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Decoupling as a mechanism of change in mindfulness and acceptance: A literature review

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Highlights

- Reviewed decoupling effects between internal experiences and/or overt behavior
- 44 studies tested mindfulness and acceptance decoupling effects
- Preliminary evidence for decoupling found in a broad range of problem areas
- Strongest evidence for decoupling effects found with substance use
- Further replication and exploration is needed to test decoupling hypotheses

Abstract

A growing body of research within the acceptance and mindfulness-based therapies suggests these treatments may function in part by reducing or eliminating (i.e., decoupling) the normative relationships between internal experiences and other internal/overt behavior. Examples of decoupling effects found in this review include reduced relationships between urges to smoke and smoking behavior, between dysphoric mood and depressive cognitions, and between pain intensity and persistence in a painful task. A literature review identified 44 studies on acceptance and mindfulness that demonstrated decoupling effects. Overall, preliminary evidence for decoupling effects were found across a broad range of problem areas including substance abuse, depression, eating disorders, overeating, chronic pain, anxiety, relationships, anger, avoidance behavior, and self-harm, with the strongest evidence currently available in the area of substance abuse. However, the review also notes a general lack of replication studies on decoupling effects and the need for more well powered and controlled research testing specific decoupling hypotheses.

Keywords: Mindfulness; Acceptance; Acceptance and Commitment Therapy; Mechanisms of change; Decoupling

Decoupling as a mechanism of change in mindfulness and acceptance: A literature review

Research on the efficacy of acceptance and mindfulness-based therapies (AMT) has grown rapidly over the past decade (Hayes, Villatte et al., 2011; Khoury et al., 2013). With this growth in outcome research comes a need for a more refined empirical examination of mechanisms of change for these treatments. Such an understanding is key for furthering progress in treatment development such as in guiding improvements to the efficiency and efficacy of AMTs, applications to new clinical problems, and innovations in treatment technologies.

AMTs target a variety of related therapeutic processes focused on how one relates to experiences (e.g., nonjudgmentally, nonreactively, observing, describing, acceptance, defusing/decentering from thoughts). Acceptance and mindfulness themselves are highly overlapping and in some cases acceptance may be conceptualized as a facet of mindfulness or as a distinct therapeutic process (Hayes, Strosahl & Wilson, 2012). Common to the AMT approaches is a focus on the use of experiential methods to change the function of one's internal experiences (i.e., how one relates to thoughts and feelings) so as to achieve a compassionate and decentered awareness of these experiences without giving them undue influence over one's behavior (Hayes, Villatte et al., 2011). In other words, AMTs seek to change how one *relates* to internal experiences, rather than reducing their form or frequency per se. Much of the existing mechanisms of change research has examined this in terms of testing whether changes in mindfulness and acceptance self-report measures (i.e., whether individuals report relating to experiences in a more accepting, mindful way) predict and mediate treatment outcomes (Hayes, Villatte et al., 2011; Khoury et al., 2013).

Another means of testing whether AMTs alter the function of internal experiences is to examine if AMTs eliminate/change the existing behavioral relations between internal

experiences and other behaviors, which we refer to in this paper as “decoupling” (a term first referenced in Ostafin & Marlatt, 2008 and sometimes referred to as “desynchrony” Hayes et al., 2011). Decoupling is a process by which the normative relationships between an internal experience and another internal experience (e.g., between thoughts and feelings or between feelings and urges) or between an internal experience and overt behavior (e.g., negative affect and smoking) are reduced, eliminated, or altered through changes in the context in which they occur. Examples include reduced relationships between urges to smoke and smoking behavior (e.g., Elwafi et al., 2013), between dysphoric mood and depressive cognitions (e.g., Gilbert et al., 2009), or between pain intensity and persistence in a painful task (e.g., Gutiérrez et al., 2004). These decoupling effects directly demonstrate how AMTs alter the functional relations between internal experiences and other behavioral targets.

Contextual behavioral science, an approach to science grounded in behaviorism and functional contextual philosophy (Hayes et al., 2012), provides a model for further understanding decoupling effects and their role in behavior change. From this perspective, internal experiences such as thoughts, feelings, images, or urges are seen as part of an ongoing stream of behavior. These internal experiences may influence subsequent behaviors by functioning as eliciting stimuli or establishing operations. However, the function of internal experiences observed in any given instance depends upon the context (i.e., presently available cues as well as a learning history tied to those cues). Thus, the effect of internal experiences on overt behavior is not fixed (e.g., being dissatisfied with your body does not always lead to compensatory/restrictive eating behaviors), but rather is governed by context (e.g., whether body image dissatisfaction leads to restricting or more healthy eating behaviors depends on the current and historical context in which it occur; e.g., Ferreria et al., 2011).

Despite the potential for differing relations between internal experiences and overt behavior, a breadth of research has shown how internal experiences and overt behavior tend to co-vary in predictable ways (e.g., Ekman, 1999; Glasman & Albarracin, 2006; Hosking et al., 2009). This may be due common functions of internal experiences and the contexts in which they occur. For example, verbal behavior typically occurs in a literal context in which thoughts are responded to as accurate representations of reality and guides for actions, thus affecting behavior by transforming the function of stimuli in one's environment (Hayes, Barnes-Holmes & Roche, 2001). In the area of rule-governed behavior, people typically have a rich history and repertoire around behavior under the control of verbal rules (Hayes, 1989). Similarly, emotions can function as establishing operations for certain behaviors such as increased probability of escape and avoidance when feeling anxious (Friman, Hayes & Wilson, 1998).

Consistent behavioral relations such as those outlined above have naturally led some therapeutic approaches to emphasize trying to change internal experiences (e.g., targeting thoughts through cognitive restructuring) in order to influence downstream behaviors (e.g., emotions, overt behavior). For example, the focus on cognitive change strategies in cognitive therapy (CT) can be understood from the assumption that “The core model of CT holds that cognitions causally influence emotions and behaviors” (Hofmann, Asmundson & Beck, 2013).

Recognizing that these relations are governed by context can highlight an alternative method for targeting behavioral relations and systems. Novel learning situations can be used to establish new contexts that change the functions of internal experiences and how they influence other behaviors, without necessarily altering their form. For example, aversive emotions that typically function to elicit avoidance behavior may no longer do so after particular learning experiences have occurred (e.g., establishing an accepting, nonreactive context; Wogast et al.,

2011). This paper posits that training in acceptance and mindfulness processes results in such a decoupling between internal experience and subsequent internal/overt behaviors.

The most direct demonstration of decoupling effects come from laboratory-based experiments and treatment outcome studies in which AMT interventions reduce or eliminate the relationship between internal experiences and internal/overt behavior (e.g., urges to smoke are no longer predictive of smoking behavior after a mindfulness intervention; e.g., Elwafi et al., 2013). Decoupling can also be observed in assessment-only studies, capturing naturally varying levels of acceptance and mindfulness, in which self-reported mindfulness or acceptance moderates the relationship between internal experiences and other behaviors (e.g., the relationship of implicit attitudes to alcohol use being moderated by mindfulness; e.g., Ostafin & Marlatt, 2008).

We are not aware of any reviews to date that have been conducted on decoupling effects across the range of psychological problems to which AMTs have been applied. In order to summarize the current research and highlight areas for future research, this article will review the available literature indicating decoupling effects with acceptance and mindfulness processes.

METHODS

Articles were identified through searches conducted on PsycInfo and MedLine using the keyword term “Mindfulness” in pairwise combination with (“AND”) “Moderation” or “Interaction” or “Decoupling” as well as the term “Acceptance-based” in pairwise combination with (“AND”) “Moderation”, “Interaction” or “Decoupling.” Given that there is not a common terminology used in the literature for “decoupling effects” (also referred to as “desynchrony effects” or simply reported as moderation/interaction analyses), additional methods were used to identify potentially eligible articles. Database searches were conducted using the terms “Acceptance-based”, “Mindfulness”, “Acceptance and Action Questionnaire” and “Acceptance

and Commitment Therapy.” A comprehensive list of AMT laboratory studies (Levin et al., 2012) was reviewed for potentially relevant studies. Reference lists from identified articles were then reviewed for additional eligible studies. In addition, each article that cited a decoupling study was examined for eligibility. Searches were conducted up to January 2nd 2015. In total, 139 potentially eligible articles were identified testing a possible decoupling effect.

Eligibility criteria for this review included a) the study was published in a peer-reviewed journal, b) the study tested a decoupling effect using a valid method as defined by this review (i.e., studies were included that tested a decoupling effect, whether or not it was found to be statistically significant), c) decoupling effects were tested in relation to acceptance and/or mindfulness processes (either as an intervention/experimental manipulation or natural variations measured by self-report) and d) decoupled behaviors were of some applied relevance to psychological treatments (e.g., psychological disorders, problem behaviors, psychosocial functioning). AMTs included any treatment that primarily focuses on acceptance and mindfulness methods including mindfulness meditation practices, mindfulness-based therapies (e.g., Mindfulness-Based Stress Reduction [MBSR], Mindfulness-Based Cognitive Therapy [MBCT], Mindfulness-Based Relapse Prevention [MBRP]), and Acceptance and Commitment Therapy (ACT). Methodologies considered valid tests of decoupling effects included a) assessment-only studies testing whether self-reported acceptance/mindfulness moderates relations between internal experiences and behaviors, and b) treatment outcome or laboratory-based intervention studies testing whether AMTs weakened/eliminated normative relations between internal experiences and behaviors either relative to baseline or compared to a control condition. Only these two methods for testing decoupling effects were included in order to

clarify the scope of studies included in the review and to avoid methods that may be more susceptible to error.

Studies were primarily excluded as not testing a decoupling effect for five reasons. First, studies testing AMT effects on how individuals respond to external stressors/triggers in the environment were not considered decoupling effects. These effects represent a broader, distinct phenomenon that can occur through a variety of mechanisms without necessarily altering normative behavioral relations, including through direct reductions in negative thoughts and emotions. For example, although decreased depression from life stressors could be due to changes in the function of internal reactions to stressors (i.e., decoupling), they could also represent changes in attributions made about stressors, decreased negative affect, or similar processes in which internal experiences are altered. Second, studies that tested variables which did not have a clearly direct, normative relationship were excluded as these are more representative of a moderation effect in which only certain subgroups demonstrate an expected relation (e.g., alcohol use and sexual aggression; Gallagher et al., 2010). Third, studies were excluded that included measures of constructs other than specific internal experiences or behaviors, such as sensory processing sensitivity or the behavioral inhibition system. Lastly, treatment outcome studies were excluded that only demonstrated decoupling as defined by a pattern of uneven effects in which internal experiences do not change, but other clinical/behavioral outcomes do improve (e.g., behavioral functioning improves, but pain intensity does not, Wicksell et al., 2008, or rehospitalization rates improve, but frequency and distress from psychotic symptoms do not, Bach & Hayes, 2002). Although such studies are sometimes included in discussions of decoupling effects (e.g., Hayes, Villatte et al., 2011), they

are particularly susceptible to alternative methodological explanations (e.g., lack of statistical power, measurement issues) and so were excluded for the purposes of this review.

Each of the 139 potentially eligible articles were reviewed by the first author (MEL) to identify whether any decoupling effects from acceptance and mindfulness were reported; articles that did not clearly fit the eligibility criteria as well as all those articles deemed eligible were reviewed by the other authors. Of the 139 potential articles, 101 were excluded from the review with the most common reason being that the observed effect referred to responses to an external stressor/stimulus ($n = 46$). Overall, the review identified 38 eligible research articles reporting a total of 44 studies

RESULTS

A summary of included studies is provided in Tables 1 and 2 and described in the following sections by problem area. The review identified 16 studies testing direct decoupling effects from lab/outcome AMT interventions and 28 studies testing decoupling effects from assessment-only designs. In terms of decoupling findings, 41 of 44 studies found a decoupling effect, with 3 of 44 studies finding no support for a decoupling effect. Of the 41 studies demonstrating a decoupling effect, 8 did not find decoupling effects with all of the AMT measures/subscales or tests conducted while the other 33 found a decoupling effect with *all* of the reported decoupling tests conducted.

Decoupling effects were found across a range of AMT measures and interventions. Assessment-only decoupling effects were found for measures of emotion differentiation (8 studies), acceptance as measured by versions of the Acceptance and Action Questionnaire (AAQ; 7 studies), awareness of the present as measured by the Mindful Attention and Awareness Scale (MAAS; 5 studies) and various facets of mindfulness as measured by versions of the Five

Facet Mindfulness Questionnaire (FFMQ; 5 studies). Intervention decoupling effects were found for acceptance-based interventions (4 studies), mindful breathing/meditation interventions (3 studies), mindfulness of reactions during lab tasks (3 studies), MBCT (2 studies), MBRP (2 studies), urge surfing (1 study), and body scan mindfulness (1 study).

Decoupling effects with substance abuse problems

Decoupling effects with AMTs have been most heavily researched within the substance abuse field. Well demonstrated normative relations have been found between internal experiences, including implicit alcohol-related attitudes, negative affect, and cravings; and subsequent drug/alcohol use (Baker et al., 2004; Stacy & Wiers, 2010). A number of studies have demonstrated that mindfulness and acceptance may decrease these normative associations.

Implicit attitudes and alcohol use. Implicit alcohol attitudes can be conceptualized as relatively automatic, difficult to control and sometimes unconscious beliefs or associations with alcohol. Theoretically, AMTs may help individuals to notice implicit alcohol-related attitudes in a nonreactive and nonjudgmental way that supports effective responding and a decreased likelihood of harmful drinking. This theory has recently been tested through a series of studies by Ostafin and colleagues (Ostafin & Marlatt, 2008; Ostafin et al, 2012; 2013).

The first study (Ostafin & Marlatt, 2008) used a cross-sectional, assessment-only design with a sample of 50 college student drinkers who completed an implicit attitudes test (IAT) focused on implicit alcohol attitudes (approach or avoid alcohol), a self-report measure of mindfulness, the Kentucky Inventory of Mindfulness Scale (KIMS), and self-reported hazardous drinking. The non-judgment of emotions subscale from the KIMS moderated the relationship between implicit alcohol motivation such that implicit alcohol motivation was only related to hazardous drinking among those who were less mindful and accepting (i.e., more judgmental). In

other words, the normative relation between alcohol approach associations and hazardous drinking only occurred for drinkers low in mindfulness. However, other KIMS subscales (acting with awareness, observing and describing) were not significant moderators, indicating a decoupling effect only with the nonjudgmental subscale.

A second cross-sectional, assessment-only study further examined whether self-reported mindfulness moderated the relationship between a different set of implicit alcohol attitudes (positive or negative valence) and difficulty disengaging from alcohol-related thoughts in a sample of 61 college students (Ostafin et al., 2013). Mindfulness was assessed with the Five Facet Mindfulness Questionnaire (FFMQ) with analyses conducted using a total score as well as specific subscales. Significant moderation effects were found with the FFMQ total score as well as the FFMQ nonjudgmental subscale. Greater alcohol-positive implicit associations were related to greater preoccupation with alcohol-related thoughts only among those who were low in total mindfulness or more judgmental.

A more direct test of decoupling is provided by experimental designs that manipulate mindfulness directly. Thus far, only one published study has examined whether mindfulness training decouples implicit approach associations and heavy drinking (Ostafin et al., 2012). A sample of 41 college student drinkers first completed an IAT assessment of implicit attitudes (approach or avoid alcohol). Participants were then randomized to complete three sessions of recorded mindfulness meditation exercises (including breathing mindfulness, mindfulness of various experiences, mindfulness of a difficult situation) or an attention control condition (readings from a textbook) over the week. Finally, participants reported their alcohol consumption over the week following the baseline assessment. Results indicated an interaction

effect with condition such that baseline implicit alcohol motivation was related to heavy drinking at post in the control condition, but not in the mindfulness condition.

Together, these studies suggest that being more mindful and nonjudgmental of experiences decouples the normative relationships of implicit alcohol attitudes with both hazardous drinking and preoccupation with alcohol. In other words, individuals who are more mindful and accepting are less likely to drink or be preoccupied in thinking about alcohol in response to automatic positive/approach associations with alcohol.

Negative affect, urges, and substance use. Mindfulness may also decouple the strong interrelationships between negative affect and substance use as well as between urges to use substances and substance use. Urges to use in response to negative affect may reflect an unwillingness to experience negative affect and increases the likelihood of using substances to avoid or escape contact with negative affect. This unwillingness to experience negative affect is directly targeted in AMTs (Hayes, Villatte et al., 2011).

A laboratory-based study tested the effects of a brief mindfulness technique (urge surfing) in a sample of 123 undergraduate smokers who wanted to reduce/quit smoking (Bowen & Marlatt, 2009). Prior to completing a smoking cue exposure, participants were randomized either to receive instructions for how to respond to the cue exposure with a mindful urge surfing technique or to a no instruction condition. A follow up assessment of smoking was conducted 7 days later. While participants in the mindfulness condition showed greater reductions in smoking during the 7-day follow up compared to the control condition, there were no between group differences in intensity of urges to smoke or negative affect at any time point. Furthermore, intervention condition moderated the relationship between negative affect and urges to smoke at follow up, such that negative affect was less related to urges in the mindfulness condition relative

to the control group. Overall, these results suggest that mindfulness decouples the normative relationship between internal experiences (i.e., negative affect & urges) and smoking behavior such that people are more likely to stop smoking despite negative affect and urges. In addition, mindfulness may decouple the typical relationship between negative affect and subsequent urges to smoke, suggesting it helps reduce the desire to smoke to escape aversive emotions.

Findings from a mindfulness-based clinical trial provide further evidence for a decoupling effect. A randomized trial compared MBRP to treatment as usual (TAU) with a sample of 168 clients with substance use disorders (Witkiewitz & Bowen, 2010). Intervention condition moderated the relationship between depression severity at post treatment and cravings to use alcohol/drugs at 2-month follow up, such that this relationship was weaker among those in MBRP (i.e., depression was less strongly related to cravings to use). Post treatment depression was also less strongly related to substance use at follow up in the MBRP condition relative to TAU. In addition, there was a significant moderated mediation effect such that craving partially mediated the relationship of depression to substance use frequency in the TAU condition, but did not in the MBRP condition. This series of analyses suggest that MBRP decouples the normative and mediational relationships between depression, craving, and substance use.

Analyses of the mindfulness intervention arm of another clinical trial for smoking cessation also indicated a decoupling effect between cravings and smoking (Elwafi et al., 2013). The 33 smokers who completed an eight-session mindfulness treatment (adapted from MBRP) demonstrated the normative correlation between cravings and smoking frequency at baseline, but the correlation was no longer present at the post treatment assessment. Additional analyses indicated that there were no differences in craving scores at post between participants who were successful in quitting and those who continued to smoke, although differences did begin to

emerge at follow up time points. Furthermore, the frequency of informal meditation practice during the intervention period moderated the relationship between cravings and smoking frequency at post, such that there was a weaker relationship between these internal experiences among those who practiced more (although this moderation effect was not found with frequency of formal meditation practice). Thus, a mindfulness-based therapy was again found to decouple the relationship between craving and smoking frequency, with preliminary evidence suggesting this decoupling effect may be due to engagement in certain mindfulness practices.

Another study examined whether self-reported acceptance decouples the relationship between internal distress and smoking abstinence within smoking cessation treatment (Minami et al., in press). A RCT was conducted with 40 smokers assigned to standard behavioral therapy for smoking or a distress tolerance focused treatment targeting acceptance (note the intent to treat sample was 49, but acceptance data was missing for 9 participants). The day before the smoking quit date (approximately four weeks into therapy) participants completed self-report measures of acceptance: the Acceptance and Action Questionnaire (AAQ; a general measure of experiential avoidance/acceptance) and the Avoidance and Inflexibility Scale (AIS; a measure of experiential avoidance/acceptance specific to smoking). Internal distress and smoking abstinence were measured at multiple time points post quit date. Results indicated that the smoking-specific measure of acceptance (AIS) moderated the relationship between internal distress measures (depression, negative affect, and physical symptoms of withdrawal) and smoking abstinence up to 6 months post quit date. Each of these interaction effects were such that internal distress was only related to smoking relapse among those low in acceptance. However, the AIS did not moderate the relationship between craving and smoking abstinence and the general measure of acceptance (AAQ) was not a significant moderator. Analyses with or without treatment condition

as a variable did not affect these findings suggesting a more general decoupling process from acceptance across treatment conditions. Overall these findings suggest that acceptance decouples relations between internal distress and smoking relapse among those in treatment.

Preliminary research suggests AMTs might decouple the relation between PTSD and cannabis use disorders more specifically. A cross-sectional, assessment-only study examined whether self-reported acceptance moderated the relationship between PTSD symptoms and cannabis dependence (Bordieri et al., 2014). A sample of 123 patients in a residential substance abuse treatment program with at least some PTSD symptoms completed self-report measures of acceptance (AAQ) and PTSD symptom severity as well as a structured interview diagnosing the presence of cannabis dependence. Analyses indicated that acceptance moderated the relationship between PTSD symptoms and cannabis dependence such that PTSD symptoms were related to current dependence only among those low in acceptance.

Overall, a series of assessment, laboratory and treatment studies have consistently found that AMT processes decouple relations between negative affect, urges to use substances, and substance use behavior. With a total of 6 such studies, this represents the most replicated set of findings for decoupling effects identified in this literature review.

Weight-related concerns, negative affect and smoking. Two related studies have examined smoking-related decoupling more specifically in the context of weight-related concerns (Adams et al., 2014; 2013). A cross-sectional, assessment-only study of 112 female college student smokers found that three specific facets of mindfulness as measured by the FFMQ (acting with awareness, nonreactivity and describing) each moderated the relationship between weight-related smoking concerns (i.e., attitudes and preferences towards managing weight and body dissatisfaction through smoking) and smoking frequency (Adams et al., 2014).

Women who were low or average on mindfulness tended to smoke more if they reported greater weight-related smoking concerns, but women who were high in mindfulness did not have any relationship between weight-related smoking concerns and smoking frequency.

A second laboratory-based study further examined decoupling effects with college female smokers in the context of a body image challenge (Adams et al., 2013). Using a 2x2 design, 65 students were randomized to one of two exercises, either a body image challenge (putting on a swimsuit in front of a mirror) or a neutral condition (viewing a purse), as well as one of two coping conditions, either a mindfulness intervention (mindful breathing) prior to and during the exercise (mindfulness while engaging in lab task) or no instruction. Results indicated that mindfulness prevented an increase in body image dissatisfaction or negative affect in response to the body image challenge relative to the no instruction condition. Furthermore, mindfulness reduced the normative relationship between negative affect and urges to smoke to regulate negative affect, which was found in the no instruction condition. Mindfulness also eliminated the relationship between urges to smoke and smoking behavior following the body image challenge (i.e., whether they accepted a cigarette offered by an experimenter), which was also found in the no instruction condition. Overall, these results provide further support for the theory that mindfulness decouples the relationships between negative affect and urges as well as between urges to smoke and smoking behavior.

Summary. Overall these studies suggest that acceptance and mindfulness can decouple the normative relationships between internal experiences (i.e., implicit cognitions, cravings, negative affect, weight-related concerns) and substance use behavior. Several studies also demonstrated decoupling between negative affect and cravings, further suggesting AMTs may

change how individuals relate to aversive emotions such that they no longer respond by wanting to use substances to avoid/escape these experiences.

Decoupling effects with depression

Within the area of depression, the normative relationship of cognitive patterns to other depressive symptoms has been well demonstrated; for example associations between dysphoric mood and depressive thinking (Kuyken et al., 2010). Decoupling evidence, however, suggests AMTs may serve to weaken these normative associations.

Cognitive reactivity and depression. Cognitive reactivity refers to the activation of negative, depressive thoughts in response to dysphoric mood, an important risk factor for developing depression. A cross-sectional, assessment-only study with 278 undergraduate students tested whether individuals who are more mindful, as measured by the MAAS which emphasizes awareness of experiences in the present, are less likely to experience negative cognitions in response to depressive affect (Gilbert & Christopher, 2009). Consistent with this prediction, a significant moderation effect was found such that depressive affect was less strongly related to negative cognitions among those higher in mindfulness.

A second study compared MBCT to antidepressant medication with 123 recurrently depressed patients currently in remission (Kuyken et al., 2010). This study included a laboratory-based measure of cognitive reactivity at post treatment in which changes in depressive thinking styles are assessed before and after a sad mood induction procedure. Results indicated that cognitive reactivity (i.e., increase in depressive thoughts after mood induction) was actually greater among participants who completed MBCT relative to those in the maintenance antidepressant condition. However, intervention condition moderated the relationship between cognitive reactivity and other depressive outcomes. The normative relationship was found in the

antidepressant condition such that greater cognitive reactivity at post was predictive of greater depressive symptoms and relapse at 15 month follow up in the antidepressant condition, but reactivity was not related to either outcome in the MBCT condition. Pre to post improvements in self-compassion also moderated the relationship between cognitive reactivity measured at post treatment and depressive symptoms measured at follow up, such that those who improved more on self-compassion (in either condition) demonstrated a weaker relationship between reactivity and symptoms. Overall, these results suggest that AMTs may not consistently decouple the normative relationship between negative affect and negative thinking (cognitive reactivity), but may, at least in some instances, reduce the relationship between cognitive reactivity and subsequent depressive outcomes. The inclusion of a self-compassion measure provided initial evidence that decoupling effects might occur through changes in processes targeted in treatment.

Neuroticism and depression. A series of survey-based studies examined whether mindfulness might also decouple the relationship between neuroticism and depressive symptoms (Barnhofer et al., 2011; Feltman, 2009; Tucker et al., 2014). In one cross-sectional, assessment-only study with 195 undergraduate students, mindfulness, as measured by the MAAS, moderated the relationship between neuroticism and depressive symptoms (Feltman et al., 2009). Results indicated that neuroticism was only related to depression among those low in mindfulness.

A subsequent longitudinal, assessment-only study using a community sample of 144 participants found that mindfulness, as measured by the FFMQ total score, moderated the relationship between baseline neuroticism and depressive symptoms, assessed 6 years later (Barnhofer et al., 2011). Analyses indicated neuroticism no longer predicted depression at the 90th percentile of mindfulness scores (i.e., full decoupling was only present among the top 10% in mindfulness). This moderation effect was not found for any FFMQ subscales.

A third cross-sectional, assessment-only study with 315 college students examined whether mindfulness, as measured by the FFMQ total score, moderated the relationship between personality factors and the suicidal ideation subscale of the Hopelessness Depression Symptom Questionnaire (Tucker et al., 2014). Mindfulness significantly moderated the relation between neuroticism and suicidal ideation such that neuroticism was only related to ideation at low levels of mindfulness. Mindfulness was also found to moderate the relationship between extraversion and suicidal ideation with the same pattern. Overall, these three studies suggest that the impact of neurotic personality features on depression may be attenuated through mindfulness.

Paranoia and social acceptance. Another study examined decoupling effects between paranoia and social acceptance within depressive disorders. A randomized trial compared MBCT to a waitlist condition with 130 participants in partial remission from a depressive episode (Collip et al., 2013). Results indicated MBCT reduced paranoia and increased feeling socially accepted relative to waitlist. Furthermore, a decoupling effect was found such that treatment condition moderated the time lagged association between paranoia and social acceptance. Prior to the intervention feeling paranoid (at time 1) predicted a decrease in feeling socially accepted (at time 2), but this association was no longer present at post for those in MBCT. One interpretation of these results is that, after MBCT, individuals may respond to paranoia in a nonreactive, decentered way such that it does not impact further behaviors and reactions (i.e., withdrawal, scanning for threat) that might then interfere with feeling socially accepted.

Summary. Overall, there is some preliminary data suggesting that AMTs can decouple the relationship between internal risk factors for depression (i.e., cognitive reactivity, neuroticism) and depressive outcomes as well as with other related symptoms (i.e., social acceptance and

paranoia). This further highlights the potential impact of AMTs for depression through altering the function of these factors rather than targeting their frequency or form.

Decoupling effects with eating problems

Disordered eating cognitions and problem eating behaviors. Disordered eating cognitions (e.g., thin ideal, fear of weight gain, self-esteem linked to eating and weight control) are strong predictors of eating disorders and problem eating behaviors (Cooper et al., 2006). Theoretically, mindfulness and acceptance may alter the function of these cognitions such that individuals can observe them as just thoughts and not as literal truths that need to rigidly affect overt behavior. Two cross-sectional survey studies have been conducted in the area of eating disorders that highlight such potential decoupling effects (Ferreria, Pinto-Gouveia, & Duarte 2011; Masuda, Price, & Latzman, 2012).

One cross-sectional assessment-only study with 278 college students investigated whether mindfulness of the present moment (MAAS) and acceptance (AAQ) decoupled the relationship between disordered eating cognitions and problem eating behaviors (Masuda, Price, & Latzman, 2012). In support of this, there was a significant moderation effect with mindfulness such that those high in mindfulness had a weaker association between disordered eating cognitions and disordered eating behaviors. However, acceptance was not a moderator.

A second cross-sectional, assessment-only study with a community sample of 679 participants tested whether acceptance related to body image, as measured by the Body Image Acceptance and Action Questionnaire (BI-AAQ), moderated the relationship between body image dissatisfaction and disordered eating behaviors (Ferreira et al. 2011). Results indicated a significant moderation effect such that body image dissatisfaction was associated with both drive for thinness and problem eating behaviors only among those low in acceptance. Overall, these

preliminary studies suggest that acceptance and mindfulness may decouple the normative relations between various disordered eating cognitive processes and problem eating behaviors.

Hunger and unhealthy/overeating. A series of recent studies have examined whether mindfulness might also decouple the relationship of hunger to unhealthy and overeating behaviors (Papies et al., in press; Marchiori & Papies, 2014). A laboratory-based study with 75 college students examined whether a mindfulness manipulation would decouple the relationship of hunger to food choice and food attractiveness (study 2 in Papies et al., in press). Participants were asked to view a series of images of healthy and unhealthy foods as well as other images while practicing mindful awareness of their reactions (mindfulness condition) or while just looking carefully in a relaxed manner (control condition). They then completed a computerized food choice task in which they indicated whether they would like to eat a series of foods presented, followed by completing a series of self-report measures of food attractiveness and hunger. Intervention condition moderated the relationship between hunger and choosing unhealthy foods such that hunger was only related to unhealthy food choice in the control condition. Overall, results suggest that mindfulness training decoupled the relationship between hunger and choosing unhealthy foods.

A second study further examined the impact of the mindfulness manipulation on more naturally occurring eating behavior in a school cafeteria (study 3 in Papies et al., in press). A sample of 114 college students on their way to the cafeteria were asked to first complete a mindful attention or relaxed viewing manipulation (similar to study 2 in Papies et al., in press) or to receive no intervention at all. Researchers then observed what food participants selected in the cafeteria to eat. Intervention condition significantly moderated the relationship between hunger and number of calories worth of food taken in the cafeteria such that hunger was only related to

taking more calories in the control conditions. Thus, mindfulness again decoupled the relation between hunger and eating behavior, in this case observed directly in a natural environment.

A third laboratory-based study examined whether a mindfulness manipulation decoupled the relationship of hunger to eating behavior in a food challenge preparation with a sample of 110 college students (Marchiori & Papies, 2014). Participants were randomized to complete either a mindful body scan exercise or listen to an audio book (control condition) followed by questionnaires to give the impression the study was completed. In a supposed second experiment on consumer experiences participants were presented a plate of cookies and allowed to eat as many as they chose to. There was a significant moderation effect in which hunger was related to how many cookies were consumed in the control condition, but not in the mindfulness condition.

Although most of the reviewed studies on eating behaviors suggest mindfulness decouples the relationship between internal behaviors and problem eating, one study on psychological distress and emotional eating found contradictory results (Pidgeon et al., 2013). A cross-sectional, assessment-only study with 157 community participants found a significant mindfulness (MAAS) moderation effect for the relation between distress and emotional eating. Inspection of this effect indicated that distress was only related to emotional eating among those higher in mindfulness. Although mindfulness decreased emotional eating among those lower in distress, at high levels of distress the pattern of emotional eating was similar irrespective of mindfulness score. These results suggest that mindfulness, at least assessed by dispositional self-report, may sometimes fail to decouple the relationship between high levels of internal distress and overt behaviors such as emotional eating.

Summary: Overall these preliminary studies suggest that AMTs might decouple the normative relationships between disordered eating cognitions and problem eating behaviors as

well as between hunger and unhealthy eating. One study was found that indicated contradictory results with distress and emotional eating however.

Decoupling effects with pain

Theoretically, AMTs for chronic pain work in part by decoupling the impact of pain on behavioral functioning, mental health, and quality of life. This has been directly tested in both laboratory-based intervention and assessment-only studies.

Pain intensity, negative affect and fear of pain. Two assessment-only studies examined the relationship between pain intensity and other internal experiences (i.e., negative affect and fear of pain; Crombez, Viane, Eccleston, Devulder, & Goubert 2013; Kratz, Davis, & Zautra 2007). One study used an ecological momentary assessment design (EMA) with a sample of 62 chronic pain participants (Crombez et al., 2013). For two weeks, participants carried mobile devices that assessed, multiple times a day, attention to pain, fearful thinking about pain, and positive/negative affect. Acceptance was measured at the beginning of the two-week period with the Illness Cognition Questionnaire (ICQ). Acceptance was found to lower the attention paid to pain on average, but it did not moderate the association between attention to pain and pain intensity. However, acceptance did moderate the relationship between pain intensity and fearful cognitions of pain, such that it was weaker among those higher in acceptance. This suggests that although individuals may continue to attend to pain in response to pain intensity, acceptance reduces fearful thoughts in response to pain.

Another longitudinal study assessed whether acceptance may decouple the normative association between negative affect and pain severity (Kratz et al., 2007). A sample of 122 chronic pain participants completed an initial assessment of pain acceptance (Chronic Pain Acceptance Questionnaire) and pain catastrophizing, and then engaged in two to twelve weekly

telephone-based assessments of pain severity and positive/negative affect. Acceptance moderated the relationship between pain severity and negative affect such that the relationship was weaker among those higher in self-reported acceptance. This further suggests acceptance may decouple the relationship between negative affect and pain.

Pain intensity and behavioral persistence. A series of laboratory-based studies investigated whether acceptance-based coping interventions decouple the relationship between increased levels of pain and decreased persistence in a pain-inducing task (Gutiérrez et al., 2004; Páez-Blarrina et al., 2008a; McMullen et al., 2008). All three studies included randomization to a brief acceptance-based intervention or a cognitive control-based intervention. Each study found that compared to the control condition, acceptance led to significant increases in persistence while at a high reported level of pain. This process was referred to as a decrease in pain believability; continuing to engage in the task despite experiencing a high level of pain that would typically lead to stopping.

A similar uneven pattern is sometimes found in ACT outcome studies for chronic pain, in which overt behavior and functioning improve following treatment, despite no improvement in pain intensity (e.g., Wicksell et al., 2008). However, as previously mentioned these uneven effects from outcome studies may be due to other method factors, which is why they were excluded from this review. In the case of AMTs for chronic pain, most outcome studies find AMTs also reduce pain intensity in addition to other clinical outcomes (Reiner et al., 2013).

Summary. Overall, preliminary research suggests acceptance and mindfulness may decouple the relationship between intense pain and psychological reactions to pain. There are also some studies suggesting AMTs might decouple the relation between pain intensity and overt behaviors, although few studies have tested this directly.

Other decoupling effects

Aversive emotion and avoidance behavior. One laboratory-based study with 94 college students compared reactions to emotion-eliciting film clips after receiving one of three types of instruction: acceptance, cognitive reappraisal, or no instructions (Wolgast et al., 2011). After receiving the instructions, participants watched a series of clips, each focused on eliciting an aversive emotion including fear, disgust, and sadness. Self-reported avoidance tendencies were measured by asking participants how reluctant they would be to view the clip again. Results indicated that both cognitive reappraisal and acceptance led to lower avoidance relative to the no instruction condition. However, a decoupling effect was found such that induced negative emotion was predictive of avoidance in the reappraisal and no instruction condition, but negative emotion was not related to avoidance in the acceptance condition. Thus, although both reappraisal and acceptance reduced avoidance, it may have occurred through distinct mechanisms with only acceptance leading to a decoupling between experiencing aversive emotions and being willing to watch the clip again.

Repetitive thinking and negative reactions. One laboratory-based study examined decoupling effects with repetitive thoughts (broadly defined) by randomly assigning 190 college students to complete a brief mindful breathing exercise, loving kindness meditation or progressive muscle relaxation (Feldman et al., 2010). Although repetitive thoughts were not induced in this procedure, they were expected to occur naturally to some extent during the intervention procedures (i.e., while meditating or relaxing). At the end of the exercise, participants reported frequency of and reactions to repetitive thoughts (e.g., worry, self-criticism, thoughts about a problem) as well as a self-report measure of decentering (i.e., noticing thoughts as just thoughts). Results indicated that mindful breathing led to significantly greater frequency

of repetitive thoughts during the exercise as well as greater self-reported decentering. A moderation effect was found such that frequency of thoughts was significantly less related to negative reactions to thoughts in the mindful breathing condition, relative to the other two conditions. Furthermore, a three-way interaction adding self-reported decentering indicated that only those in the mindful breathing condition who improved highly on decentering showed a decoupling effect between frequency of and reactions to thoughts. In contrast, those who completed mindful breathing and did not improve on decentering demonstrated a similar strong relation between frequency of and negative reactions to thoughts. As a whole, this study suggests that a) mindful breathing can reduce the normative relationship between frequency of and negative reactions to repetitive thoughts, b) this effect is not attributable to meditative exercises with distinct foci such as loving kindness or progressive muscle relaxation, and c) this effect appears to be related to increases in decentering produced through mindful breathing.

Anxiety sensitivity and anxious symptoms. Anxiety sensitivity refers to the tendency to be afraid of the physical, cognitive and social experiences and consequences of anxiety. Although distinct from anxious symptoms themselves, research has consistently found anxiety sensitivity to be strongly related to anxious symptomatology. A series of studies examined whether acceptance decouples this relationship (Bardeen et al., 2013; 2014). One cross-sectional assessment-only study with 838 online community participants found a significant moderation effect such that anxiety sensitivity was less related to anxiety symptoms (measured by the Depression Anxiety Stress Scale; DASS) among those higher in acceptance (as measured by the AAQ-II)(study 2 in Bardeen et al., 2013). A subsequent longitudinal, assessment-only study with 135 college students similarly found a moderation effect with baseline acceptance (AAQ-II) such

that baseline anxiety sensitivity only predicted later anxiety symptoms (DASS) among those lower in acceptance (Bardeen et al., 2014).

However, it is important to note these anxiety sensitivity decoupling effects might be less stable depending on problem area and measures used, with multiple contradictory findings reported in the literature. For example, two cross-sectional, assessment-only studies (study 1 $N = 127$ college students, study 2 $N = 324$ community members) failed to find a significant acceptance (AAQ-II) moderation effect for the relationship between anxiety sensitivity and social anxiety (Panayiotou et al., 2014). Furthermore, both cross-sectional studies by Bardeen and colleagues (2013) found a significant moderation effect with acceptance (AAQ-II) such that anxiety sensitivity was only related to perceived stress among those high in acceptance (opposite to the decoupling effects found with anxiety symptoms). These counterintuitive findings might suggest that decoupling effects vary based on construct measured, but it also raises concerns regarding the stability and replicability of some decoupling findings.

Anxious attachment and relationship difficulties. One assessment-only study examined whether mindfulness (as measured by the MAAS) might decouple the relationship between an anxious attachment style and relationship difficulties in a sample of 1,702 community members completing a series of online surveys in a longitudinal study (Saavedra et al., 2010). Results found that mindfulness did not moderate the relationship between anxious attachment and relationship satisfaction, but it did moderate the relationship between anxious attachment and whether participants ended their relationship during the course of the study. Those low in mindfulness demonstrated the expected relationship between anxious attachment and greater probability of breaking up, but these variables were not correlated among those high in

mindfulness. These results suggest that mindfulness might mitigate the features of anxious attachment that typically lead to ending relationships.

Sexual motivation and attraction/partner selection. One lab-based study with 78 college students tested whether a mindfulness manipulation decouples the relationship between motivation for casual sex partners and attraction/partner selection (study 1 in Papiés et al., in press). Participants were randomized to view a series of faces while practicing mindful awareness of their reactions (mindfulness condition) or while just viewing the images closely (control condition). Participants then reviewed images of opposite sex people and, as quickly as possible, indicated whether each could be a partner. These images were then rated on attractiveness. There was a significant moderation effect by intervention condition such that casual sex motivation was only related to more attractiveness ratings among those in the control condition, but not in the mindfulness condition. Although there was no significant moderation effect on potential partner selection, casual sex motivation was only associated with selecting more people as potential partners in the control condition and not in the mindfulness condition. These results suggest that mindfulness might decouple the relation of casual sex motivation with greater attraction to and selection of sexual partners.

Neuroticism and anger. A cross-sectional study with 195 undergraduate students explored a decoupling effect between neuroticism and anger (Feltman et al., 2009). The study found that mindfulness, as measured by the MAAS, moderated the relation between neuroticism and anger, such that neuroticism was less strongly related to anger among those higher in mindfulness.

Summary. A variety of studies have begun to explore decoupling effects across other psychological problems. These preliminary results highlight potential areas for decoupling

effects related to aversive emotions and avoidance behavior, reactions to repetitive thoughts, anxiety sensitivity and anxious symptoms, the impact of anxious attachment on relationship functioning, sexual motivation and attraction, and neuroticism and anger.

Emotion differentiation decouples internal experiences and overt behavior

A related construct to mindfulness is emotion differentiation, which refers to individuals' ability to identify and label discrete emotional experiences (e.g., sad, angry, guilty) beyond more global valence labels (e.g., feeling good or bad). This overlaps with key facets of mindfulness, such as awareness of and ability to describe internal experiences. For example, the "describing" subscale of the FFMQ includes items such as "I'm good at finding words to describe my feelings" and "I can usually describe how I feel at the moment in considerable detail." Research has found that mindfulness is related to level of emotion differentiation with both positive and negative emotions (Hill & Updegraff, 2012). Thus emotion differentiation might produce similar decoupling effects as mindfulness.

Consistent with this, a series of studies have examined decoupling effects from emotion differentiation using EMA in which participants provide intermittent ratings on a variety of current negative emotions over several days (Dixon-Gordon et al., 2014; Kashdan et al., 2010; Kashdan et al., 2013; Pond et al., 2012; Selby et al., 2014; Zaki et al., 2013). An intraclass correlation coefficient is calculated with these emotion ratings, with lower correlations indicating a greater tendency to differentiate specific negative emotions and higher correlations indicating a tendency to rate each negative emotion similarly without differentiation.

One EMA study examined whether emotion differentiation moderated the relationship between intense negative emotion and alcohol use in a sample of 106 underage drinkers (Kashdan et al., 2010). The study found a significant moderation effect such that high emotion

differentiators were less likely to binge drink when experiencing intense negative emotions prior to drinking. This suggests that the capacity to differentiate, and possibly be mindful of one's emotions, decouples the normative relationship between negative affect and problem drinking.

Another series of EMA studies tested whether emotion differentiation moderated the relationship between anger and aggressive behavior (Pond et al., 2012). Across three studies with college students, emotion differentiation consistently moderated the relation between daily anger intensity and daily aggressive tendencies, such that it was weaker among those high in emotion differentiation. In addition, the third study found that emotional control partially mediated this moderation effect, such that high emotion differentiators were less likely to be aggressive in response to intense anger due in part to having greater emotional control with anger.

One EMA study examined whether positive emotion differentiation decoupled the relationship between positive emotions and eating problems in a sample of 118 women with anorexia nervosa (Selby et al., 2014). A series of significant moderation effects were found such that among those lower in positive emotion differentiation there was a greater relationship between higher positive emotions and anorexic behaviors including vomiting, laxative use, body fat checking, excessive weighing, exercise, and days with less than 1,200 calories of food eaten. These results suggest that positive emotion differentiation may decouple the relation of positive emotions to anorexic behaviors found in previous research.

Two studies on emotion differentiation decoupling effects were conducted in the area of Borderline Personality Disorder (BPD). One EMA study with 38 participants diagnosed with BPD found that emotion differentiation moderated the relationship between rumination and nonsuicidal self-injury. Results indicated that higher rumination was not predictive of self-injury among those high in emotion differentiation, but it was among those low in differentiation (Zaki

et al., 2013). A second EMA study examining both positive and negative emotion differentiation separately was conducted with 34 college students experiencing high levels of BPD symptoms and 50 with low levels of symptoms (Dixon-Gordon et al., 2014). There were two significant moderation effects with positive emotion differentiation such that BPD symptom level related to both impulsivity and urges to engage in problem behaviors only among those lower in positive emotion differentiation; these variables were not related at high levels of differentiation. Interestingly negative emotion differentiation did not significantly moderate either of these relations. These two studies suggest emotion differentiation, particularly with positive emotions, decouples the relation between rumination and BPD symptoms with problem behaviors.

In addition to the reviewed studies finding that emotion differentiation decouples relations between internal experiences and overt behavior, one study found that emotion differentiation decouples self-esteem and emotional distress in response to social rejection as measured by fMRI (Kashdan et al., 2013). A study with 25 college students involved completing a virtual ball tossing preparation that simulates social rejection while being scanned in a fMRI. Results indicated a moderation effect such that lower self-esteem was only related to greater neural activity representing “social pain” among those low in emotion differentiation; there was no significant correlation among high differentiators.

Overall, these results suggest that the capacity to differentiate and discretely label aversive emotions can decouple a variety of normative relations between affect/cognitive processes and problem behaviors (i.e., binge drinking, aggression, restrictive eating and compensatory behaviors, self-injury).

DISCUSSION

This review highlights the breadth of emerging research indicating that AMTs may decouple the normative behavioral relations between internal experiences and other internal experiences/overt behaviors. Preliminary evidence for decoupling effects were found in problem areas including substance abuse, depression, eating disorders, overeating, chronic pain, anxiety, relationships, anger, avoidance behavior, and self-harm, with the strongest evidence currently available in the area of substance abuse.

Theoretical implications

These findings are consistent with many of the AMT models, which generally theorize that these intervention methods change how individuals' relate to their inner experiences, promoting an accepting, nonreactive and nonjudgmental awareness of them simply for what they are. Through this process, the function of these experiences is altered such that they no longer elicit the maladaptive reactions they had in the past. For example, pain might be compassionately acknowledged rather than eliciting judgments or avoidant coping strategies. Similarly, anxious thoughts might be noticed as simply thoughts rather than literally true. From this perspective, decoupling effects are an empirical signature of the application of mindfulness and acceptance processes to ineffective behavioral patterns of psychological reactions and overt behavior.

A contextual behavioral science perspective (Hayes, Barnes-Holmes, et al., 2012) helps explain why AMTs do not focus on changing internal experiences directly. Traditional cognitive behavioral therapies often work within these normally occurring behavioral relations by trying to reduce/change key internal experiences in order to affect subsequent behavioral outcomes (e.g., restructuring catastrophizing thoughts to reduce avoidant behaviors). In contrast, AMTs target maladaptive relations between internal experiences and internal/overt behavior by altering the contexts in which they occur, so that internal experiences no longer lead to problematic

behaviors (e.g., shifting from a context in which catastrophizing thoughts are literally true to one in which they are noticed as just a thought and thus do not necessarily entail avoidance). This contextual approach to intervening on behavioral relations further explains why AMTs do not see changing internal experiences directly as necessary to produce clinical improvements.

While decoupling effects appear to provide compelling evidence for how AMTs alter the function of internal experiences, there are potential alternative theoretical explanations worth considering that could also lead to decoupling. One alternative account may be that decoupling effects are due to an increase in self-control and capacity to inhibit maladaptive responses, such as through improved executive functioning or self-control resources. For example, a study by Ostafin and colleagues (2013) found that degree of executive control predicted a similar decoupling effect as self-reported mindfulness. Similarly, a study with 48 problem drinkers found that working memory training produced a decoupling effect such that those receiving the training who also had highly positive implicit alcohol attitudes were significantly less likely to drink one month later relative to those in the control condition (Houben et al., 2011). This conceptualization shifts the explanation of decoupling effects to a more generalized ability and suggests alternative routes to decoupling through improving executive functioning and reducing self-control resource depletion. Research indicating that mindfulness training can improve executive functioning (Chiesa et al., 2010) and counteract depletion of self-control resources (Friese et al., 2012) suggests this is a plausible alternative hypothesis.

Another explanation is that acceptance and mindfulness processes might enhance one's ability to use effective emotion regulation strategies to reduce/change internal experiences. For example, one study found that the decoupling effect from emotion differentiation (between anger intensity and aggression) was mediated by enhanced emotional control (Pond et al., 2012). In

other words, individuals who are better at differentiating specific negative emotions are better able to control their emotions when experiencing anger, possibly because being able to identify more specific emotions can guide more effective selection and application of emotion regulation strategies. This would differ notably from a typical AMT model as it suggests decoupling may occur due to increased control over psychological reactions rather than changes in their function.

Each of these accounts still lead to decoupling effects, but highlight different pathways for doing so (i.e., altering the function of inner experiences, improving self-control, emotion regulation). The available evidence suggests these mechanisms might each lead to decoupling effects in some contexts and through some methods. One important area for future research is to determine whether AMTs produce decoupling effects through theorized mechanisms (i.e., altering the functions of inner experiences) or through other mechanisms. This review supports the traditional AMT account, with studies showing decoupling effects are related to improvements in self-compassion from treatment (Kuyken et al., 2010), improvements in decentering following mindful breathing (Feldman et al., 2010) and amount of meditation practice (Elwafi et al., 2013). More refined research is needed to determine which mechanisms are most effective/efficient for producing decoupling effects for which individuals and contexts. The results could be more targeted, efficient, and effective methods for achieving decoupling.

Clinical implications

Decoupling effects represent an alternative method for addressing internal experiences that elicit maladaptive responding. A common therapeutic strategy focuses on changing/eliminating relevant internal experiences, such as through cognitive restructuring, stimulus control, and relaxation strategies, in order to try to change downstream psychological reactions and behaviors. Alternatively, AMTs could be applied to reduce maladaptive responses to these

internal experiences independent of whether they change or not, by targeting the function of these experiences and the contexts that govern their relations to other behavior.

Although such decoupling effects are already emphasized in some AMTs such as ACT, this research could increase the focus on decoupling across AMTs. This may be particularly important as mindfulness is incorporated as a component in other treatment packages in order to maintain an emphasis on decoupling. Further research on decoupling effects may help guide treatment innovations and refinements. For example, this review found that AMTs decouple distress, cravings, and substance use. This finding could guide more targeted assessment and intervention efforts when using AMTs among substance abusing clients with comorbid mood and anxiety disorders. In the area of assessment, client monitoring could include a greater emphasis on decoupling effects (e.g., tracking whether overt behavioral goals are achieved despite continued anxiety or depression). With further research, client and contextual factors could be identified to guide when focusing on decoupling effects may be more effective than focusing on reducing/changing internal experiences (e.g., chronic pain, patient characteristics).

Limitations and future directions

Although the preliminary findings summarized in the current review have promising implications for theory and clinical applications of AMTs, they also highlight a number of methodological issues and areas for further research. A review of these studies despite these limitations is critical in summarizing the available evidence and highlighting the importance of continued research and replication of promising findings there in.

File drawer and replication issues. A major limitation of this review is the difficulty identifying studies that failed to find a decoupling effect. Although reporting failed replications is a larger issue within psychological science, it is particularly notable in an exploratory, diverse

area such as this in which studies are rarely developed specifically to test for a decoupling effect and may not be reported as part of study results in the absence of a significant finding (i.e., file drawer effect). This issue was increased by the lack of a consistent term for decoupling effects to guide study identification (sometimes referred to as “desynchrony,” simply as moderation effects, or sometimes not highlighted at all). One aim of this paper is to increase awareness to and consistency in examining such decoupling effects.

Despite these issues, three studies were identified that did not find support for any decoupling effects (Panayiotou et al., 2014; Pidgeon et al., 2013). Furthermore, of the 41 studies showing decoupling effects, 8 studies did not show decoupling effects in all targeted areas. For example, in one study mindfulness reduced cognitive reactivity to depressed affect (Gilbert & Christopher, 2009) but not in a second (Kuyken et al., 2010). Relatedly, studies that used multiple subscales of self-reported mindfulness tended to find that decoupling effects only occurred with some of the scales (e.g., Ostafin et al., 2013). These variations in how and whether decoupling effects occur raises further concerns about the number of unreported studies, that are well powered and controlled, which have failed to find decoupling effects

Furthermore, with the exception of a few studies, mostly relating to substance use, specific decoupling effects have not been tested in published replication studies. Without this broader context of evidence, it is difficult to determine ultimately whether or not such findings are spurious versus valid/reliable with AMTs. Future well-powered and controlled studies are needed to test the replicability of findings identified in this review.

Low statistical power. In several of these studies, the file drawer issue is worsened by insufficient power to adequately test decoupling effects. Some of the studies included fairly small sample sizes for moderation analyses, the approach typically used in testing decoupling

effects (see Table 1 for sample sizes). The use of such underpowered studies has the tendency to lead researchers to only publish studies that manage to demonstrate a decoupling effect despite low power, while those that fail to demonstrate an effect remain unpublished.

Furthermore, if decoupling effects were based only on the lack of a significant relationship (e.g., depressive affect no longer relating to craving after an AMT), then inadequate power provides a reasonable alternative explanation for the finding. However, this was not the case in the reviewed studies, which with only a few exceptions used moderation analyses to test for decoupling (although see Wolgast et al., 2011). This is also why the review excluded treatment studies that only reported an uneven pattern of effects in which overt behavioral outcomes improved, but internal experiences did not (e.g., Bach & Hayes, 2002; Wicksell et al., 2008), since such findings may be due in part to lack of power.

Methodologies to test decoupling. The reviewed studies varied in terms of their methodological quality in demonstrating decoupling effects. There were only 16 eligible studies that specifically tested whether AMT interventions weakened the relationship between internal experiences and behavioral outcomes. However, even these studies did not rule out alternative explanations for decoupling effects such as measurement issues and restricted range/variability (e.g., if a mindfulness condition reduced depression, then the range/variability of scores will be reduced, which could attenuate correlations to cravings in this condition). Furthermore, several studies were underpowered to test decoupling effects and it was often not clear the degree to which they were specifically designed to test apriori hypotheses for decoupling. Assessment-only designs that use acceptance and mindfulness self-report measures raise additional issues such as whether participants have the necessary insight/understanding to accurately report these processes outside an intervention context, how to conceptualize what mindfulness is outside a

specific training history, and whether these measures are capturing similar psychological processes as those targeted in AMTs. Overall, these studies provide exploratory tests of potential decoupling effects, which now need to be further tested in well powered and controlled studies.

Decoupling effects from other treatment methods. The current review was limited to decoupling effects produced through acceptance and mindfulness processes. However, theoretical discussions of decoupling effects have occurred in the literature since some of the early stages of cognitive and behavioral therapies (Fordyce et al., 1968; Rachman, 1978). This raises the question of whether other therapeutic processes may lead to decoupling effects or if these effects are a unique feature of acceptance and mindfulness.

For example, preliminary evidence suggests CT can produce decoupling effects between depressive cognitions and other depressive symptoms. A RCT comparing antidepressant medication, CT and/or family therapy with 121 depressed patients found that depressive cognitions were significantly less related to depressive symptoms among those completing CT (Beevers & VanMiller, 2005). This may be due to the cognitive distancing component of CT, which served as one foundation for the later development of ACT and involves “stepping back” and rationally examining one’s thoughts. However, CT assumes maladaptive thoughts need to be changed in order to change symptoms. This preliminary finding suggests an alternative mechanism of change for CT that may warrant further testing relative to cognitive change.

Another process sometimes included within AMTs is contact with and articulation of values. Theoretically, clarifying and connecting with personal values may produce similar decoupling effects as behavior becomes less under the control of certain internal experiences and is guided more by one’s stated values. Consistent with this, a laboratory-based study with 30 participants compared a brief values intervention to a control condition, finding that those in the

values condition were significantly more likely to persist in a self-shocking procedure while at a high rated level of pain (Páez-Blarrina et al., 2008b). Further research is needed to examine whether values produce a similar set of decoupling effects.

Expanding and increasing decoupling research on AMTs. This review highlights a number of areas for further research on decoupling effects. Despite the relevance of decoupling effects to AMTs, the review found a lack of common terminology to orient researchers to this important set of studies and phenomenon. Given the promising initial findings with these studies, a more explicit and organized focus on testing decoupling effects with AMTs is needed.

The review purposefully excluded those studies which tested how AMTs alter responses to external stressors/stimuli given this phenomena can be accounted for by a number of processes (e.g., decoupling, distress reduction, cognitive restructuring). However, many of the excluded studies touch on important areas for further research such as responses to exposure procedures (e.g., Eifert et al., 2003), stressful events (e.g., Ciesla et al., 2012), and exposure to racism (e.g., West et al., 2013). One way to test for decoupling effects inside studies examining psychological reactions to external events would be to measure whether acceptance and mindfulness alters subsequent behavioral responses to one's initial reactions (e.g., does acceptance increase willingness to repeat exposure independent of the anxiety it brings up?). One goal of this review is to further highlight the utility of measuring and testing for such decoupling effects in research.

This review did include emotion differentiation studies, which significantly overlap with the awareness and describing facets of mindfulness. These studies were included in part because they exemplify the strategic methods and in-depth questions that may be examined with decoupling effects. The use of EMA in such studies allow for a more fine grained analysis, examining whether decoupling occurs in specific contexts and instances such as when

experiencing intense emotions (Kashdan et al., 2010) or when someone hurts their feelings (Pond et al., 2012). EMA also provides intensive longitudinal data to better examine mediators of decoupling effects (e.g., Pond et al., 2012).

Further research is needed to identify which components of AMTs produce decoupling effects. This review combined a variety of AMT interventions and measures, with results showing decoupling from mindful awareness of the present moment, acceptance, being nonjudgmental of inner experiences, differentiating emotional experiences, among others (see Table 1). How to systematically parse out and test the components of AMTs is a challenge in AMTs. However, one AMT component that was clearly not tested in isolation was cognitive defusion or decentering. This component is sometimes even defined in terms of reducing the impact of thoughts on behavior, but no studies were found that directly tested such a decoupling effect from defusion/decentering in isolation (although see Feldman et al., 2010 for an example of a decentering measure correlating with a decoupling effect from mindful breathing).

A final noteworthy area for future research is to examine whether decoupling effects can serve as process measures that help account for later treatment outcomes. Theoretically, decoupling might be an empirical signature of changes in the function of internal experiences and might predict later treatment gains. If this was the case, it could lead to more targeted intervention methods and means of monitoring therapeutic progress.

This review sought to highlight a growing area of research examining how AMTs might alter the function of internal experiences such that they no longer lead to maladaptive behavioral outcomes. Although the available evidence is preliminary and varied, these results suggest a potentially important area for further research seeking to understand how AMTs, and potentially other therapeutic approaches, produce clinical gains.

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Table 1. List of included decoupling studies.

Study	Problem area	Decoupled relations (<i>internal experience/ internal or overt behavior</i>)	Sample	<i>n</i>	Method	AMT Measure / Intervention
Adams et al., 2014	Substance Use	Weight-related smoking concerns / Smoking frequency	Female student smokers	112	Assess	Act with awareness, nonreact, describe (FFMQ)
Adams et al., 2013	Substance Use	Negative affect / Urges to smoke; Urges to smoke / Smoking behavior	Female student smokers	64	Lab-based	Mindful breathing, mindfulness during task
Bordieri et al., 2014	Substance Use	PTSD symptoms / Cannabis dependence	In SUD treatment with PTSD symptoms	123	Assess	Acceptance (AAQ)
Bowen et al., 2009	Substance Use	Negative affect / Urges to smoke; Negative affect & urges / Smoking frequency	Student smokers	123	Lab-based	Urge surfing
Elwafi et al., 2013	Substance Use	Cravings / Smoking frequency	Smokers	33	Treatment	Program adapted from MBRP
Kashdan et al., 2010	Substance Use	Negative emotion / Binge drinking	Underage drinkers	106	Assess	Emotion differentiation
Minami et al., in press	Substance Use	Negative emotion and withdrawal / Relapse	Smokers in treatment	40	Assess	Acceptance (AIS)
Ostafin et al., 2008	Substance Use	Implicit alcohol attitudes / Hazardous drinking	Student drinkers	50	Assess	Nonjudgment (KIMS)
Ostafin et al., 2012	Substance Use	Implicit alcohol attitudes / Heavy drinking	Student drinkers	41	Lab-based	Mindful meditation

Ostafin et al., 2013	Substance Use	Implicit alcohol attitudes / Preoccupation with alcohol-related thoughts	Student drinkers	61	Assess	Nonjudgment, general mindfulness (FFMQ)
Witkiewitz et al., 2010	Substance Use	Depression / Cravings; Depression / Substance use frequency	Clients with substance use disorders	168	Treatment	MBRP
Barnhofer et al., 2011	Depression	Depressive symptoms / Neuroticism	Community sample	144	Assess	General mindfulness (FFMQ)
Collip et al., 2013	Depression	Feeling paranoid / Feeling socially accepted	Clients with depression in remission	130	Treatment	MBCT
Feltman et al., 2009, Study 2	Depression	Depressive symptoms / Neuroticism	College students	94	Assess	Awareness of present (MAAS)
Gilbert et al., 2009	Depression	Depressive affect / Depressive cognitions	College students	278	Assess	Awareness of present (MAAS)
Kuyken et al., 2010	Depression	Cognitive reactivity / Depression	Clients with depression in remission	123	Treatment	MBCT
Tucker et al., 2014	Depression	Suicidal ideation / Neuroticism	College students	315	Assess	General mindfulness (FFMQ)
Ferreria et al., 2011	Eating Problems	Body image dissatisfaction / Drive for thinness and problem eating behaviors	Community sample	679	Assess	Acceptance (BI-AAQ)
Marchiori et al., 2014	Eating Problems	Hunger / Caloric intake	College students	110	Lab-based	Mindful body scan
Masuda et al., 2012	Eating Problems	Disordered eating cognitions / Disordered eating behaviors	College students	278	Assess	Awareness of present (MAAS)

Papies et al., in press Study 2 & 3	Eating Problems	Hunger / Unhealthy food choice	S1: College students S2: College students	S1: 75 S2: 114	Lab-based	Mindfulness of reactions during task
Pidgeon et al., 2013	Eating Problems	Failed study without decoupling of Distress / Emotional eating	Community sample	157	Assess	Awareness of present (MAAS)
Selby et al., 2014	Eating Problems	Positive affect / Disordered eating behaviors	Diagnosed with anorexia	118	Assess	Emotion differentiation
Crombez et al., 2013	Pain	Pain intensity / Fearful cognitions of pain	Chronic pain patients	62	Assess	Acceptance (ICQ)
Gutiérrez et al., 2004	Pain	Intense pain / Behavioral persistence	College students	56	Lab-based	Acceptance intervention
Kratz et al., 2007	Pain	Pain intensity / Negative affect	Chronic pain patients	122	Assess	Acceptance (CPAQ)
McMullen et al., 2008	Pain	Intense pain / Behavioral persistence	Community sample	80	Lab-based	Acceptance intervention
Páez-Blarrina et al., 2008a	Pain	Intense pain / Behavioral persistence	College students	20	Lab-based	Acceptance intervention
Bardeen et al., 2013, Study 2	Anxiety	Anxiety sensitivity / Anxiety symptoms	Community sample	838	Assess	Acceptance (AAQ)
Bardeen et al., 2014	Anxiety	Anxiety sensitivity / Anxiety symptoms	College students	135	Assess	Acceptance (AAQ)
Panayiotou et al., 2014, studies 1 & 2	Anxiety	Failed replication without decoupling of anxiety sensitivity / anxiety symptoms	S1: College students S2: Community sample	S1:127 S2:324	Assess	Acceptance (AAQ)
Wolgast et al., 2011	Avoidance	Induced negative emotion / Reluctance to view video again	College students	94	Lab-based	Acceptance intervention
Feldman et al., 2010	Repetitive thoughts	Frequency of repetitive thoughts / Reactions to thoughts	College students	190	Lab-based	Mindful breathing

Kashdan et al., 2013	Social rejection	Self Esteem / Distress from social rejection (measured with fMRI)	College students	25	Assess	Emotion differentiation
Saavedra et al., 2010	Relationships	Anxious attachment /Relationship termination	Community sample	1,702	Assess	Awareness of present (MAAS)
Papies et al., in press, Study 1	Relationships	Casual sex motivation / Attraction and potential partner rating	College students	78	Lab-based	Mindfulness of reactions during task
Feltman et al., 2009, Study 1	Anger	Neuroticism / Anger	College students	195	Assess	Awareness of present (MAAS)
Pond et al., 2012, Studies 1, 2 & 3	Anger	Anger / Aggressive behavior	College students	S1:199 S2:186 S3:243	Assess	Emotion differentiation
Dixon-Gordon et al., 2014	BPD	BPD symptoms / Impulsivity and urges to engage in problem behaviors	Students high and low in BPD symptoms	84	Assess	Emotion differentiation
Zaki et al., 2013	BPD	Rumination / Self-harm	Diagnosed with BPD	38	Assess	Emotion differentiation

Assess = Assessment-only studies examining decoupling through self-reported acceptance/mindfulness; Lab-based = Laboratory-based studies examining decoupling through brief AMT manipulations; Treatment = Treatment outcome studies examining decoupling through AMTs for psychological problems.

Table 2. Number of studies showing decoupling effects by problem area and number of failed decoupling tests

Problem area	# of studies showing decoupling effects	Any failed decoupling effects
Substance use	11	3 only significant with some AMT scales
Depression	6	1 only significant with some AMT scales 1 did not show all tested decoupling effects
Eating problems	6	1 only significant with some AMT scales 1 other did not show decoupling with distress/emotional eating
Pain	5	1 did not show all tested decoupling effects
Anger	4	
Anxiety	2	2 others did not show decoupling with anxiety sensitivity/anxiety symptoms
Relationships	2	
BPD	2	1 did not show all tested decoupling effects
Avoidance	1	
Repetitive thoughts	1	
Social rejection	1	