	-.30*	-.50**	-
MASQ-GDA		-	-	-	-	-	-	-	-	.85**	-.20	-.52**	-.50**	-.47**	-.37**	-.57**	-
MASQ-GDD	-	-	-	-	-	-	-	-	-	-	-32**	-.53**	-.43**	-.50**	-.37**	-.59**	-
FFMQ-OB	-	-	-	-	-	-	-	-	-	-	-	.50**	.48**	.13	.52**	.66**	-
FFMQ-DE	-	-	-	-	-	-	-	-	-	-	-	-	.60*	.47**	.43**	.84**	-
FFMQ-AAW	-	-	-	-	-	-	-	-	-	-	-	-	-	.40**	.47**	.78**	-

FFMQ-NJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.40**	.70**	-
FFMQ-NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.70**	-

** Correlation significant at 0.01 level (2 tailed) * Correlation significant at 0.05 level (2 tailed)

Appendix C: Ethics

Ethics Approval System
To: Jodi Pitt
Reply-To: D.M.Salway@exeter.ac.uk
Your application for ethical approval (2015/858) has been accepted

Ethical Approval system

Your application (2015/858) entitled Investigating Mind Wandering in Depression in everyday life using Experience Sampling Methodology. has been accepted

Please visit http://www.exeter.ac.uk/staff/ethicalapproval/

Please click on the link above and select the relevant application from the list.

Psychology on line Ethics approval system - Jodi Pitt

This Application has been marked as accepted, so no further edits can be made.

DETAILS | Summary | Consent | Psychology | Groups | Animals | Track B | Attachments

Project details

® Title of Project (max 25 words)	Investigating Mind Wandering in Depression in everyday life using Experience Sampling Methodology.
® Type of Project	Staff or joint Staff/Student project
® Names of researchers	Jodi Pitt Dr. Nick Moberly Dr. Barney Dunn
® Correspondent's Email (separate with a semi-colon if providing more than one)	Jdp209@exeter.ac.uk
Estimated start date (dd/mm/yyyy) and duration of the project	02/05/2015 18 months

Research Groups

Animal Behaviour	☐
Clinical	☑
Cognition	☐
SEORG	☐

Reviewer Comments

The ethical issues seem adequately considered (as far as I can tell, clinical psychology not being my area).

Ethics submission: Lay Summary (400 words max):

A key symptom of depression is a loss of enjoyment (anhedonia). Individuals low in enjoyment are more likely to be depressed for a long time, are at high risk of depression recurring in the future, and respond poorly to current treatments. This may be in part because existing treatments neglect building enjoyment and instead focus on lowering negative thoughts and feelings. To improve the capacity to build enjoyment in treatment, we need to understand what factors get in the way of depressed individuals experiencing it and then target these factors.

The aim of the study is to see whether mind wandering (when thinking about something other than what you are doing) is associated with a loss of enjoyment (anhedonia) in depression.

Individuals recruited from the community with varying levels of depressed mood will rate their daily experiences of positive mood and mind wandering using an electronic watch 8 times a day over six days (each rating taking 2-3 minutes).

Participants will also be asked to complete three positive activities over the week (20m each) and rate their mood and mind wandering during each activity.

For both the diary and activity data, we will examine if mind wandering is related to loss of enjoyment and if this relationship is particularly strong for individuals high in depressed mood. If findings show mind wandering does relate to loss of enjoyment in depressed individuals, this would suggest it should be targeted in depression treatments.

Is there a realistic risk of any participants experiencing either physical or psychological distress or discomfort? Yes

If Yes, give details and state what you will tell them to do if they should experience any problems (e.g. who they can contact for help).

We do not think participants will experience marked distress as a result of taking part in the experiment, as it focuses on positive mood and experiences. However, the following aspects of the study could induce minor distress.

First, participants may find the diary part of the study intrusive, as the diary watch will beep at random times throughout the day. What the study involves will be made clear during the consent process. Participants will be told they can choose to delay answering a beep or to miss out that beep entirely if it is at an inconvenient time.

Second, participants may experience a transient lowering of mood when answering questions about past or present experience of depression or other related mental health conditions. If participants do experience low mood, our experience from similar studies is that this will be short lasting in nature and expected not to last beyond the initial session.

Third, we are recruiting individuals with a spread of depression scores, so some individuals may be suffering from psychological distress and/or be at risk of suicide at the point they enter the study. To manage risk, we will exclude people who are currently actively suicidal (screened using BDI-II question 9 rated at 2 or greater). We will follow the mood disorders centre risk protocol to ensure that this risk is adequately managed (including ensuring we get details of and permission to contact the participant's GP to ensure this risk is handed over to someone responsible for the participant's clinical care). To manage distress, those scoring above the clinical cut off the PHQ-9 (>10) either at first assessment will be given a document listing available sources of help (including

local IAPT services, GP, and university wellbeing service if they are a student). If participants do experience any adverse reactions or drop in mood during the study, they will be advised to contact the researcher. IF necessary a clinical assessment will be offered by the researcher (a trainee clinical psychologist), supervised by Barney Dunn (a qualified clinical psychologist).

Purpose of project and its academic rationale

Previous research by Killingsworth & Gilbert (2010) has shown that mind wandering is related to loss of everyday enjoyment in the general population. In this study, mind wandering in response to daily activities was measured using a smartphone application to initiate questions for 2250 adults to respond to at random intervals throughout their daily lives. These notifications asked questions about what they were doing, whether they were thinking about what they were doing and the nature of these thoughts e.g. pleasant, unpleasant or neutral, if not presently focused on the task in hand. Killingsworth and Gilbert (2010) found that people who were not thinking about what they were doing typically made them feel less happy.

We plan to extend this study by examining if this association between mind wandering and loss of enjoyment becomes more marked with increasing depression severity. In particular, we will explore if greater mind wandering mediates the relationship between increasing depression and reduced pleasure experience. This is to find out whether mind wandering may be a mechanism for reduced positive affect in depression. Part 1 will replicate the diary study of Killingsworth & Gilbert, additionally measuring depression severity as a moderator in the sample. Part 2 will additionally ask participants to complete 3 potentially positive activities. This is closely linked to therapy-based tasks found

in Cognitive Behavioural Therapy (CBT) such as 'activity scheduling' (planning in activities in the week that improve mood).

Should a mediation relationship be observed, this would then suggest that targeting mind wandering might be an effective way to build pleasure experience in depressed clients during treatment.

Brief description of methods and measurements:

Participants will be asked to complete some questionnaires:

(Patient Health Questionnaire (PHQ-9) (Kroenke, Spitzer & Williams, 2001) when screened for study, to assess depression severity. Item 1 includes assessment of anhedonia: “over the last two weeks, how often have you been bothered by little interest or pleasure in doing things?”

Snaith Hamilton Pleasure Scale (Snaith, Hamilton, Morley, Humayan, Hargreaves & Trigwell, 1995), to assess level of anhedonia.

Five Facet Mindfulness Questionnaire (FFMQ). (Baer, Smith, Hopkins, Krietemeyer & Toney, 2006). Investigate mindful or mind wandering traits. To see if dispositional mindfulness is negatively correlated with depressive symptoms.

MASQ-S (Mood and Anxiety Symptom Questionnaire) (Watson & Clark, 1991), To assess anhedonia and distinguish symptom from anxiety and depressive symptoms.

These questionnaires should take no more than 30 minutes to complete.

Phase 1: Participants will be loaned a diary watch from the university that they will use for a week. It contains an app/built in system that will randomly ask

participants to respond to questions about what participants are doing, how they are feeling and what they are thinking about. The watch will ask them to do this about 8 times a day throughout the day (through the hours of 8am-9pm). Questions will take no longer than 2-3 minutes to complete each time. If the time is not convenient for participants to respond participants can delay a signal for a later time and can temporarily turn off the beep. Questions will ask participants to describe what they are currently doing (selecting from a variety of list box options), rate their mood using a short form of the circumplex of affect (Posner, 2005) to measure trait positive and negative affect, then answer questions about if and how their mind is wandering.

Phase 2: Participants will also schedule, under the guidance of the experimenter, 3 potentially positive activities (each lasting 20 minutes) at a time of their choosing. Participants will rate their mood 10 minutes during and at the end using the short form of the circumplex of affect (Posner, 2005) (identical to questions used in the diary component of the study).

Participants will then return the watch to the University of Exeter and receive a debrief from taking part in the study. Participants will be asked to complete a qualitative questionnaire, using open questions to describe about what they noticed about their experience of mind wandering, mood and enjoyment in activities.

Participants

1. Human research
    - Recruitment methods
    - number
    - age
    - gender
    - exclusion/inclusion criteria

An opportunity sample utilising participants (approximately 68) with a continuum of levels of depression severity (on the PHQ-9) will be invited to take part in the study

Inclusion criteria for the study are:

• Participants must be native English speakers, given that the procedures can only be explained in English.

• Participants must be able to use a diary watch e.g. answering questions via an application/watch about what they are thinking about, how they feel and what they are doing.

• Participants must be able to take part in both phase 1 & 2 of the study and agree to be signalled randomly for 6 days.

Exclusion criteria. Exclusion criteria for the study are:

• Participants must not currently be at high risk of suicide ideation as indicated by the BDI-II item 9. I would follow the MDC risk protocol if risk were identified.

A community sample will be sought within the Devon area through posters and social media advertising of the study. Different posters will be used to recruit individuals high and low in depression symptoms to ensure we get a good spread of depression scores. All participants will be offered £5 for their participation.

Consent and participant information arrangements, debriefing. (Not relevant for animal research) Please attach intended information and consent forms.

Participants will provide written informed consent forms before partaking in the study. The initial session and final debriefing will be conducted in a comfortable,

suitable, confidential room at the University of Exeter. Please see attached information sheets, consent forms and debriefing forms.

Participants will be provided with an information sheet prior to meeting the researcher at the university to provide informed consent. Participants will be advised they can withdraw from the study at any time and for whatever reason. If they do decide to withdraw during the study, we will ask them if they wish us to destroy data that has already been collected or if we can use this in ongoing analyses.

A clear but concise statement of the ethical considerations raised by the project and how you intend to deal with them:

See earlier response to question “Is there a realistic risk of any participants experiencing either physical or psychological distress or discomfort? If Yes, give details and state what you will tell them to do if they should experience any problems (e.g. who they can contact for help)” for possible ethical issues and our plan for managing them if they arise. Please note, to ensure we identified and dealt with ethical issues linked to the study, we consulted the Lived Experience Group at the Mood Disorders Centre during the design phase (one hour meeting with service user, Nigel Reed). LEG feedback was that the study design seemed appropriate and raised no significant concerns. Our risk and mood management plan was deemed satisfactory.

Patient Information Sheet: Investigating Mind Wandering in Depression in everyday life using Experience Sampling Methodology.

Researchers: Jodi Pitt, Trainee Clinical Psychologist, Dr Barney Dunn & Dr Nick Moberly

Please read the information below to decide if you would like to take part in the study

What is the aim of the study?

This study will examine whether the tendency for the mind to wander away from the moment changes positive emotion experience during everyday pleasant activities and how this varies with depression symptoms. This may have clinical implications for the treatment of depression, helping us decide if training individuals to control mind wandering could help build their positive mood.

What is involved?

Participating in this study will require you to attend a short training session at the Washington Singer Laboratories at the University of Exeter, at a time convenient for you. This training session will last no more than 45 minutes and you will be asked to fill in some questionnaires regarding past and present mental health conditions, specific personality characteristics, and thinking style. You will also be trained how to use an electronic watch to rate your mood experience and mind wandering over the coming week.

We will then loan you the watch and ask you to rate your mood over the following week. The watch will ask you to do this by beeping at 8 random times a day throughout the day (typically through the hours of 8am-9pm, however these can be adjusted according to your preference) for the next six days.

Questions will take no longer than 2-3 minutes to complete each time. If the time is not convenient for you to respond you can chose not to respond to the signal. You may also turn the beep off at times when it would be inconvenient.

We will also ask you to schedule three pleasurable activities during that week (lasting 20 minutes each) and to rate your mood and mind wandering before, during and after each activity.

At the end of the week we will ask you to return the watch to us and we will then debrief you about the experiment.

Potential Risks and Ethical Considerations:

There are no significant risks associated with this study. However, you may experience a transient low mood when answering questions about past or present experience of depression or other related mental health conditions. If you do experience low mood, this will be short lasting in nature and not last beyond the initial session. If you do experience any upset or anxiety during the experiment, you are free to withdraw at any time and we will offer you a full debrief meeting with a clinical psychologist on our team.

You may also at times experience the beeps from the diary watch (8 times over 6 days) as burdensome.

You can choose not to respond to the signal at any time, and you can withdraw from the study at any time if it gets too much

Remuneration:

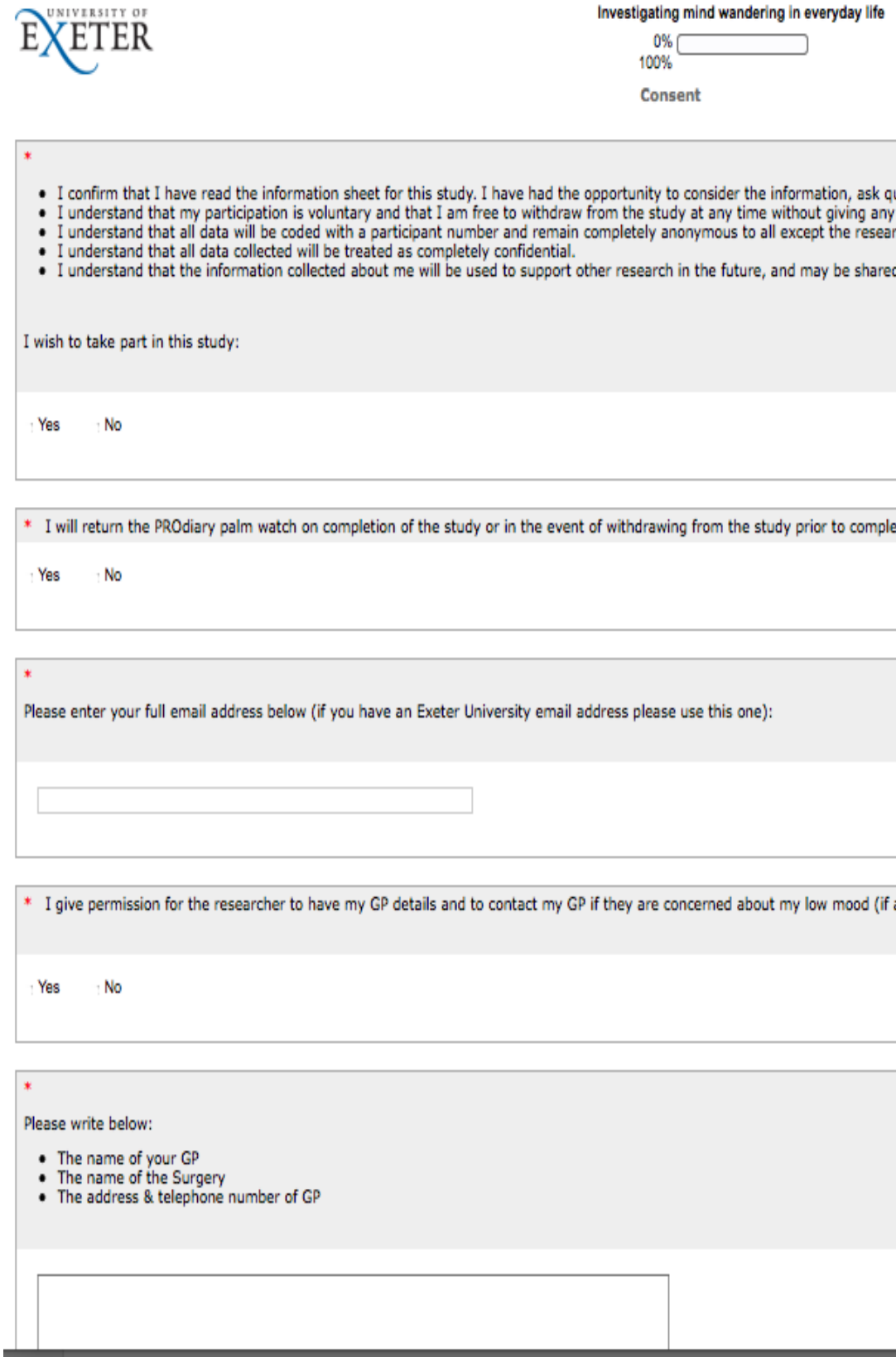
Participation will be remunerated with a single payment of £5, or 2 course credits if you are a University of Exeter student, once the diary watch is returned at the second lab session.

Confidentiality and withdrawal

This study has received ethical approval from the Ethics Committee of the University of Exeter. The data we collect will be strictly confidential. Only the investigator and supervisors will have access to the data. Results from the study will be written up as part of a DClinPsy Project. Results will be presented in such a way that individual data will not be identifiable. You are free to decide not to take part in the study and can withdraw from the study at any time and for whatever reason. If you do decide not to take part or to withdraw you do not need to explain your reasons if you do not want to, and you can still receive the £5 remuneration or 2 course credits. We will ask you to return the watch if you decide to withdraw.

If you would like any further information about the project please contact the investigator: jdp209@exeter.ac.uk

Electronic Consent Form:



UNIVERSITY OF EXETER

Investigating mind wandering in everyday life

0% 100%

Consent

*

- I confirm that I have read the information sheet for this study. I have had the opportunity to consider the information, ask questions and have had these answe
- I understand that my participation is voluntary and that I am free to withdraw from the study at any time without giving any reason.
- I understand that all data will be coded with a participant number and remain completely anonymous to all except the research team for this study.
- I understand that all data collected will be treated as completely confidential.
- I understand that the information collected about me will be used to support other research in the future, and may be shared anonymously with other researche

I wish to take part in this study:

Yes No

* I will return the PROdiary palm watch on completion of the study or in the event of withdrawing from the study prior to completion.

Yes No

*

Please enter your full email address below (if you have an Exeter University email address please use this one):

* I give permission for the researcher to have my GP details and to contact my GP if they are concerned about my low mood (if applicable).

Yes No

*

Please write below:

- The name of your GP
- The name of the Surgery
- The address & telephone number of GP

Appendix E: Dissemination statement

The results of this study will be disseminated to interested parties through feedback, journal publication and presentation.

Dissemination to participants and NHS services.

As stated on the participant information sheet participants will be informed of the results of the study. Participants will be provided with details of who to contact, should they require further information.

Journal Publication

It is expected that the study will be submitted for publication with Emotion.

Presentation

On 8th August 2016, my research findings were presented to an academic audience, for peer review, as part of the Doctorate in Clinical Psychology at the University of Exeter.

Appendix F: Preparation and Submission Requirements for Target Journal

Emotion

Scope of the Journal

Emotion ® publishes significant contributions to the study of emotion from a wide range of theoretical traditions and research domains. The journal includes articles that advance knowledge and theory about all aspects of emotional processes, including reports of substantial empirical studies, scholarly reviews, and major theoretical articles.

Submissions from all domains of emotion research are encouraged, including studies focusing on cultural, social, temperament and personality, cognitive, developmental, health, or biological variables that affect or are affected by emotional functioning. Both laboratory and field studies are appropriate for the journal, as are neuroimaging studies of emotional processes. Studies of psychopathology contributing to the understanding of the role of emotional processes in affective and behavioral disorders are also welcome. Reports of work at the animal and molecular levels will be considered if they help to elucidate fundamental mechanisms of emotion.

Submitting manuscripts

Submit manuscripts electronically through the Manuscript Submission Portal in Word Document format (.doc). All tables and figures should be included in the manuscript file. David DeSteno , Northeastern University, Boston, MA 02115, General correspondence may be directed to the Editor's Office.

Masked Review Policy

Masked reviews are optional, and authors who wish masked reviews must specifically request them when they submit their manuscripts.For masked reviews, the manuscript must include a separate title page with the authors' names and affiliations, and these ought not to appear anywhere else in the manuscript. Footnotes that identify the authors must be typed on a separate page. Authors are to make every effort to see that the manuscript itself contains no clues to their identities. If your manuscript was mask reviewed, please ensure that the final version for production includes a byline and full author note for typesetting.

Manuscript Submission Guideline

In addition to addresses and phone numbers, authors should supply email addresses and fax numbers for use by the editorial office and later by the production office. The majority of correspondence between the editorial office and authors is handled by email, so a valid email address is important to the timely flow of communication during the editorial process. Authors should provide email addresses in their cover letters and should keep a copy of the manuscript to guard against loss. Manuscripts are not returned. Manuscripts for *Emotion*® can vary in length; typically they will range from 10 to 40 double-spaced manuscript pages. Manuscripts should be of sufficient length to ensure theoretical and methodological competence.

Most of the articles published in *Emotion* will be reports of original research, but other types of articles are acceptable.Case studies from either a clinical setting or a laboratory will be considered if they raise or illustrate important questions that go beyond the single case and have heuristic value. Articles that present or discuss theoretical formulations of emotion and related affective phenomena

that evaluate competing theoretical perspectives, or that offer innovative commentary or analysis on timely topics of inquiry may also be accepted. Comprehensive reviews of the empirical literature in an area of study are acceptable if they contain a meta-analysis and/or present novel theoretical or methodological perspectives. Comments on articles published in the journal will be considered. To facilitate a more complete understanding of the reported results, submissions based on empirical findings must report effect sizes and 95% confidence intervals for the primary findings in each study.

Manuscript Preparation

Prepare manuscripts according to the *Publication Manual of the American Psychological Association* (6th edition). Manuscripts may be copyedited for bias-free language (see Chapter 3 of the *Publication Manual*). Review APA's Checklist for Manuscript Submission before submitting your article. Double-space all copy. Other formatting instructions, as well as instructions on preparing tables, figures, references, metrics, and abstracts, appear in the *Manual*. Additional guidance on APA Style is available on the APA Style website. Below are additional instructions regarding the preparation of display equations, computer code, and tables.

Tables

Use Word's Insert Table function when you create tables. Using spaces or tabs in your table will create problems when the table is typeset and may result in errors.

Submitting Supplemental Materials

APA can place supplemental materials online, available via the published article in the PsycARTICLES® database. Please see Supplementing Your Article With Online Material for more details.

Abstract and Keywords

All manuscripts must include an abstract containing a maximum of 250 words typed on a separate page. After the abstract, please supply up to five keywords or brief phrases.

References

List references in alphabetical order. Each listed reference should be cited in text, and each text citation should be listed in the References section.

Figures

Graphics files are welcome if supplied as Tiff or EPS files. Multipanel figures (i.e., figures with parts labeled a, b, c, d, etc.) should be assembled into one file. The minimum line weight for line art is 0.5 point for optimal printing.

For more information about acceptable resolutions, fonts, sizing, and other figure issues, please see the general guidelines. When possible, please place symbol legends below the figure instead of to the side. APA offers authors the option to publish their figures online in color without the costs associated with print publication of color figures.

The same caption will appear on both the online (color) and print (black and white) versions. To ensure that the figure can be understood in both formats, authors should add alternative wording (e.g., "the red (dark gray) bars represent") as needed.

Permissions

Authors of accepted papers must obtain and provide to the editor on final acceptance all necessary permissions to reproduce in print and electronic form any copyrighted work, including test materials (or portions thereof), photographs, and other graphic images (including those used as stimuli in experiments).On advice of counsel, APA may decline to publish any image whose copyright status is unknown.

Publication Policies

APA policy prohibits an author from submitting the same manuscript for concurrent consideration by two or more publications. APA requires authors to reveal any possible conflict of interest in the conduct and reporting of research (e.g., financial interests in a test or procedure, funding by pharmaceutical companies for drug research). In light of changing patterns of scientific knowledge dissemination, APA requires authors to provide information on prior dissemination of the data and narrative interpretations of the data/research appearing in the manuscript (e.g., if some or all were presented at a conference or meeting, posted on a listserv, shared on a website, including academic social networks like ResearchGate, etc.). This information (2–4 sentences) must be provided as part of the Author Note. Authors of accepted manuscripts are required to transfer the copyright to APA.

Ethical Principles

It is a violation of APA Ethical Principles to publish "as original data, data that have been previously published" (Standard 8.13). In addition, APA Ethical Principles specify that "after research results are published, psychologists do

not withhold the data on which their conclusions are based from other competent professionals who seek to verify the substantive claims through reanalysis and who intend to use such data only for that purpose, provided that the confidentiality of the participants can be protected and unless legal rights concerning proprietary data preclude their release" (Standard 8.14). APA expects authors to adhere to these standards. Specifically, APA expects authors to have their data available throughout the editorial review process and for at least 5 years after the date of publication. Authors are required to state in writing that they have complied with APA ethical standards in the treatment of their sample, human or animal, or to describe the details of treatment. The APA Ethics Office provides the full Ethical Principles of Psychologists and Code of Conduct electronically on its website in HTML, PDF, and Word format. You may also request a copy by emailing or calling the APA Ethics Office (202-336-5930). You may also read "Ethical Principles," December 1992, *American Psychologist*, Vol. 47, pp. 1597–1611.