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Constructive and Unconstructive Repetitive Thought

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Abstract

The author reviews research showing that repetitive thought (RT) can have constructive or unconstructive consequences. The main unconstructive consequences of RT are: (a) depression; (b) anxiety; (c) difficulties in physical health. The main constructive consequences of RT are: (a) recovery from upsetting and traumatic events; (b) adaptive preparation and anticipatory planning; (c) recovery from depression; d) uptake of health-promoting behaviors. Several potential principles accounting for these distinct consequences of RT are identified within this review: (a) the valence of thought content; (b) the intrapersonal and situational context in which RT occurs; (c) the level of construal (abstract versus concrete processing) adopted during RT. Of the existing models of RT, it is proposed that an elaborated version of the control theory account provides the best theoretical framework to account for its distinct consequences.

Keywords: repetitive thought, rumination, worry, problem solving, cognitive processing, abstraction, control theory, construal theory, depression, anxiety

Constructive and Unconstructive Repetitive Thought

Repetitive, prolonged and recurrent thought about one's self, one's concerns and one's experiences is a mental process commonly engaged in by all people (Harvey, Watkins, Mansell, & Shafran, 2004). Such thinking bridges many topics within psychology: social cognition, emotion, motivation, self-regulation, goal attainment, stress, psychopathology, and mental health. Examples of such thinking include worry, rumination, perseverative cognition, emotional processing, cognitive processing, mental simulation, rehearsal, reflection, and problem solving (e.g., Martin & Tesser, 1996; Mor & Winquist, 2002; Papageorgiou & Wells, 2004; Wyer, 1996). Across these constructs, there is considerable similarity and overlap in theoretical conceptualizations and operational definitions. However, because these constructs have emerged in distinct research domains, they are usually not equated with one another and have rarely been considered together. Moreover, research has shown that these constructs have diverse outcomes, such that repetitive thought (RT) can have both unconstructive and constructive consequences. For example, on one hand, within the cognitive processing literature, RT about symptoms and upsetting events has been conceptualized as necessary for people to come to terms with traumatic and upsetting events (Horowitz, 1985; Pennebaker, 1997; Rachman, 1980; Tedeschi & Calhoun, 2004). On the other hand, RT about symptoms and upsetting events has been found to predict future depression (Ingram, 1990; Nolen-Hoeksema, 1991; Nolen-Hoeksema, 2000; Pyszczynski & Greenberg, 1987) and poor recovery from traumatic and upsetting events.

Accounting for the discrepant consequences of RT is critical in understanding the underlying mechanisms of RT, as well as of obvious applied and clinical value, in terms of improving recovery from traumatic events and reducing vulnerability to anxiety and depression. Nonetheless, there have been few systematized attempts to account for the distinct constructive

and unconstructive outcomes of RT (for initial suggestions see Harvey et al., 2004; Martin & Tesser, 1996; Nolen-Hoeksema, 2004b; Segerstrom, Stanton, Alden & Shortridge, 2003). Thus, the first aim of the current article is to address this omission by reviewing and organizing the extensive literature on the distinct consequences of RT in a coherent way. The second aim is to identify principles and/or mechanisms that could explain the distinct consequences of RT. The third aim is to discuss existing models of RT in the light of this review to determine which theory best accounts for the extant literature on RT. I first define the constructs used in this review, including the generic construct “repetitive thought” (RT), as well as more specific examples and classes of RT considered in this article. I then evaluate the evidence relevant to making a distinction between constructive and unconstructive consequences of RT, before summarizing and abstracting the key factors that emerge from this review to account for these distinct consequences of RT. Finally, I examine which of the existing models of RT best account for this data.

What is meant by repetitive thought (RT)?

This review focuses on a number of thought processes that have been highlighted as important in the wider literature relevant to self-regulation, psychopathology, and mental and physical health. A property common to all of these constructs is the process conceptualized by Segerstrom et al., (2003, p.3) as “repetitive thought” (RT), defined as the “process of thinking attentively, repetitively or frequently about one’s self and one’s world”, which was proposed to form “the core of a number of different models of adjustment and maladjustment”. As the rest of this section makes clear, these different classes of RT encompass a wide range of conceptualizations, associated with both unconstructive and constructive consequences.

Depressive Rumination (Nolen-Hoeksema, 1991)

Nolen-Hoeksema defined depressive rumination as “behaviors and thoughts that focus one's attention on one's depressive symptoms and on the implications of these symptoms” (Nolen-Hoeksema, 1991, p. 569) and as “passively and repetitively focusing on one’s symptoms of distress and the circumstances surrounding these symptoms” (Nolen-Hoeksema, McBride, & Larson, 1997). Nolen-Hoeksema’s Response Styles Theory (RST; 1991; 2000; 2004) hypothesized that depressive rumination is a particular response style to depressed mood, which is causally implicated in the onset and maintenance of depression. Depressive rumination is typically assessed on the Response Styles Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991), which asks participants to endorse how much they ruminate in response to sad or depressed mood (e.g., When you feel sad, down or depressed how often do you: "Think 'Why do I always react this way?'"). A related questionnaire is the Rumination on Sadness Scale (RSS; Conway, Csank, Holm, & Blake, 2000), which assesses tendency to engage in RT when feeling sad, down or blue (e.g., “I repeatedly analyze and keep thinking about the reasons for my sadness”).

Rumination (Martin & Tesser, 1996)

Rumination was defined as “a class of conscious thoughts that revolve around a common instrumental theme and that recur in the absence of immediate environmental demands requiring the thoughts” (Martin & Tesser, 1996, p.7). Within this conceptualization, rumination is RT on a theme related to personal goals and concerns, which can have either constructive or unconstructive consequences, depending on whether the RT helps or hinders the progress towards the unattained goal that triggered the rumination. It is assessed using the Global rumination scale (e.g. “When I have a problem, I tend to think of it a lot of the time”, McIntosh & Martin, 1992).

Worry

Worry has been defined as “a chain of thoughts and images, negatively affect-laden and relatively uncontrollable”, and as “an attempt to engage in mental problem-solving on an issue whose outcome is uncertain but contains the possibility of one or more negative outcomes” (Borkovec, Robinson, Pruzinsky, & Depree, 1983, p. 9). Worry typically involves RT about future potential threat, imagined catastrophes, uncertainties, and risks (e.g., “What if they have an accident?”). It is conceptualized as an attempt to avoid negative events, prepare for the worst and to problem solve and is linked to unconstructive outcomes including increased negative affect, interference with cognitive function and disruptions to physiological processes (Borkovec, Ray, & Stober, 1998). However, worry is also proposed to serve a number of constructive functions when it is objective, controllable, and brief (Tallis & Eysenck, 1994): (a) an alarm function that interrupts ongoing behavior and directs attention to an issue demanding immediate priority; (b) a prompt function, keeping an individual aware of potential unresolved threats and (c) a preparation function, motivating an individual to prepare for difficulties and to adopt adaptive behaviors that reduce potential threat. The Penn State Worry Questionnaire (see Davey, 1993 for discussion of this and other measures; PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990), assesses predisposition to worry (e.g., “I am always worrying about something”).

Perseverative Cognition

Perseverative cognition has been defined as “the repeated or chronic activation of the cognitive representation of one or more psychological stressors” and is hypothesized to be a core feature of worry, rumination and other forms of RT (Brosschot, Gerin, & Thayer, 2006; Brosschot, Pieper, & Thayer, 2005; Pieper & Brosschot, 2005). Perseverative cognition is hypothesized to involve repeated cognitive representations of a psychological problem or crisis,

which acts to prolong the immediate psychological and physiological responses to such life events and daily stressors, such that the body's systems associated with stress (e.g., cardiovascular, hypothalamic pituitary adrenal and immune systems) become chronically activated, leading to the development of disease (Brosschot et al., 2006; Schwartz et al., 2003).

Cognitive and Emotional Processing

Cognitive processing has been defined as the process of actively thinking about a stressor, the thoughts and feelings it evokes and its implications for one's life and future (Bower, Kemeny, Taylor, & Fahey, 1998; Greenberg, 1995), thus falling within the definition of RT (Silver, Boone, & Stone, 1983). Cognitive processing accounts propose that RT about upsetting events, for example in the form of persistent intrusions about the event, is part of the process of attempting to resolve the discrepancy between stressful events and core beliefs and assumptions (Greenberg, 1995; Horowitz, 1985; Mccann, Sakheim, & Abrahamson, 1988; McIntosh, Silver, & Wortman, 1993). Such accounts hypothesize that in response to a stressful experience, people think repetitively about their experience in order to work it through, make sense of it, and integrate it into their beliefs and assumptions about the world (Harber & Pennebaker, 1992; Horowitz, 1986; Janoff-Bulman, 1992; Tait & Silver, 1989). Similarly, RT is hypothesized to be a central process in the development of post-traumatic growth, defined as “the experience of significant positive change arising from the struggle with a major life crisis” (Calhoun, Cann, Tedeschi, & McMillan, 2000; see also Calhoun & Tedeschi, 1998; Tedeschi & Calhoun, 2004). Tedeschi and Calhoun (2004) proposed that major traumatic events challenge or destroy key aspects of individual's beliefs and goals, producing emotional distress, which in turn produces RT in order to resolve the distress, leading to personal growth.

Emotional processing has been defined as volitional efforts to acknowledge and understand the significance of one's emotions and is operationalized as persistent focus and analysis of feelings (e.g., "I take time to figure out what I'm really feeling")(Stanton et al., 2000; Stanton, Kirk, Cameron, & Danoff-Burg, 2000). Emotional processing has been associated with both constructive outcomes, such as better adjustment, and unconstructive outcomes, such as increased distress.

Planning, Problem solving and Mental Simulation

RT can also take the form of cognitive coping strategies, such as anticipatory coping, planning, rehearsal and problem-solving. Problem solving has been conceptualized as involving several stages: definition or appraisal of the problem, generation of alternative solutions, selection of alternatives, implementing the chosen solution and evaluating its effectiveness (D'Zurilla & Goldfried, 1971), each of which could involve RT. Plan rehearsal involves envisioning the steps or strategies one could use to achieve a desired outcome and often involves repetitive mental rehearsing of future actions and situations. Similarly, mental simulation has been defined as the imaginative and imitative mental construction and representation of some event or series of events (Taylor, Pham, Rivkin, & Armor, 1998; Taylor & Schneider, 1989). Repeated mental simulation can be an important process in planning, coping and self-regulation, via rehearsal of likely future events or by replaying past events (Pham & Taylor, 1999). Mental simulations can also take the form of "painful ruminations that plague many people suffering from depression or reacting to trauma" (Taylor et al., 1998, p. 431), for example, an individual repetitively replaying a memory of a car accident.

Counterfactual Thinking

Counterfactual thinking is the generation of imagined mental representations of alternative versions of the past (Roese, 1997; upward if better than what actually happened, e.g., “If only I had studied more, I would have done better”; downward if worse than reality, e.g., “If I had turned left, I would have crashed”). Repeated counterfactual thinking is often prompted by negative affect and in response to difficult events (Roese & Olson, 1993). Upward counterfactuals can have unconstructive consequences, such as exacerbating shame, guilt, anxiety, sadness and regret (Mandel, 2003; Markman, Gavanski, Sherman, & McMullen, 1993; Niedenthal, Tangney, & Gavanski, 1994; Sanna, 1997), and constructive consequences, such as generating inferences about the causes of previous difficulties, guiding effective preparative and preventive behavior (Mandel & Lehman, 1996; Roese, 1997).

Defensive Pessimism

Defensive pessimism is characterized by (a) setting low expectations about future outcomes and (b) a “thinking through” process, called reflectivity/reflection, in which individuals extensively reflect on and rehearse possible “worst-case scenarios” of what could go wrong prior to an event, and then imagine how these negative outcomes might be prevented (Cantor & Norem, 1989; Norem & Cantor, 1986a; Norem & Cantor, 1986b; Norem & Chang, 2002; Norem & Illingworth, 1993; Norem & Illingworth, 2004; Spencer & Norem, 1996). Defensive pessimism is conceptualized as strategically serving: (a) a self-protective goal of preparing for possible failure and (b) a motivational goal of increasing effort to enhance the possibility of doing well (Sanna, 1996; Sanna, 2000; Showers, 1992; Showers & Ruben, 1990).

Reflection

Reflection has been defined as chronic self-consciousness that involves playful exploration of novel, unique or alternative self-perceptions, motivated by curiosity and

pleasurable, intrinsic interest in philosophical thinking (Trapnell & Campbell, 1999). The construct of reflection developed as an attempt to explain the “self-absorption paradox”, which reflects the fact that private self-consciousness is positively associated with both increased self-knowledge, assumed to facilitate psychological adjustment, but also with increased psychological distress and psychopathology. Noting that private self-consciousness was correlated with both neuroticism and openness to experience, Trapnell and Campbell (1999) hypothesized that the self-absorption paradox could be explained if there was a neurotically-motivated, threat-avoidant form of chronic self-focus, labeled “rumination”, which contributes to psychopathology, and a contrasting form of chronic self-focus, motivated by epistemic curiosity, labeled “reflection”, which would be associated with increased self-knowledge. The Rumination-Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999) distinguishes between reflection (e.g., “I love analyzing why I do things”) and rumination, defined as RT about the self prompted by threats, losses, or injustices to the self.

Mind wandering

Mind wandering has been defined as “a shift of attention from a primary task toward internal information, such as memories” (Smallwood & Schooler, 2006, p. 946). Mind wandering can be persistent and repetitive, and as such fits within RT. Mind wandering has unconstructive consequences in terms of reduced attention to external task-related information and interfering with performance on tasks that require substantial controlled processing (Smallwood et al., 2004; Teasdale et al., 1995). However, it is hypothesized to facilitate problem solving by repeated working over unresolved current concerns (Smallwood & Schooler, 2006).

Post-event Rumination

Post-event rumination (also called “post-event processing”, “post-mortem thinking”) has been defined as “repetitive thoughts about subjective experiences during a recent social interaction, including self-appraisals and external evaluations of partners and other details involving the event” (Kashdan & Roberts, 2007, p. 286). Post-event rumination is hypothesized to contribute to the development and maintenance of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997).

Positive Rumination

Positive rumination has been defined as “the tendency to respond to positive affective states with thoughts about positive self-qualities, positive affective experience, and one’s favorable life circumstances that might amplify the positive affect” (Johnson, McKenzie, & McMurrich, in press). Positive rumination is hypothesized to be a process that may contribute to the dysregulation of positive affect in individuals vulnerable to mania and hypomania. The Responses to Positive Affect Questionnaire (RPA; Feldman, Joorman, & Johnson, in press) assesses how much an individual ruminates in response to positive mood (e.g., When you feel happy, excited, or enthused how often do you: “Think about how happy you feel”).

Habitual Negative Self-Thinking

Habitual negative self-thinking is negative self-thinking that has become a mental habit, defined as having “a history of repetition, characterized by a lack of awareness and conscious intent, mentally efficient, and sometimes difficult to control” (Verplanken, Friborg, Wang, Trafimow, & Woolf, 2007). The Habit Index of Negative Thinking (HINT; Verplanken et al., 2007) assesses the self-reported experience of the frequency, awareness, automaticity and control of negative thinking.

Overview

From this brief summary, it is clear that RT is a process common to a number of important constructs in the realms of psychopathology and self-regulation, which has been hypothesized to have both constructive and unconstructive consequences. Throughout this article, I will use the construct RT as the generic label to represent the constructs reviewed above, in preference to other labels such as worry and rumination, because this construct is: (a) more inclusive than other conceptualizations, encompassing the full range of constructs reviewed above; (b) not wedded to a particular theoretical viewpoint, unlike, say, rumination, which is typically associated with RST; (c) less likely to cause confusion than other terms that already have multiple conceptualizations and meanings (e.g., rumination); (d) uncontaminated with prior assumptions as to whether it is constructive or unconstructive, unlike rumination, whose clinical usage typically reflects pathological processes; (e) highly correlated with measures of worry and rumination, which in turn are highly related to each other, suggesting the value of examining more generic conceptualizations of thought process (Feldman & Hayes, 2005; Fresco, Frankel, Mennin, Turk, & Heimberg, 2002; Harrington & Blankenship, 2002; Hong, 2007; Muris, Roelofs, Rassin, Franken, & Mayer, 2005; Segerstrom, Tsao, Alden, & Craske, 2000; Verplanken et al., 2007; Watkins, 2004b; Watkins, Moulds, & Mackintosh, 2005).

Studies included in the review

A computerized search using key word terms was conducted to identify relevant publications for this review. The search, intended to search for studies investigating RT, included the following terms (using wild cards, such as *ruminat** for *ruminate*, *rumination*, *ruminator*, *ruminative*): *repetitive thought*, *worry*, *rumination*, *perseverative cognition*, *mental simulation*, *cognitive processing*, *emotional processing*, *reflection*, *problem solving*, *defensive pessimism*, *mind wandering*, *counterfactual* entered into a number of academic databases (e.g., Web of

Science-Science Citation Index Extended and Social Science Citation Index, PsycINFO, MEDLINE) from the beginning point of each database through the middle of 2007. The Social Science Citation Index was also searched for references citing seminal articles (e.g., Nolen-Hoeksema, 1991; 2000). In addition, reference lists of the obtained articles as well as numerous review articles and chapters (e.g., Martin & Tesser, 1989; 1996) were reviewed for relevant articles.

Studies were included in this review if they reported either constructive or unconstructive consequences associated with RT. Constructive consequences were defined in terms of beneficial and positive outcomes and products, including (but not limited to) reduced negative affect, increased positive affect, decreases in anxiety and depression, improved physical or mental health, improved performance (e.g., better academic grades and exam results), helpful cognitions and behaviors (e.g., generating plans, active behavioral problem solving, information seeking) and improved cognitive functioning (e.g., improved memory recall, better concentration), with unconstructive consequences defined in terms of the reverse, detrimental and negative outcomes.

Three principal types of studies were considered: (a) cross-sectional designs in which a measure of RT was found to be correlated with a measure of positive or negative outcome; (b) prospective longitudinal designs that assessed extent of RT at an initial assessment point (T1) and examined whether it predicted a dependent variable (e.g., depression) at a later date (T2), typically controlling for the dependent variable at T1; (c) experimental designs that manipulated degree and/or nature of RT and measured potential consequences, and, thus could determine whether RT had a causal effect on the measured dependent variable. The latter two designs were given greater weight in the review because they demonstrate that the dependent variable is a consequence of RT, through indicating either a direct causal role of RT (experimental), or a

predictive function for RT antecedent to the dependent variable (longitudinal). Throughout, the review will be organized by type of study, and, where appropriate, by whether the consequences are main effects of RT or moderated by interactions with other factors. It is worth noting at the outset that the literature on the unconstructive consequences of RT is better developed than the literature on the constructive consequences of RT.

Repetitive Thought with Unconstructive Consequences

The main findings that emerge from reviewing this literature are that RT is implicated in: (a) vulnerability to depression; (b) vulnerability to anxiety; (c) difficulties in physical health. Table 1 summarizes the relevant articles, reporting the design, sample, measures and main findings. The section on RT and depression is the largest because of the extensive research on depressive rumination.

Repetitive Thought and Vulnerability to Depression

Cross-sectional Studies

In cross-sectional studies using the RSQ, depressive rumination is found to be: (a) elevated in currently depressed patients, formerly depressed patients, and women relative to men (Riso et al., 2003; Roberts, Gilboa, & Gotlib, 1998); (b) associated with depressive symptoms in adults (Eshun, 2000; Ito et al., 2003; Lam, Smith, Checkley, Rijdsdijk, & Sham, 2003; Richmond, Spring, Sommerfeld, & McChargue, 2001; see review by Thomsen, 2006), children (Abela, Vanderbilt, & Rochon, 2004; Ziegert & Kistner, 2002) and adolescents (Kuyken, Watkins, Holden, & Cook, 2006). Moreover, depressive rumination partially accounts for the 2:1 rates of depression in women relative to men: once statistically adjusted for, there is no difference between men and women in rates of depression (Butler & Nolen-Hoeksema, 1994; Grant et al., 2004; Nolen-Hoeksema, Larson, & Grayson, 1999).

Measures of forms of RT other than depressive rumination are also positively and significantly correlated with depression, including a general tendency towards RT (e.g., global rumination scale, Harrington & Blakenship, 2002; McIntosh & Martin, 1992; Segerstrom et al., 2000, Study 1), worry (PSWQ, Meyer et al., 1990; Segerstrom et al., 2000, or self-rating, Borkovec et al., 1983), rumination on sadness (Conway et al., 2000), rumination as operationalized by Trapnell and Campbell (1999), content-independent perseverative thinking (Ehring, 2007) or RT measured on the Measure of Mental Anticipatory Processes (MMAP, Feldman & Hayes, 2005). The MMAP assesses trait disposition to respond with various forms of RT when faced with an “important, difficult and stressful problem”, including Stagnant Deliberation (e.g., “Whenever I think about the problem, I often wind up getting stuck”), Problem Analysis (e.g., “I think about why this problem is happening”), Plan Rehearsal (e.g., “I mentally visualize the steps involved in solving the problem”) and Outcome Fantasy (e.g., “I fantasize about it all just going away”). Both Stagnant deliberation and Outcome fantasy were positively correlated with worry (PSWQ), depressive rumination (RSQ) and depression symptoms. Likewise, mind wandering, as measured by thought sampling during a task, is consistently associated with self-reported dysphoria across a wide range of tasks including word learning (Smallwood et al., 2003; Smallwood, O'Connor, Sudberry, Haskell, & Ballantyne, 2004; Smallwood, O'Connor, Sudberry, & Obonsawin, 2007), sustained attention (Smallwood et al., 2004), and word fragment completion (Smallwood, O'Connor, & Heim, 2005).

Prospective longitudinal studies

Main effect of RT. Prospective longitudinal studies have found that the RSQ predicts: (a) the future onset of a major depressive episode across a range of follow-up periods in initially non-depressed individuals (Just & Alloy, 1997; Nolen-Hoeksema, 2000; Spasojevic & Alloy,

2001 using the same sample as Just & Alloy 1997, found that rumination mediated effect of other risk factors on onset of depression); (b) depressive symptoms across a range of follow-up periods in initially non-depressed individuals, after controlling for baseline symptoms (Abela, Brozina, & Haigh, 2002; Butler & Nolen-Hoeksema, 1994; Hong, 2007; Nolen-Hoeksema, 2000; Nolen-Hoeksema & Morrow, 1991; Nolen-Hoeksema, Parker, & Larson, 1994; Nolen-Hoeksema, Stice, Wade, & Bohon, 2007; Sakamoto, Kambara, & Tanno, 2001; Schwartz & Koenig, 1996; Smith, Alloy, & Abramson, 2006); (c) depressive symptoms in patients with clinical depression, after controlling for baseline depression (Kuehner & Weber, 1999; Nolen-Hoeksema, 2000; Rohan, Sigmon, & Dorhofer, 2003), although one non-replication should be noted (88 college students with recent onset major depressive episode, follow-up after 6 mths; reported in both Kasch, Klein, & Lara, 2001, Lara, Klein, & Kasch, 2000).

It is worth noting one limitation of the RSQ: RSQ items are multidimensional, such that rumination assessed on the RSQ overlaps conceptually with a number of other constructs including depressive symptoms (Roberts et al., 1998; Treynor, Gonzalez, & Nolen-Hoeksema, 2003), negative affectivity-neuroticism (Kasch, Klein, & Lara, 2001; Watson & Clark, 1984), and cognitive reactivity (Scher, Ingram, & Segal, 2005; Segal et al., 2006; Segal, Gemar, & Williams, 1999; Van der Does, 2002), each of which could potentially account for RSQ predicting prospective depression. However, this concern is offset by convergent evidence that other measures of RT predict depression. First, other measures of depressive rumination predict future depressive mood: (a) diary studies in which participants recorded their moods and responses to their moods every day for at least two weeks, for both undergraduates (Nolen-Hoeksema, Morrow, & Fredrickson, 1993) and patients with seasonal affective disorder (Young & Azam, 2003); (b) ratings of interview transcripts for rumination about the recent death of their

partner from AIDS in gay men (Nolen-Hoeksema, McBride, & Larson, 1997); (c) experience sampling methodology in which momentary ruminative self-focus reported in response to randomly timed beeps on an electronic watch predicted negative affect at the subsequent recording point (on average 1.5 hrs later), after controlling for T1 negative affect (Moberly & Watkins, in press).

Second, forms of RT other than depressive rumination predict future levels of depression in prospective longitudinal studies including: (a) the Rumination to Sadness Scale in depressed patients with 7-month follow-up (Raes et al., 2006); (b) the Emotion Control Questionnaire-Rehearsal subscale with 8 week follow-up (Rector & Roger, 1996); (c) Stagnant deliberation and Outcome fantasy scales on the MMAP predicted depression symptoms 13 weeks later in first year law students, after controlling for initial levels of depression (Feldman & Hayes, 2005); (d) habitual negative self-thinking predicted depressive symptoms 9 months later, after controlling for baseline depression, negative life events, and dysfunctional attitudes in 1,102 Norwegian citizens (Verplanken et al., 2007); (e) with a 8-month follow-up, rumination about negative content predicted future depression and mediated the effects of depressive rumination in predicting depression (Ito, Takenaka, & Agari, 2005; Ito, Takenaka, Tomita, & Agari, 2006).

Effect of RT moderated by context. Several studies report moderating relationships between depressive rumination and intrapersonal variables in predicting future depression. First, within the Temple-Wisconsin Cognitive Vulnerability to Depression (CVD) project, in which undergraduates selected for high and low risk on negative cognitive style were followed up for 2.5 years, an interaction of negative cognitive style and stress-reactive rumination significantly predicted the rate, number, and duration of major depressive episodes, even after controlling for level of depression at T1 (Just & Alloy, 1997; Robinson & Alloy, 2003; for other CVD studies

see; Smith et al., 2006; Spasojevic & Alloy, 2001). Stress-reactive rumination assessed the tendency to ruminate about negative inferences following stressful events by adapting the RSQ (e.g., “Think about how the stressful event was all your fault”). Negative cognitive style was assessed by the Dysfunctional Attitudes Scale (DAS; Weissman & Beck, 1978), which indexes the endorsement of maladaptive, perfectionistic beliefs about the contingencies necessary to demonstrate self-worth, (e.g., “If I do not do well all the time people will not respect me”) and by the Cognitive Style Questionnaire, which assesses attributions about the internality, stability and globality of events and inferences about the consequences of events for self-worth. Stress-reactive rumination predicted future episodes of major depression in individuals with high levels of negative cognitive style, but not in individuals with low levels of negative cognitive style.

Second, trait depressive rumination, self-esteem, and stressful life events interacted in predicting maintenance of depression over a 6-week period in mildly depressed undergraduates (Ciesla & Roberts, in press). Depressive rumination predicted depression at follow-up only among participants with both low self-esteem and a high level of stressful life events. Third, depressive rumination interacted with baseline depression symptoms to predict future depression (Nolan, Roberts, & Gotlib, 1998; Roelofs, Muris, Hulbers, Peeters, & Arntz, 2006). Moreover, one study found that depressive rumination interacted with stressful life events to predict future depression, indicating that situational context can moderate the effects of rumination (Morrison & O'Connor, 2005). Thus, across these studies, the unconstructive consequences of depressive rumination only occurred in individuals with more negative self-beliefs, more pessimistic attributions, more depressed mood or negative life events.

Effect of RT moderated by thought content. Factor analyses of the RSQ have identified distinct subtypes of depressive rumination: Brooding versus Reflective Pondering (Treyner et al.,

2003); Dwelling on the Negative versus Active Cognitive Appraisal (Fresco et al., 2002); Symptom-focused rumination versus Introspection versus Self-Blame (Roberts et al., 1998). Across these distinctions, the subtypes linked to more unconstructive consequences (Brooding, Dwelling on the Negative, Self-Blame) all share a common theme as reflected in scale items, i.e., negative, self-critical, evaluative (e.g., “Why can’t I handle things better?”), judgmental, and comparative thinking about the self (e.g., “Why do I have problems other people don’t have?”). The evidence is strongest for the distinction between Brooding and Reflective Pondering, which was found when the RSQ was factor analyzed once the items referring to symptoms of depression were removed. Brooding is characterized by “moody pondering” (Treyner et al., 2003, p.251), whereas reflective pondering is characterized by items such as “Analyze recent events to understand why you are depressed” and was interpreted “as a purposeful turning inward to engage in cognitive problem solving to alleviate one’s depressive symptoms” (p. 256). Brooding measured at T1 predicted both increased concurrent depression and increased future depression assessed one year later, even after controlling for depression levels at T1, whereas reflective pondering measured at T1 predicted increased concurrent depression but reduced future depression assessed one year later (Treyner et al., 2003). In adolescents, brooding but not reflective pondering predicted the development of depressive symptoms over time (Burwell & Shirk, 2007). Furthermore, in patients with major depression, brooding but not reflective pondering was significantly correlated with an attentional bias towards sad facial expressions relative to neutral facial expressions, as assessed on a facial dot-probe task, after controlling for level of depressive symptoms (Joormann, Dkane, & Gotlib, 2006). These results suggest that thought valence and content during RT may moderate its consequences, with the negative, self-critical thinking typical of brooding more maladaptive.

Limitations. A general limitation of these longitudinal prospective studies is that many studies have not factored prior episodes of the relevant disorder (e.g., prior major depression, as opposed to depressive symptoms) into the analyses. As such, the possibility that past major depressive episodes is a common factor linking RT and prospective depression cannot be ruled out. For example, if RT is the result of “scarring” from a previous episode then this relationship could explain why RT is associated with increased risk for future depression.

Experimental studies

Main effect of RT. Studies that experimentally manipulated RT in the form of worry, by asking participants to briefly worry about a self-chosen concern, found that worry increases depressed mood in normal participants (Andrews & Borkovec, 1988; Behar, Zullig, & Borkovec, 2005; Borkovec et al., 1983; McLaughlin, Borkovec, & Sibrava, 2007; see review in Borkovec et al., 1998) and produces a short-term increase in negative intrusive thoughts, relative to relaxation or visual imagery or no instruction conditions (Borkovec et al., 1983; Wells & Papageorgiou, 1995; York, Borkovec, Vasey, & Stern, 1987). Experimental studies have also demonstrated that trait predisposition towards RT increases emotional reactivity to negative mood inductions and mood challenges, particularly when participants are provided with a delay period that allows the opportunity to ruminate (Conway et al., 2000; Thomsen, Jorgensen, Mehlsen, & Zachariae, 2004).

Effect of RT moderated by intrapersonal context. Moreover, a series of studies provide convergent evidence that RT in the form of depressive rumination plays a causal role in a range of unconstructive outcomes associated with depression, including exacerbating negative affect and increasing negative cognition (for further details see Table 1). These studies used a standardized rumination induction, in which participants are instructed to spend 8 minutes

concentrating on a series of sentences that involve rumination about themselves, their current feelings and physical state and the causes and consequences of their feelings (e.g., “Think about the way you feel inside”; Lyubomirsky & Nolen-Hoeksema, 1995; Nolen-Hoeksema & Morrow, 1993). As a control condition, a distraction induction is typically used, in which participants are instructed to spend 8 minutes concentrating on a series of sentences that involve imagining visual scenes that are unrelated to the self or to current feelings (e.g., “Think about a fire darting round a log in a fire place”).

Compared to the distraction induction, the rumination induction is reliably found to have negative consequences on mood and cognition. Critically the differential effects of these manipulations are only found *when participants are already in a dysphoric mood* before the manipulations, indicating a moderating role for intrapersonal context. Under these conditions, compared to distraction, rumination exacerbates negative mood (Lavender & Watkins, 2004; Lyubomirsky & Nolen-Hoeksema, 1995; Morrow & Nolen-Hoeksema, 1990; Nolen-Hoeksema & Morrow, 1993; Watkins & Teasdale, 2001), increases negative thinking (Lyubomirsky & Nolen-Hoeksema, 1995), increases negative autobiographical memory recall (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998), reduces the specificity of autobiographical memory retrieval (Kao, Dritschel, & Astell, 2006; Park, Goodyer, & Teasdale, 2004; Watkins & Teasdale, 2001; Watkins, Teasdale, & Williams, 2000, see Williams et al., 2007 for discussion), increases negative thinking about the future (Lavender & Watkins, 2004), impairs concentration and central executive functioning (Lyubomirsky, Kasri, & Zehm, 2003; Watkins & Brown, 2002), impairs controlled memory retrieval (Hertel, 1998) and impairs social problem solving (Donaldson & Lam, 2004; Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky, Tucker, Caldwell, & Berg, 1999). Likewise, when they ruminated after a negative mood induction,

dysphoric individuals recalled more negative memories, whereas non-dysphoric individuals recalled more positive memories (Joormann & Siemer, 2004). This pattern of results has been found for both dysphoric, non-clinical participants and for depressed patients (e.g., Donaldson & Lam, 2005; Lavender & Watkins, 2004; Park, Goodyer, & Teasdale, 2004; Rimes & Watkins, 2004; Watkins & Brown, 2002; Watkins & Teasdale, 2001), suggesting that the effects generalize to clinical samples.

Extending the role of intrapersonal context, Ciesla and Roberts (in press) found that the effect of trait predisposition towards depressive rumination (RSQ) on subsequent emotional response was moderated by dysfunctional attitudes and self-esteem, such that following a negative mood induction, higher levels of trait rumination were associated with higher levels of dysphoric affect after an 8-minute no-task delay period in participants with low self-esteem or high dysfunctional attitudes but not in participants with high self-esteem or low dysfunctional attitudes. Moreover, self-esteem and dysfunctional attitudes interacted with the rumination versus distraction manipulations after a sad mood induction to predict later levels of dysphoria, such that individuals with lower self-esteem and more dysfunctional attitudes had elevated dysphoric mood, with this effect stronger in the rumination condition than in the distraction condition (Ciesla & Roberts, in press).

Markman and Miller (2006) further extended the moderating effect of level of depression on the consequences of RT to forms of RT other than depressive rumination. A sample of students with a range of depressive symptoms (non-depressed, ND; mild-to-moderately depressed, MD; severely depressed, SD) generated upward counterfactuals about a recent negative academic outcome (Markman & Miller, 2006). There was a greater reduction in negative evaluation of the event following RT for the ND and MD participants than for the SD

participants. Further, MD participants generated a greater proportion of counterfactuals focusing on specific controllable behaviors relative to uncontrollable, enduring qualities of the self than the ND and SD participants. In turn, the SD participants generated more counterfactuals involving characterological self-blame than the ND and MD participants. Thus, RT was unconstructive in the SD group but constructive in the MD depressed group.

Effect of RT moderated by concrete vs. abstract processing during RT. The effect of trait predisposition towards RT on emotional reactivity is moderated by the thinking style adopted by participants. Increasing trait predisposition towards RT (as assessed on the Action Control Scale-Preoccupation, Kuhl, 1994, sample item “When I am in a competition and have lost every time, the thought that I lost keeps running through my mind”) was correlated with slower emotional recovery following a prior failure experience (Watkins, 2004a) and greater emotional reactivity to a subsequent failure experience (Moberly & Watkins, 2006), but only in participants manipulated into adopting an abstract, evaluative mindset focused on the causes, meanings, and implications of events. Watkins (2004a) randomly allocated participants to expressive writing about a previously induced failure in either an abstract, evaluative way (e.g., “Why did you feel this way?”) or a concrete, experiential way (e.g., “How did you feel moment-by-moment?”). At higher levels of preoccupation, levels of negative mood 12 hours after the failure were greater, but only in individuals who wrote in the abstract, evaluative way, and not in individuals who wrote in the more concrete, experiential way. Moberly and Watkins (2006) trained participants to repetitively think about emotional scenarios, either imagining the concrete details of what is happening in each scenario or evaluating the causes, meanings and implications of each scenario, prior to an unanticipated failure experience. After the failure experience, higher levels of trait

preoccupation were significantly correlated with lower levels of positive affect, but only for participants in the evaluative condition and not for participants in the concrete condition.

Limitations. A limitation of many experimental studies comparing rumination vs. distraction is the lack of a no-intervention control making it impossible to determine whether the distinct consequences are due to active negative effects of rumination and/or active positive effects of distraction. However, selecting an appropriate control condition is difficult in dysphoric participants: a passive control condition that involves “doing nothing” may simply allow naturally occurring rumination to continue (e.g., Hertel, 1998), whereas any active control condition may act as a distraction. Nonetheless, a number of other experimental manipulations of RT, for example of worry, also included a no-intervention control and replicated the finding that RT increased depression, consistent with RT having an active detrimental effect.

Summary of RT and vulnerability to depression

This review reveals that there is an extensive body of findings suggesting that RT is involved in the onset and maintenance of depression, with both depressive rumination and a range of other types of RT predicting future depression in longitudinal prospective studies, and increasing negative affect when experimentally induced. Thus, there is convergent evidence across numerous studies utilizing different populations, different measures (RSQ, interview, self-report), different study designs, and different forms of RT, all of which are consistent with the hypothesis that RT is a process underpinning the onset and development of depression.

Repetitive Thought and Vulnerability to Anxiety

Cross-sectional studies

In non-clinical samples, RT is significantly and positively correlated with increased levels of concurrent trait and state anxiety, whether assessed as worry (e.g., Davey, Hampton,

Farrell, & Davidson, 1992; Meyer et al., 1990; Siddique, LaSalle-Ricci, Glass, Arnkoff, & Diaz, 2006), stagnant deliberation, outcome fantasy, problem analysis (Feldman & Hayes, 2005), global rumination (Harrington & Blakenship, 2002), rumination about a traumatic event (Steil & Ehlers, 2000), or emotional processing (Stanton et al., 2000).

Moreover, RT is a key element of a number of anxiety disorders (Chelminski & Zimmerman, 2003; Harvey et al., 2004): generalized anxiety disorder (GAD), social anxiety, and post-traumatic stress disorder (PTSD). Chronic worry is a central and defining characteristic of GAD (American Psychiatric Association, 1994; Hoyer, Becker, & Margraf, 2002). Within social anxiety, post-event rumination has been identified as an important process: Compared to low-anxious controls, individuals with high social anxiety and patients with a diagnosis of social anxiety demonstrate significantly more post-event RT following social interactions, performing mental “post-mortems” on how the interaction went and how they performed (Abbott & Rapee, 2004; Edwards, Rapee, & Franklin, 2003; Kocovski, Endler, Rector, & Flett, 2005; Mellings & Alden, 2000; Perini, Abbott, & Rapee, 2006; Rachman, Gruter-Andrew, & Shafran, 2000; Rapee & Heimberg, 1997).

RT has also been implicated as an important process in the development of PTSD. Ehlers and colleagues have conceptualized RT about a traumatic event as a causal mechanism in the development of PTSD. Using brief self-report measures of RT about an identified traumatic event (e.g., “Do you go over and over what happened again and again?”), they have found RT to be elevated in patients with PTSD compared to non-clinical controls (e.g., Ehlers, Mayou & Bryant, 1998). Likewise, in survivors of physical assault, the frequency of counterfactual thoughts was positively correlated with PTSD symptoms such as intrusions about the negative event (El Leithy, Brown, & Robbins, 2006), and for women who had experienced recurrent

miscarriage, upward counterfactual thinking was positively correlated with anxiety (Callander & Brown, 2007). Similarly, counterfactual thinking following uncontrollable and traumatic events, such as sudden infant death, is associated with a greater level of distress (Davis, Lehman, Wortman, Silver, & Thompson, 1995).

Prospective longitudinal studies

In non-clinical samples, RT has been found to predict: (a) elevated levels of self-reported anxiety in undergraduates following their midterm exams, after controlling for baseline anxiety (Sarin, Abela, & Auerbach, 2005; Segerstrom et al., 2000); (b) prospective increases in anxiety for law students before and after their first semester final exams (Siddique et al., 2006); (c) prospective increases in anxiety over 1 month (Hong, 2007), over 6-8 weeks (Calmes & Roberts, 2007), and over 9 months (Verplanken et al., 2007); (d) the onset and severity of post-traumatic stress symptoms following traumatic events such as the Lomo Prieta earthquake of 1989 (Nolen-Hoeksema & Morrow, 1991). Furthermore, following traumatic events, RT about the trauma predicts the persistence of PTSD in prospective longitudinal studies from 6 months to 3 years later, for road accidents (Ehlers, Mayou, & Bryant, 1998; Ehlers, Mayou, & Bryant, 2003; Holeva, Tarrier, & Wells, 2001; Mayou, Bryant, & Ehlers, 2001; Mayou, Ehlers, & Bryant, 2002; Murray, Ehlers, & Mayou, 2002), assaults (Halligan, Michael, Clark, & Ehlers, 2003; Michael, Ehlers, Halligan, & Clark, 2005), and in ambulance workers (Clohessy & Ehlers, 1999).

Experimental studies

Main effects of RT. In experimental studies, RT has been found to increase anxiety, whether the RT consists of brief periods of worry about self-chosen concerns (Andrews & Borkovec, 1988; Borkovec et al., 1983; Behar et al., 2005; McLaughlin et al., 2007), or a

rumination manipulation that exacerbates pre-existing anxious mood (Blagden & Craske, 1996). When university students were asked to describe a distressing event that occurred in the last 2 years and then randomly allocated to rumination (prompts like “Why has this event happened to me?”) or distraction (a word generation task), rumination resulted in a greater increase in negative affect and higher levels of intrusive memories than distraction (Ehring, Szeimies, & Schaffrick, 2007), suggesting a potential causal role for rumination in the development of post-traumatic symptoms.

Effect of RT moderated by interpersonal and situational context. Kashdan and Roberts (2007) found that there was an interactive effect of intrapersonal and situational context on the consequences of post-event rumination for next-day negative affect following a social situation. Unacquainted undergraduates engaged in 45 min interactions with randomly paired opposite-sex partners, working through questions structured to induce either personal self-disclosure (e.g., “What is your most treasured memory?”) or to mimic small-talk (“What is the best TV show you’ve seen?”). For individuals with higher levels of trait social anxiety, post-event rumination for the 24 hrs post-event was associated with increases in negative affect following personal disclosure, but associated with decreases in negative affect following small-talk (Kashdan & Roberts, 2007). There was no interaction between rumination and situation in predicting negative affect for individuals with lower levels of social anxiety. Thus, in a situational context that was more personally revealing, and, presumably, more meaningful and threatening for individuals high in social anxiety, post-event rumination had more negative consequences.

Effect of RT moderated by concrete vs. abstract processing during RT. In an analogue study of post-traumatic stress symptoms, undergraduates watched a distressing film showing the aftermath of motor vehicle accidents, known to induce negative affect and intrusions, and were

then randomly allocated to abstract rumination, concrete rumination or distraction (Ehring et al., 2007). Across time, abstract rumination resulted in slower recovery of negative affect than concrete rumination or distraction. Moreover, concrete rumination resulted in fewer negative intrusions than abstract rumination and distraction, which did not differ from each other. Thus, these results suggest that abstract rumination may be particularly unconstructive following exposure to a distressing event.

Repetitive Thought and Impaired Physical Health

Consistent with the perseverative cognition hypothesis (Brosschot et al., 2006), RT correlates with indices of poor physical health and prospectively predicts health-related outcomes.

Cross-sectional studies

First, RT is associated with increases in cortisol secretion, which is an index of activation of the hypothalamic-pituitary-adrenal axis, whether assessed as worry (Schlotz, Hellhammer, Schulz, & Stone, 2004) or Rehearsal (Roger & Najarian, 1998). Second, high trait worry is associated with suppression of the expected increase in natural killer immune cells when experimentally exposed to a fearful situation (Segerstrom, Glover, Craske, & Fahey, 1999) and with reduced natural killer immune cells in response to a naturally-occurring trauma (Segerstrom, Solomon, Kemeny, & Fahey, 1998). Third, RT is associated with dysregulated cardiovascular function: worry is associated with reduced heart rate variability and increased heart rate (Borkovec & Hu, 1990; Borkovec, Lyonfields, Wisner, & Deihl, 1993; Brosschot & Thayer, 2003; Lyonfields, Borkovec, & Thayer, 1995); RT (Rehearsal) is associated with delayed heart rate recovery following a challenging task (Roger & Jamieson, 1988; Roger & Najarian, 1989). Reduced heart rate variability is an index of parasympathetic activity and a risk

factor for increased mortality, specifically associated with hypertension and cardiovascular disorders (Stein & Kleiger, 1999). Fourth, high levels of depressive rumination are associated with delay in presenting the symptoms of breast cancer to a healthcare professional (Lyubomirsky, Kasri, Chang, & Chung, 2006) and RT is associated with more physical symptoms in women undergoing a breast cancer prevention trial (Segerstrom, Stanton, Alden, & Shortridge, 2003). Fifth, RT has also been implicated in the development of insomnia (Gross & Borkovec, 1982; Harvey, 2000; Nelson & Harvey, 2002). Insomnia is associated with increased pre-sleep worry (Harvey, 2000), and RT is associated with poorer sleep quality and longer time to fall asleep (Thomsen, Mehlsen, Christensen, & Zachariae, 2003).

Prospective longitudinal studies

Increased RT prospectively predicts: (a) increased heart disease over a 20 year follow-up doubling the risk for high worriers compared to low worriers (Kubzansky et al., 1997); (b) increased somatic health complaints in high school students, with the use of a controlled worry period reducing subsequent somatic complaints (Brosschot & van der Doef, 2006); (c) higher levels of fatigue over a 10 month follow-up (Andrea et al., 2004); (d) slower recovery and impaired wound healing following surgery for hernias (Broadbent, Petrie, Alley, & Booth, 2003); (e) fewer natural killer (NK) cells in the months after the Northridge earthquake (Segerstrom et al., 1998); (f) slower clearing of psoriasis in response to psoralen-UV-A (PUVA) photochemotherapy (Fortune et al., 2003); (g) reduced functional status and reduced grip strength 1 year after the diagnosis of rheumatoid arthritis (Evers, Kraaimaat, Geenen, & Bijlsma, 1998); and (h) self-reported physical health problems 1 year later in 20-35 year olds and increased health care utilization over the subsequent year in 70-85 year olds (Thomsen et al., 2004b; Thomsen et al., 2004a).

Experimental studies

Consistent with the hypothesis that RT plays a causal role in poor physical health, experimental manipulations of RT have been shown to influence health-related indices. First, experimental induction of rumination about a previous emotionally stressful task results in increased blood pressure (BP) and delayed recovery of BP whereas distraction facilitates BP recovery (Glynn, Christenfeld, & Gerin, 2002). Second, trait anger rumination predicts prolonged elevated BP after recalling an angry event (Schwartz et al., 2000) or after an anger provocation (Suchday, Carter, Ewart, Larkin, & Desiderato, 2004). High sustained BP is a risk factor for many diseases including cardiovascular disease and diabetes. Third, compared to distraction, ruminating about a mid-session exam resulted in more pre-sleep intrusive thoughts and poorer ratings of sleep quality for high-trait ruminators but not for low-trait ruminators (Guastella & Moulds, 2007). Fourth, Nelson and Harvey (2002) gave patients with insomnia a speech threat just prior to bedtime. Thinking about giving the speech in images produced more initial distress and self-reported arousal but shorter sleep onset latency than worrying about the speech verbally.

Repetitive Thought with Constructive Consequences

There is also a growing literature indicating how RT can be adaptive, functional and beneficial, although, as noted earlier, the constructive consequences of RT have been less investigated than the unconstructive consequences of RT. The relevant studies are summarized in Table 2. The main emergent findings are that RT is implicated in: (a) successful cognitive processing and recovery from upsetting and traumatic events; (b) adaptive preparation and planning for the future; (c) recovery from depression; and (d) uptake of health-promoting behaviors.

*Repetitive Thought and Successful Cognitive Processing of Stress, Loss and Trauma**Cross-sectional studies*

Main effects of RT. A number of studies have found that following stressful or traumatic events, RT in the form of cognitive processing is associated with acceptance and recovery. People who actively think about the trauma and its implications are more likely to find meaning or experience growth than people who do not dwell on the trauma (Bower et al., 1998; Calhoun et al., 2000; Tedeschi & Calhoun, 2004; Ullrich & Lutgendorf, 2002). Extent of RT after a traumatic or stressful event was positively associated with more post-traumatic growth, as indexed by self-reported increases in relating to others, discovering new possibilities, discovering personal strength, and increased appreciation of life (Calhoun et al., 2000). For example, RT immediately after a child's death was associated with posttraumatic growth in bereaved parents, whereas more recent RT was not, and, in older adults, growth attributed to the struggle with their most stressful events was associated with frequency of rumination across all traumatic events (Calhoun, Tedeschi, Fulmer & Harlan, 2000 and Tedeschi, Calhoun & Cooper, 2000, both cited in Tedeschi et al., 2004). Similarly, RT, defined as recurrent event-related thoughts that help one understand, resolve and make sense of trauma-related events, was correlated with competency beliefs about ability to handle problems arising from the trauma in children evacuated because of Hurricane Floyd (Cryder, Kilmer, Tedeschi, & Calhoun, 2006).

Effects of RT moderated by thought content. Segerstrom and colleagues (2003) examined the nature of RT and its role in adjustment in women who were exposed to a stressful situation through being identified as being at high risk for breast cancer. In previous undergraduate studies, (Segerstrom et al., 2003, studies 1 and 2), multidimensional scaling across large samples of structured measures of ruminative thinking and sampled thoughts concerning rumination had revealed that RT could be described on 2 independent structural dimensions: valence of content

(negative versus positive) and purpose. As thought content became more negative, affect was rated as more negative. The purpose dimension reflected the goals motivating rumination, with two extremes of purpose: searching for new ideas and experiences versus solving problems and improving certainty and predictability. Solving was defined as “trying to narrow down, to make sure, to make plans or to declare knowledge” (p. 24). Examples included causal statements, summary statements, statements of definite consequences, and planning. Searching was defined as “exploring, considering possibilities, or expressing confusion”. Examples included expressions of uncertainty, generating options, indecision or confusion, listing multiple possibilities, and learning new perspectives or ways. In the breast cancer study, the valence of thought content during RT predicted concurrent affect and well-being: less negative content during RT was associated with less negative affect, more positive affect, better overall mental health, less anxiety, and fewer physical symptoms (Segerstrom et al., 2003). Furthermore, there were also interactions between valence and purpose on affect and ratings of physical health: when the valence of RT content was positive, a searching purpose was associated with decreased positive affect and decreased ratings of physical health, but when the valence of thought content was negative, a searching purpose was associated with increased positive affect and increased ratings of physical health. This pattern of results suggests that during RT about negative content, RT with a searching, exploring purpose is associated with more constructive outcomes than RT with a solving, making sure purpose.

Prospective longitudinal studies

In a prospective study examining outcomes for HIV-seropositive men who had experienced an AIDS-related bereavement, RT about the bereavement was associated with finding more meaning in the loss over the next 2-3 years, which in turn was associated with

better immune responses and reduced AIDs-related mortality over a 7 year follow-up (Bower et al., 1998). Finding meaning was operationalized as a major shift in values, priorities or perspectives in response to the loss. RT about bereavement was a necessary although not a sufficient condition for discovery of meaning and improved physical health. Discovery of meaning included developing new personal growth goals, an enhanced sense of living in the present and the development of new perspectives, such as life is precious, which is consistent with the concept of “finding benefit”. Finding benefit is defined as considering positive meanings of the traumatic event and positive benefits or value learnt as a result of the event, and is increasingly hypothesized to be an important contributor to successful cognitive processing of upsetting events (Affleck & Tennen, 1996; King & Miner, 2000; Moskowitz, Folkman, Collette, & Vittinghoff, 1996). There is growing evidence from prospective longitudinal studies that finding benefit predicts better future psychological adjustment and more adaptive responses to negative life events than simply trying to understand and make sense of the event (Davis, Nolen-Hoeksema, & Larson, 1998; Stein, Folkman, Trabasso, & Richards, 1997; Taylor, Wood, & Lichtman, 1983; Tugade & Fredrickson, 2004; Tugade, Fredrickson, & Barrett, 2004).

Experimental studies

Experimental studies of expressive writing, in which repeated writing about distressing events is found to have more beneficial consequences for psychological and physical health than repeated writing about a neutral event, provide broad evidence consistent with a constructive effect for (at least a constrained form of) RT following distress (Foa, Molnar, & Cashman, 1995; Klein & Boals, 2001; Pennebaker, 1997; Pennebaker, Mayne, & Francis, 1997; Pennebaker & Seagal, 1999; Sloan & Marx, 2004; Smyth, True, & Souto, 2001). For example, when undergraduates completed journals for one

month, those who wrote about cognitions and emotions related to a stressful event had a greater increase in self-reported post-traumatic growth than those who wrote only about emotions related to a stressful event or who wrote factually about media events (Ullrich & Lutgendorf, 2002). As described earlier, Ehring et al., (2007) found experimental evidence that concrete RT about a distressing film resulted in fewer intrusions about the film compared to abstract RT or distraction.

Limitations

It is important to acknowledge that this cognitive processing and posttraumatic growth literature has two major limitations: (a) the majority of studies are only cross-sectional; (b) the principal outcome measures are self-report, leading to questions as to whether reported benefits can be taken at face value or reflect inaccurate, biased or defensive perceptions (Nolen-Hoeksema & Davis, 2004; Zoellner & Maercker, 2006).

Repetitive Thought Contributes to Adaptive Preparation and Anticipatory Planning

There is convergent evidence that RT contributes to anticipatory planning and adaptive self-regulation, consistent with the hypothesis that RT can facilitate preparatory and adaptive behaviors designed to reduce potential threats (Tallis & Eysenck, 1994).

Cross-sectional studies

RT is associated with better academic and workplace performance, and correlated with constructive problem-solving and creativity. First, worry is associated with better workplace performance but only for more able individuals (Perkins & Corr, 2005). Second, after controlling for trait anxiety, worry is correlated with increased report of active behavioral problem-solving and seeking more information in response to a recent stressful event (Davey et al., 1992). Third, diary measures indicate that a large proportion of worry reflects problem-solving attempts, which are often successful (Szabo & Lovibond, 2004; Szabo & Lovibond, 2006). Fourth, for survivors

of physical assault, upward counterfactual fluency, assessed in terms of the number of different upward counterfactual thoughts generated about the trauma, was correlated with the generation of behavioral plans (El Leithy et al., 2006). Fifth, reflectivity, operationalized as the number of themes and ideas produced when generating actions, outcomes and consequences for coping plans to hypothetical but common problem situations, is positively correlated with better subsequent academic performance for individuals who preferentially use the defensive pessimism strategy but negatively correlated with academic performance for individuals who preferentially use an optimistic strategy, characterized by high expectations and little reflection prior to a task (Cantor, Norem, Niedenthal, Langston, & Brower, 1987). Sixth, the reflective pondering subscale from the RSQ is significantly positively correlated with self-rated creative interests and objectively measured creative fluency, originality and elaboration (Verhaeghen, Joormann, & Khan, 2005). Unfortunately, brooding was not assessed so it is not known whether the relationship between RT and creativity is unique to reflective pondering or not.

Prospective longitudinal studies

After controlling for trait anxiety, worry prospectively predicts better academic performance during the first year of law school (Siddique et al., 2006). Upward counterfactuals have also been found to produce useful intentions for future behavior and predict better subsequent performance on anagram tasks and academic courses (Nasco & Marsh, 1999; Roesse, 1994; Spellman & Mandel, 1999).

Experimental studies

Effect of RT moderated by thought content and intrapersonal context. On a laboratory arithmetic task, during a lab-based social interaction, or when pursuing their personal goals during an experience sampling methodology study, defensive pessimists performed better (e.g.,

more arithmetic solutions, talking for longer, more positive ratings by other participant in conversation) and experienced less negative affect and more positive self-relevant thoughts when manipulated to repetitively focus on possible negative outcomes, compared to no reflection or to focus on positive outcomes (Norem & Illingworth, 1993; Showers, 1992). In contrast, there was little effect on performance of manipulating reflection in optimists. Similarly, defensive pessimists performed best on a dart-throwing task when they imagined what could go wrong and ways to correct these problems and performed significantly worse when they engaged in relaxation imagery or imagined a flawless performance (Spencer & Norem, 1996). Thus RT on negative outcomes was constructive for defensive pessimists but not for optimists.

Effect of RT moderated by concrete vs. abstract processing during RT. There is evidence that the focus of attention during repetitive mental simulations influences the effectiveness of planning and self-regulation (Taylor & Schneider, 1989; Taylor, Pham, Rivkin & Armor, 1998). For example, students who repeatedly imagined the process of how to take steps towards obtaining a high exam grade studied more and obtained better grades than students who repeatedly imagined the outcome of obtaining a high grade or students who simply monitored their studying with no mental simulation (Pham & Taylor, 1999; Taylor et al., 1998). This effect of process simulation versus outcome simulation on exam performance was mediated by a reduction in anxiety and by increases in planning. Similarly, repeated imagining of an ongoing stressful event, how it happened and its associated emotions produced more positive affect and greater report of active coping after one week than imagining having resolved the situation or not imagining the event at all (Rivkin & Taylor, 1999). Likewise, process simulations help to reduce the planning fallacy, in which participants tend to underestimate the time taken to complete tasks (Taylor et al., 1998). Similarly, prompting RT focused on causal attributions and abstract

evaluations (using a set of questions such as “Why did this problem happen?”) impaired social problem solving in a recovered depressed group, who performed as well as never-depressed participants in a no-prompt control condition, whereas prompting RT focused on the concrete process of how to proceed (using a set of questions such as “How are you deciding what to do next?”) ameliorated the problem-solving deficit normally found in a group of currently depressed patients (Watkins & Baracaia, 2002). Again, RT focused on planning, induced by working through a list of the concrete (who, what) steps necessary to plan a charity fundraiser resulted in less dysphoric mood, better concentration and more efficient performance on a subsequent reading task than the standard rumination manipulation in dysphoric participants (Lyubomirsky et al., 2003, Study 1).

Repetitive Thought Predicts Recovery from Depression

Prospective longitudinal studies

Main effect of RT. RT prospectively predicts reduced levels of depression, whether in: (a) currently depressed patients receiving pharmacotherapy (Yamada, Nagayama, Tsutiyama, Kitamura, & Furukawa, 2003, RT = rating of extent "absorbed in thought about the dysphoric mood itself, its cause, and possible results when feeling down or depressed"); (b) a community sample (Treyner et al., 2003, reflective pondering on RSQ); (c) first year law students (Feldman & Hayes, 2005; Plan Rehearsal).

Effect of RT moderated by intrapersonal context. Depressive rumination interacted with self-esteem and dysfunctional attitudes in predicting response in patients with major or minor depression to a group psychoeducational treatment for depression (Ciesla & Roberts, 2002). In participants with low self-esteem or high dysfunctional attitudes, increased trait rumination was associated with worse treatment outcomes, whereas for participants with moderate levels of self-

esteem or low levels of dysfunctional attitudes, increased trait rumination predicted lower levels of depression symptoms post-treatment, even when controlling for symptoms pre-treatment.

Experimental studies

Effect of RT moderated by concrete vs. abstract processing during RT. There is evidence from experimental studies suggesting that RT can have constructive consequences on aspects of cognition implicated in the onset and maintenance of depression. A series of studies have adapted the standardized rumination induction (Nolen-Hoeksema & Morrow, 1993). Importantly, all variants retain the key elements of the original rumination manipulation, namely, repetitive focus on self, symptoms and mood, but with instructions to adopt different styles of processing when focusing on the self. Thus, in depressed patients, a rumination induction encouraging more concrete, experiential processing, in which participants were instructed to “focus attention on the experience of” feelings, mood and symptoms, was compared to a rumination induction encouraging more abstract and evaluative processing, in which participants were instructed to “think about the causes, meanings, and consequences” of feelings, mood, and symptoms (Watkins & Teasdale, 2001; 2004). Compared to abstract, evaluative rumination, experiential rumination reduced negative global self-judgments such as “I am worthless” (Rimes & Watkins, 2005), improved social problem solving (Watkins & Moulds, 2005a), and increased specificity of autobiographical memory recall (Watkins & Teasdale, 2001; Watkins & Teasdale, 2004). These cognitive processes are implicated in the onset and maintenance of depression (Williams et al., 2007). These findings suggest that RT focused on the direct experience of moods and feelings reduces patterns of cognitive processing implicated in increased vulnerability for depression, relative to RT focused on the causes, meanings and consequences of moods and feelings. It is important to note that both variants of rumination involve focus on negative

content: both repetitively focused attention on the feelings and symptoms of patients with current depression¹.

Repetitive Thought Contributes to the Uptake of Health-Promoting Behaviors

There is some preliminary evidence that RT is implicated in health-promoting behaviors. First, increased worry about physical health predicted prospective attempts to quit smoking in smokers over the following 8 months (Dijkstra & Brosschot, 2003). High worry was especially associated with a quit attempt in smokers with both high self-efficacy and beliefs that denied or rationalized away the risks associated with smoking. However, in ex-smokers with low self-efficacy and high denial beliefs, worry predicted a relapse back into smoking. Second, in a meta-analysis of 12 prospective studies that measured worry about breast cancer at baseline and subsequent breast self-examination or utilization of mammography, a small but reliable positive association was found between worry about breast cancer and screening behavior, with increased worry associated with greater probability of undertaking screening (Hay, McCaul, & Mangan, 2006).

Properties of Constructive and Unconstructive Repetitive Thought

Reviewing the extant literature, it therefore appears that RT can be both helpful and unhelpful. It is important to acknowledge that sometimes RT has predominantly either constructive or unconstructive outcomes, but that at other times RT may simultaneously have both constructive and unconstructive outcomes, for example, posttraumatic growth can occur alongside increased distress (Tedeschi & Calhoun, 2004). What then determines whether RT has constructive consequences and/or unconstructive consequences? Examining the literature reviewed, a number of properties emerge that potentially account for the distinct consequences of RT. These properties reflect both *structural* aspects of RT, such as the valence of thought content

during RT, and *process* aspects, such as the level of construal (concrete vs. abstract processing) adopted during RT².

Valence

Unsurprisingly, valence is important in determining the consequences of RT, both in terms of thought content (positive versus negative) and the cognitive-affective systems of the individual engaged in RT (e.g., positive versus negative mood; optimism versus pessimism). For example, RT about the acceptance of a paper that has had much work invested in it will have a very different and more positive affective quality than RT about the same paper if it was rejected.

There is considerable evidence that the valence of thought content is a major factor in determining whether RT is helpful or unhelpful. First, Segerstrom et al's (2003) structural analysis of RT identified the valence of thought content as an important dimension within RT, with more negative content associated with worse overall mental health, more anxiety, and more physical symptoms. Second, Martin and Tesser (1996) identified that rumination contains several subclasses or modes, including RT about positive content or about negative content. Third, in a large meta-analysis of the self-focus literature, attention to negative aspects of the self was strongly related to increased levels of negative affect, whereas attention to positive aspects of the self was related to lower levels of negative affect (Mor & Winquist, 2002). Moreover, depressive rumination was more strongly related to negative affect than nonruminative self-focus. Thus, RT focused on negative aspects of the self would have more negative consequences than RT focused on positive aspects of the self. Fourth, depressive rumination, the form of RT most convincingly implicated in causing unconstructive consequences, is conceptualized in terms of response to negative mood, and indexed by a measure (RSQ) that explicitly involves focuses on negative

content, with items characterized by thinking about feelings and symptoms when feeling sad, down and depressed.

Fifth, the result that “finding benefit” during RT has more constructive consequences (e.g., Bower et al., 1998) is consistent with the valence of thought content influencing outcomes: finding benefit involves a focus on positive content when repetitively thinking about the difficult or traumatic event. Consistent with this, the measure of RT used in the posttraumatic growth literature includes items that focus on positive gains (e.g., “I try to think of some good things that happened to me after the flooding”; Calhoun et al., 2000; Cryder et al., 2006). Sixth, the more pathological consequences found for Brooding could be a result of its particularly negative thought content, focused on self-evaluative analysis and self-critical judgment (Treyner et al., 2003). A number of commentators have suggested that brooding is characterized by self-evaluative, self-critical and self-judgmental analysis, consistent with more negative valence (Gortner, Rude, & Pennebaker, 2006; Joormann et al., 2006; Mathews, 2006; Treyner et al., 2003; Watkins & Moulds, 2005a; Watkins & Teasdale, 2004). Seventh, when the items of the RSQ were altered to de-emphasize evaluative, self-critical judgments, this non-judging Reflection scale was uncorrelated with depression symptoms, unlike the standard Reflection scale which was significantly correlated with depression. Thus, changing the negative judgmental quality of these items reduced their relationship to depression (Rude, Maestas, & Neff, 2007). Eighth, whilst rumination about negative content predicted depression in an 8-month longitudinal study, rumination about depression was no longer a significant predictor of depression after controlling for negative rumination (Ito et al., 2006). Thus, the effects of rumination appear to depend upon whether it is focused on negative or non-negative content.

Ninth, the consequences of problem solving are known to depend on the valence of the problem orientation adopted. A positive orientation encompassing confidence in one's ability to solve the problem is associated with better outcomes than a negative orientation characterized by reduced self-confidence, reduced optimism and more extreme views of the severity and intractability of the problem (Belzer, D'Zurilla, & Maydeu-Olivares, 2002; D'Zurilla, Chang, Nottingham, & Faccini, 1998; D'Zurilla & Nezu, 1990; D'Zurilla & Nezu, 1999; Elliott, Sherwin, Harkins, & Marmarosh, 1995; Maydeu-Olivares & D'Zurilla, 1996; Shewchuk, Johnson, & Elliott, 2000). Thus, the valence of thought content during RT appears to be a key determinant of whether RT has constructive or unconstructive consequences.

One mechanism by which valence may moderate the consequences of RT is by determining the direction of action for the magnifying effects of RT on mood and cognition. It has been hypothesized that RT exacerbates the preexisting mood state and amplifies the reciprocal relationships between existing cognition and mood (Ciesla & Roberts, in press; Nolen-Hoeksema, 1991). It is argued that repetitive focus on affect and cognition serves to make them more salient, and to further elaborate, consolidate and strengthen them. Consistent with this RT amplification hypothesis: (a) a considerable body of research indicates that self-focus amplifies the effect of negative mood on thinking (Ingram, 1990; Ingram & Smith, 1984; Pyszczynski & Greenberg, 1987) and of negative thoughts on mood (Mor & Winquist, 2002); (b) depressive rumination is more strongly related to negative affect than nonruminative self-focus, indicating additional effects of RT (Mor & Winquist, 2002); (c) compared to distraction, rumination exacerbates pre-existing anxious mood (Blagden & Craske, 1996), pre-existing anger (Rusting & Nolen-Hoeksema, 1998) and increases anger in response to a provocation (Bushman, 2002; Bushman, Bonacci, Pedersen, Vasquez, & Miller, 2005). Thus, for negatively valenced

cognitions, RT would amplify the negative consequences of these negative cognitions and exacerbate existing negative mood, resulting in more unconstructive outcomes.

With this amplification hypothesis in mind, it is worth noting that, whilst in the majority of cases more negative valence during RT will be associated with more unconstructive consequences, positive valence during RT could possibly lead to unconstructive consequences in individuals vulnerable to hypomania and mania. Recent theories of bipolar disorder have hypothesized that repeated dwelling on positive affect could amplify positive mood and associated behavioral activation, fuelling the spiral of mood and cognition up into hypomania (Johnson et al., in press). Consistent with this hypothesis, compared to controls with no history of mood disorders and individuals with major depression, individuals diagnosed with bipolar disorder endorsed elevated emotion-focused rumination in response to positive affect. Moreover, positive rumination was associated with hypomanic symptoms (Johnson et al., in press). Although preliminary, these findings suggest a link between excessive positive rumination and bipolar disorder: future research will need to examine its causal relationship with mania symptoms.

Intrapersonal and Situational Context in which Repetitive Thought Occurs: Valence and Ability

The context in which repetitive thinking occurs is also an important determinant of the consequences of RT. Key elements of context are (a) the prevailing valence of the cognitive-affective system of the individual engaged in RT, in terms of mood state, self-beliefs, and dispositional traits; (b) the situation and environment in which RT occurs. Both contexts can range from negatively valenced (e.g., intrapersonal: dysphoric mood, negative expectations, low self-esteem; situational: stressful, traumatic events) to positively valenced (intrapersonal: positive mood, positive expectations, high self-esteem; situational: successful, rewarding events),

and both will often determine the valence of thought content during RT. For example, when an individual has low self-esteem or is in a dysphoric mood, negative thoughts, memories and expectations become more easily accessible and available, as illustrated by the phenomenon of mood-congruent memory (Bower, 1981; Teasdale, 1983; Teasdale, 1988). Similarly, a negative, stressful environment will activate negative thoughts and increase the likelihood of negative mood. Thus, by extension, in the context of a negative valenced intrapersonal or situational context, RT about this negative context (which is itself negatively valenced) would further amplify the effect of that context on mood and cognition.

There is good evidence that the prevailing valence of an individuals' cognitive-affective system determines whether RT is helpful or unhelpful. First, there is extensive evidence that dysphoric mood and/or depressed symptoms is a setting condition for depressive rumination to produce unconstructive consequences: (a) the experimental literature repeatedly finds that there is no maladaptive effect on mood and cognition of manipulating rumination compared to distraction in individuals who are not already in a dysphoric mood (e.g., see review by Nolen-Hoeksema, 2004b); (b) the effects of ruminative style on delay in presenting symptoms of breast cancer to a healthcare professional was moderated in part by the experience of positive mood at the time of symptom discovery (Lyubomirsky et al., 2005); (c) rumination exacerbated the predictive effects of baseline depression on depression 6 months later, but did not predict prospective depression in the absence of depression (Roelofs et al., 2006). Second, in a similar way, there is evidence that the consequences of worry are moderated by the levels of trait anxiety: worry is associated with more active coping and greater information-seeking (Davey et al., 1992) and predicts better prospective performance (Siddique et al., 2006) once levels of associated trait anxiety are held constant, suggesting that worry may be more constructive when

levels of anxiety are low but becomes more problematic as trait anxiety increases. Trait anxiety is associated with poor problem-solving confidence (Davey et al., 1992), which in turn is implicated in the content of worrying becoming more negative and more catastrophic, resulting in less constructive consequences (Davey, Jubb, & Cameron, 1996). Davey et al. (1992, p.145) hypothesize that “pathological worrying is generated by a problem-focused cognitive style being thwarted by a lack of confidence in the solutions being generated”. Thus, an intrapersonal context characterized by ongoing negative affect, whether depressed mood or trait anxiety, will lead to more negative content during RT, and, thereby, more unconstructive consequences.

Third, a number of studies find that the ability of RT to predict depression is moderated by the degree of negative self-related beliefs, with dysfunctional attitudes and self-esteem moderating the extent to which rumination prospectively predicts (a) the onset of depressive episodes (Robinson & Alloy, 2002); (b) worse treatment outcome (Ciesla & Roberts, 2002). Likewise, the effects of experimentally manipulating rumination were moderated by the negative self-related beliefs held by individuals (Ciesla & Roberts, in press). Similarly, the effects of worry on smoking behavior are moderated by levels of self-efficacy (Dijkstra & Brosschot, 2003). Thus, there is a good evidence to suggest that negative representations of the self and maladaptive beliefs about what is required to be a worthwhile person moderate whether RT is constructive or unconstructive. In the absence of dysphoric mood or negative self-beliefs, RT focused on the self need not be negative; however, in the presence of negative mood or negative self-beliefs, RT focused on the self is likely to involve negative content. As suggested by Ciesla and Roberts (2002, p. 447) “the process of turning’s one attention inward may be particularly caustic if one’s thoughts are dominated by self-deprecating and perfectionistic cognitions”.

Similarly, there is good evidence that situational context can influence the effects of RT. First, Morrison and O'Connor (2005) found that depressive rumination interacted with reported stress to predict social dysfunction six months later. Second, trait rumination was predictive of depression at 6-week follow-up only among initially mildly depressed undergraduates who had both low self-esteem and a high level of stressful life events (Ciesla & Roberts, in press). Third, for individuals with higher levels of social anxiety, but not for individuals with low levels of social anxiety, post-event rumination was associated with increases in negative affect following personal disclosure, but associated with decreases in negative affect following small-talk (Kashdan & Roberts, 2007).

Another aspect of context that influences the consequences of RT is an individual's ability and expertise. Greater competence, ability, practice and expertise in the domain of concern are hypothesized to produce more constructive outcomes during RT. First, the defensive pessimism literature finds that RT is associated with constructive outcomes when RT is congruent with an individual's preferred strategy, such that defensive pessimists find RT focused on negative outcomes an adaptive strategy but optimists do not. Moreover, studies of defensive pessimism have explicitly selected participants on the basis of a history of success in the studied domain, whether academia or social interactions (e.g., Grade Point Averages > 3.0 and reporting generally performing well in the past, Norem & Cantor, 1986), such that, by definition, all defensive pessimists have been successful in the domain under study. Thus, the benefit of RT for defensive pessimists occurs within the context of a reasonably high level of experience and ability. Second, in a sample of financial sector managers, worry is correlated with better workplace performance for more able individuals but worry is correlated with worse workplace performance for less able individuals, indicating the value of ability in moderating the role of RT

(Perkins & Corr, 2005). Third, the more constructive consequences of RT for individuals with high self-esteem and high self-efficacy, may, in part, reflect greater objective ability, as well as more positive subjective perceptions of the self. Fourth, RT about the traits necessary to be a good tennis player was negatively correlated with the quality of play in inexperienced players, but not in experienced players, suggesting that RT has less unconstructive consequences for those with more expertise in the relevant domain (Wicklund & Braun, 1987). Thus, there is some evidence that personal ability and expertise may influence the consequences of RT.

Level of Construal adopted during repetitive thought

Whilst valence is a major factor in determining the consequences of RT, it cannot explain all observed findings. In particular, RT focused on negative content has been found to have constructive consequences in studies of depressive rumination (Rimes & Watkins, 2005; Watkins & Moulds, 2005a; Watkins & Teasdale, 2001; 2004) and of defensive pessimism (Cantor & Norem, 1989; Norem & Cantor, 1986a; Norem & Cantor, 1986b; Norem & Chang, 2002; Spencer & Norem, 1996). Moreover, simply focusing on positive outcomes in of itself is not necessarily the most adaptive form of RT, as revealed by the comparison of process versus outcome simulations (Pham & Taylor, 1999; Rivkin & Taylor, 1999; Taylor & Schneider, 1989; Taylor, Pham, Rivkin & Armor, 1998). It is hypothesized that another property that can account for whether RT has constructive or unconstructive consequences is the level of construal during RT. Research on mental representation in the cognitive and social-cognitive literatures makes a distinction between higher level, abstract construals versus lower level, concrete construals (e.g., Dweck & Leggett, 1988; Freitas, Gollwitzer, & Trope, 2004; Freitas, Salovey, & Liberman, 2001; Liberman, Sagristano, & Trope, 2002; Markman & McMullen, 2003; Mischel & Shoda, 1995; Trope, 1989; Trope & Liberman, 2003). High-level construals are abstract, general,

superordinate and decontextualized mental representations that convey the essential gist and meaning of events and actions, whereas low-level construals are more concrete mental representations that include subordinate, contextual, specific, and incidental details of events and actions³. High-level abstract construals are focused on the desirability and importance of outcomes, whereas low-level concrete construals are focused on the feasibility and planning of outcomes. Thus, different levels of construal can be adopted when perceiving one's own and other's behavior: inferences of global traits that are invariant across different situations (e.g., laziness) constitute relatively high-level, abstract construals of behavior, whereas inferences of situation-specific states (e.g., tiredness), constitute relatively low-level concrete construals of behavior (Nussbaum, Trope, & Liberman, 2003). Similarly, actions, events and goals can be represented in terms of high-level or low-level construals: representations of the abstract "why" aspects of an action and of the ends consequential to an action constitute relatively high-level construals, whereas representations of the specific "how" details of the action and of the means to the end constitute relatively low-level construals (Frietas, Gollwitzer & Trope, 2004; Trope & Liberman, 2003; Vallacher & Wegner, 1987).

Across this review, there is evidence that RT characterized by high-level, more abstract construals has more unconstructive consequences relative to RT characterized by low-level, more concrete construals, *at least when RT is focused on negatively valenced content* (to date, the majority of studies relevant to level of construal in RT have involved negatively valenced RT). First, within experimental studies that manipulate RT, one experimental condition is often characterized by lower-level construals that focus on contextual details and the means to desired ends (e.g., experiential rumination, Rimes & Watkins, 2005; Watkins & Moulds, 2005a; Watkins & Teasdale, 2001, 2004; simulation of the *process* of how to achieve a goal, Taylor et al., 1998;

mindsets involving imagining how things unfold or how to proceed, Moberly & Watkins, 2006; Watkins & Baracaia, 2002; Watkins, 2004a), whereas the other condition is characterized by higher-level construals that focus on meanings and implications (e.g., analytical rumination, Ehring et al., 2007; Rimes & Watkins, 2005; Watkins & Moulds, 2005a; Watkins & Teasdale, 2001, 2004; outcome simulation, Taylor et al., 1998; mindsets involving thinking about causes, meanings, consequences, Moberly & Watkins, 2006; Watkins & Baracaia, 2002; Watkins, 2004a). For example, because representations of desired ends and outcomes sought by an action constitute relatively high-level construals, whereas representations of the specific “how” details of the action and of the means to the end constitute relatively low-level construals, process simulations involve relatively lower level construals than outcome simulations. Critically, the manipulations of RT involving lower-level construals produce more constructive consequences than the manipulations of RT involving higher level construals, including better social problem solving, more specific autobiographical memory, less global negative self-judgments (Rimes & Watkins, 2005; Watkins & Baracaia, 2002; Watkins & Moulds, 2005a; Watkins & Teasdale, 2001; 2004), improved self-regulation and academic performance (Pham & Taylor, 1999; Rivkin & Taylor, 1999; Taylor & Schneider, 1989; Taylor, Pham, Rivkin & Armor, 1998), better emotional recovery from prior failure (Watkins, 2004a) and upsetting images (Ehring et al., 2007), and reduced emotional vulnerability to subsequent failure (Moberly & Watkins, 2006). Importantly, these manipulations of RT are often matched for degree of negative thought content, such that the distinct functional consequences cannot be due to differences in valence of thought content.

Second, the form of anticipatory RT within the MMAP focused on low-level construals (plan rehearsal) was negatively correlated with depression both concurrently and prospectively,

whereas the form of anticipatory RT focused on higher-level construals (problem analysis) was associated with increased anxiety (Feldman & Hayes, 2005). Third, the current construal-level analysis subsumes the reduced concreteness theory of worry, which proposes that worry is predominantly experienced in a more abstract-verbal form rather than in a more concrete-visual imagery form, and that this reduced concreteness leads to negative consequences for problem-solving and affect regulation (Borkovec et al., 1998; Stober, 1998; Stober & Borkovec, 2002; Stober, Tepperwien, & Staak, 2000). Consistent with this theory, worry seems to be predominantly experienced in a verbal form rather than in images (Borkovec & Inz, 1990; Borkovec et al., 1993; Borkovec et al., 1998; Borkovec et al., 1983; Freeston, Dugas, & Ladouceur, 1996; McLaughlin et al., 2007). Moreover, elaborations of problems about which participants worry are independently and blindly rated as more abstract and less concrete than problems about which participants do not worry (Borkovec et al., 1998; Stöber, 1998; Stöber & Borkovec, 2002). Within reduced concreteness theory, concrete thought is defined as “distinct, situationally specific, unequivocal, clear, singular” and abstract thought as “indistinct, cross-situational, equivocal, unclear, aggregated” (Stober & Borkovec, 2002, p.92), which fits within the existing conceptualization of low-level versus high-level construals. Furthermore, reduced concreteness has been found during RT in currently depressed patients (Cribb, Moulds, & Carter, 2006; Watkins & Moulds, in press) and during rumination in undergraduates (McLaughlin et al., 2007), indicating that this analysis applies to other forms of RT than worry.

Fourth, there is indirect evidence that level of construal could contribute to the beneficial effects of defensive pessimism. Defensive pessimists appear to have a strategy of viewing negative futures as temporally close, and this strategy predicts improved task performance, through the mediator of increased preparation (Sanna, Chang, Carter, & Small, 2006). Temporal

construal theory proposes that thinking about distant futures involves more high-level construals, whereas thinking about close futures involves more low-level construals (Trope & Liberman, 2003). Lower-level construals would in turn lead to more specific preparation for an upcoming task.

One mechanism by which the level of construal may influence the consequences of RT is by influencing the efficacy of problem solving. Both the reduced concreteness theory (Stober & Borkovec, 2002) and the action identification theory (Vallacher & Wegner, 1987) hypothesize that processing at lower level of construal provides more elaborated and contextual detail about the specific means, alternatives and actions by which to best proceed when faced with difficult, novel or complex situations. Consistent with this hypothesis, lower-level construals are associated with better problem solving (Watkins & Baracaia, 2002; Watkins & Moulds, 2005a).

A second mechanism by which level of construal may influence the consequences of RT is through its effects on self-regulation. Increased focus on a concrete level of construal is hypothesized to facilitate self-regulation in situations where elevated self-focused attention and deliberate efforts to control behavior may be counter-productive, such as choking under pressure and test anxiety (Leary, Adams, & Tate, 2006). Since elevated self-focused attention and increased efforts at self-regulation are often characteristic of RT, in particular of rumination and worry, RT may become more constructive as thinking becomes more concrete. Leary et al., (2006) argued that abstract construals about the evaluative or interpersonal implications of one's behavior interrupt the smooth performance of behaviors, whereas, in contrast, more concrete construals benefit self-regulation by (a) focusing attention on the immediate demands of the present situation, (b) reducing anxiety, and (c) requiring less effort and thus using up less self-regulatory resources. For example, a basketball player would perform better when focusing on

how to make the shot, rather than when thinking about the implications of missing. Consistent with this analysis, the use of concrete construals frees up cognitive resources, reduces anxiety and/or improves task performance, whether in the form of implementation intentions specifying how and when an action will be performed (“If I encounter situation X, then I’ll perform behavior Y”) or via focusing on the sound of one’s voice (versus trying to be persuasive) when giving a speech, especially when the task is considered difficult or occurs under conditions of high cognitive load (Brandstatter, Lengfelder, & Gollwitzer, 2001; Gollwitzer, 1999; Gollwitzer & Sheeran, 2006; Vallacher, Wegner, & Somoza, 1989; Webb & Sheeran, 2003).

A third mechanism by which the level of construal may influence the consequences of RT is by influencing the degree of generalization in response to emotional events. Processing characterized by higher-level construals produces mental representations that generalize across situations and that do not incorporate specific contextual details. Such generalizations can be beneficial by allowing gainful and useful inferences across different situations beyond available data and by enabling transfer of learning from one situation to another (Forster & Higgins, 2005; Vallacher & Wegner, 1987). However, in negative situations, more abstract construals could facilitate negative overgeneralizations where a single failure is explained in terms of a global personal inadequacy (e.g. “I am worthless”) rather than in terms of situation-specific difficulties (Hamilton, Greenberg, Pyszczynski, & Cather, 1993). Such negative generalizations are implicated in the development of depression (Beck, 1976; Beck, Rush, Shaw, & Emery, 1979; Carver, 1998; Carver & Ganellen, 1983; Carver, Lavoie, Kuhl, & Ganellen, 1988). Thus, when faced with *negative* information, more concrete construals are hypothesized to be more adaptive by reducing negative overgeneralizations. Consistent with this hypothesis, more concrete thinking is found to facilitate the interpretation of the causes of negative events as unstable and

controllable (Showers, 1988), voluntarily recalling an emotional event in specific detail produces less emotional response than recalling it at a more general level (Philippot, Baeyens, & Douilliez, 2006; Philippot, Schaefer, & Herbette, 2003) and practice at recalling specific, contextualized autobiographical memories reduces the negative experience to a subsequent stressful task relative to practice at recalling general, decontextualized memories (Raes, Hermans, Williams, & Eelen, 2006).

Evaluating models of repetitive thought

What theory best accounts for the data and properties described above? A first step towards answering this question is to consider the existing theoretical models of RT and evaluate how well they account for the different consequences and properties reviewed. Three principal approaches can be identified: the response styles approach (Nolen-Hoeksema, 1991; Nolen-Hoeksema, 2004b), the cognitive processing approach (Greenberg, 1995; Horowitz, 1985; Tedeschi & Calhoun, 2004), and the discrepancy-focused control theory approach (Martin & Tesser, 1989, 1996)⁴.

Response Style Theory of Rumination

Nolen-Hoeksema's (1991; 2000; 2004) seminal Response Styles Theory (RST) hypothesizes that rumination is a trait-like style of responding to depressed mood, which has been found to be consistent across situations and repeated testing (Nolen-Hoeksema et al., 1993), and appears to be a stable individual difference characteristic (Nolen-Hoeksema & Davis, 1999). The ruminative response style is hypothesized to be learnt in childhood, either because it was modeled by parents who themselves had a passive coping style (Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 1995) or because the child failed to learn more active coping strategies for negative affect as a consequence of overcritical, intrusive and over-controlling parents (Nolen-

Hoeksma, Mumme, Wolfson, & Guskin, 1995) or early physical/sexual abuse. Retrospective studies find that elevated rumination is associated with self-report of over-controlling parents (Spasojevic & Alloy, 2002) and reports of physical and sexual abuse (Conway, Mendelson, Giannopoulos, Csank, & Holm, 2004), although, like all retrospective studies, current mood, memory biases and demand biases could influence the report of past events, raising questions as to veridicality.

The RST provides a detailed analysis of the mechanisms by which RT leads to unconstructive outcomes, but was conceived with less explanatory power with regard to explaining how RT can be constructive. The RST emphasizes the importance of repeated and passive focus on depressed symptoms in determining the negative effects of rumination (e.g., Lyubomirsky & Nolen-Hoeksma, 1995; Nolen-Hoeksma, 1991, 2004b). The RST proposes that ruminative self-focus in response to a depressed mood amplifies a vicious cycle between depressed mood and negative, pessimistic thinking, thereby, exacerbating negative mood and negative thinking and impairing problem solving. Research has demonstrated that depressed mood has negative effects on thinking by selectively priming mood-relevant information and activating mood-congruent memories, beliefs and expectations (Bower, 1981; Teasdale, 1983). In turn, these negative cognitions can then further maintain or exacerbate negative mood, producing a vicious cycle between depressed mood and negative thinking. RST proposes that focus on symptoms further fuels this vicious cycle, consistent with a considerable body of research indicating that self-focus can act to amplify the effect of negative mood on thinking (Ingram, 1990; Ingram & Smith, 1984; Pyszczynski & Greenberg, 1987). As such RST provides a good account of how structural factors such as negatively valenced thought content, current dysphoric mood or negative self-beliefs would result in RT with unconstructive consequences.

However, a major limitation of the RST was that it was not designed to explain RT with constructive outcomes, and, as such, does not directly instantiate how RT could have positive consequences. Nonetheless, by logical extension, one can hypothesize that the amplifying effects of RT could also work for positive valence, such that RT focused on positive thought content would amplify a self-reinforcing cycle between positive mood and more optimistic thinking, consistent with the observed influence of thought valence on the consequences of RT. However, even with this extension to the RST, it cannot account for the evidence that RT focused on negative content can still have constructive consequences, as found in experimental manipulations of depressive rumination, defensive pessimism or cognitive processing of distressing events. For example, several experimental studies found that RT focused on depressive symptoms has constructive consequences (Watkins & Moulds, 2005a; Watkins & Teasdale, 2001; 2004), inconsistent with the RST. Nor can the RST account for constructive consequences of RT that are not tied to increases in positive affect, since the constructive effects of RT would depend upon amplifying the reciprocal cycle between positive mood and optimistic cognition. For example, improvements in problem-solving following RT that are not associated with improvements in mood (e.g., Lyubomirsky et al., 1999; Watkins & Baracaia, 2002), cannot be explained by RST. Furthermore, RST cannot account for the influence of process aspects of RT on its consequences, in particular, the level of construal adopted during RT. A further limitation of RST is that it exclusively focuses on RT in response to sad or depressed mood. Although this is an important focus for RT, RT can also be triggered by and focused on other negative mood states, unresolved goals and life events (Lavalley & Campbell, 1995; Millar, Tesser, & Millar, 1988; Robinson & Alloy, 2003) and on positive content (Martin & Tesser, 1996).

Cognitive Processing Theories

RT focused on coming to terms with past upsetting events is a key element of the cognitive processing literature. Stressful and traumatic events often contain novel information or give rise to appraisals that are not consistent with prior mental structures such as the beliefs and assumptions that people hold about themselves and the world (Janoff-Bulman, 1992). For example, a violent assault and the increased sense of vulnerability it produces would clash with prior beliefs such as “the world is basically safe” and “bad things don't happen to good people”. Cognitive processing accounts propose that this discrepancy between the meaning of the negative event and pre-existing mental structures makes it difficult to integrate this new information into current mental structures and leads to distress. Recovery from distressing experiences is assumed to require that the person work through and resolve the incongruence between the information acquired from the distressing experience and pre-existing mental structures representing the world (Horowitz, 1986). Within cognitive processing accounts, the discrepancy between the meaning of the event and pre-existing mental structures is proposed to produce RT in the form of repeated intrusions and re-experiencing of the distressing event until the discrepancy is resolved. Thus, cognitive processing accounts explain the onset and maintenance of RT. However, these accounts have not tended to explicitly instantiate what determines whether RT has constructive or unconstructive outcomes. Indeed, there is some debate as to whether the RT is a necessary and active part of working through the upsetting event or simply an epiphenomenon of recovery (Harber & Pennebaker, 1992; Horowitz, 1986; Janoff-Bulman, 1992; Tait & Silver, 1989).

Nonetheless, cognitive processing approaches are consistent with structural factors such as valence influencing the consequences of RT. Recent cognitive processing accounts emphasize

that a focus on finding benefit when thinking about upsetting and traumatic events results in better outcomes, consistent with the valence of thought content influencing the consequences of RT. In addition, theoretical accounts of cognitive processing suggest that it will be easier to organize and make coherent one single event rather than multiple events simultaneously, because multiple memories will interfere with the processing of each other, take up more central executive resources (Foa & Kozak, 1986) and include more disparate material that does not easily fit into the temporal and spatial sequence necessary for the creation of a coherent story, which is hypothesized to be essential for effective working through of upsetting events (Foa et al., 1995; Klein & Boals, 2001; Pennebaker, 1997; Pennebaker et al., 1997; Pennebaker & Seagal, 1999; Sloan & Marx, 2004; Smyth et al., 2001). Thus, because a negative intrapersonal context increases the availability and accessibility of negative concerns and negative memories (Smith & Petty, 1995; Teasdale, 1983; Teasdale & Barnard, 1993; Teasdale & Dent, 1987) it may make it harder to effectively process any particular difficult event.

However, cognitive processing theories cannot account for how the level of construal could influence the consequences of RT. A further limitation of cognitive processing accounts is that they have predominantly focused on RT related to traumatic and distressing events, where there is a discrepancy between the meaning of the distressing events and existing beliefs. As such, cognitive processing theories do not account for different consequences of RT that are unrelated to such discrepancies in meaning and emotion, for example, anticipatory RT associated with adaptive planning and preparation or the uptake of health-promoting behaviors.

Control Theory Approaches to Repetitive Thought

Control theory proposes that all behavior, including mental activities, reflect a process of feedback control. Individuals perceive their current state and behavior, and then compare these

perceptions with salient reference values such as their goals, standards or desired outcomes. If the comparison indicates a discrepancy between actual state and reference value, such as an unresolved goal, behavior will be adjusted in order to bring it closer to the reference value (Carver & Scheier, 1982; Carver & Scheier, 1990; Carver & Scheier, 1998). In particular, discrepancies between expected rates of progress towards goals are hypothesized to influence behavior and affect. The original control theory approach to RT emphasized that rumination is triggered by a discrepancy in goal progress and that these goals are organized hierarchically (Martin & Tesser, 1989, 1996). Furthermore, RT focused on the discrepancy in attaining the unresolved goal is intended to serve the function of facilitating progress toward the reference value. Within this account, the RT will continue either until the goal is met or until the individual disengages from and abandons the goal (Carver & Scheier, 1990; Klinger, 1975; Martin, Shrira & Startup, 2004; Martin & Tesser, 1989; 1996; Pyszczynski & Greenberg, 1987; Wells & Matthews, 1994)⁵. It is important to recognize that representations of both external stimuli (e.g., a physical situation, a concrete outcome) and internal stimuli (e.g., moods, feelings) can act as reference values for goals, such that RT can be influenced by discrepancies in representations of both external and internal states.

There is accumulating evidence consistent with this goal-discrepancy control theory approach to RT. RT about important people and activities left behind when coming to college was positively predicted by the extent to which these activities remained interrupted at college, that is, the extent these important goals were not attained (Millar et al., 1988). Abstract goals that are more important and meaningful to people, such as attaining happiness, and concrete goals that are linked to these important abstract goals, such as being in a romantic relationship, produce more RT when not attained (McIntosh, Harlow, & Martin, 1995; McIntosh & Martin,

1992). In a diary study, negative events that were related to personal goals produced more RT than goal-unrelated negative events (Lavalley & Campbell, 1995).

The tendency towards RT seems to depend upon the perseverance of unresolved goal-related thoughts, as evidenced in the Zeigarnik effect, in which recall of interrupted and uncompleted tasks is significantly better than recall of completed tasks (Kuhl & Beckmann, 1985; Kuhl & Helle, 1986; Zeigarnik, 1938). There is an extensive literature confirming that unresolved and blocked goals increase the priming and accessibility of goal-relevant information, and the perseverance of goal-related thoughts (Brunstein & Gollwitzer, 1996; Goschke & Kuhl, 1993; Martin & Tesser, 1989), whereas resolved goals inhibit the priming and accessibility of goal-relevant information, consistent with a control process account of how RT would be initiated and terminated (Forster, Liberman, & Higgins, 2005; Johnson, Chang, & Lord, 2006).

Moreover, principles within control theory can be elaborated to account for the reviewed findings. Critically, unlike the other accounts, the control theory account (Martin & Tesser, 1989; 1996) explicitly hypothesizes that RT can have constructive or unconstructive consequences. Within control theory, RT produces constructive consequences if it helps to resolve the discrepancy between the intended goal and actual current state, whether by aiding progress towards the goal, or by helping to modify or abandon the goal (Klinger, 1975; Martin & Tesser, 1989; Martin & Tesser, 1996; Wrosch, Scheier, Miller, Schulz, & Carver, 2003). In contrast, RT becomes unconstructive if a person experiences an inability to progress toward reducing the discrepancy and at the same time is unable to give up on the reference value or goal. In such a case, RT would only serve to focus attention on the discrepancy between the desired goal and the actual situation, making the unresolved discrepancy more salient, perpetuating the unresolved issue, and exacerbating negative affect (Carver & Scheier, 1990, 1998; Klinger,

1975; Kuhl & Beckmann, 1985; Martin & Tesser, 1989, 1996; Pyszczynski & Greenberg, 1987). It is important to distinguish between disengaging from efforts at goal pursuit, whether mentally or physically, and disengaging from the underlying goal: the former combines a lack of goal progress with the ongoing maintenance of the desired but unattained goal, further highlighting the unresolved discrepancy, whereas the latter constructively reduces the goal discrepancy.

To date, control theory accounts have focused on hypothesizing the mechanisms underpinning the onset, frequency and duration of RT, rather than instantiating the mechanisms that determine whether RT is constructive or unconstructive. RT was proposed to be beneficial if individuals “use a form of rumination that can provide a solution for the type of problem they are facing”, although this was not further specified other than to suggest that applying logic to insight problems or insight to logic problems may be unhelpful (Martin, Shrira, & Startup, 2004, p. 171). Nonetheless, there are principles within control theory that can be elaborated to explain how the properties identified in this review can influence the consequences of RT.

First, control theory can account for the findings that structural aspects of RT such as valence of thought content and intrapersonal context influence the consequences of RT. Within control theory, expectancies and beliefs about the self and about the outcomes of behavior are hypothesized to play an important role in determining how a person responds to a discrepancy between the actual state and the desired state, by influencing persistence at goal pursuit, the reference values by which goal progress is judged, the interpretation of feedback, and the judgment of when to abandon a goal (Carver & Scheier, 1990; Carver & Scheier, 1998; Hyland, 1987). More negative expectancies, such as doubts about ability to succeed, will lead to attempts to disengage from goal pursuit, as well as a greater perceived discrepancy between desired state and actual state. As noted above, disengaging from goal pursuit will leave an unresolved

discrepancy, which in the absence of abandoning the unresolved goal, will cause RT to have unconstructive consequences. Moreover, an individual's beliefs and moods, particularly those relevant to judging self-worth, will influence their goals and reference values, such that more extreme beliefs about what is required to achieve self-worth will result in (a) harder-to-attain reference values, making discrepancies between the desired state and the actual state harder to resolve; (b) harder-to-abandon goals. For example, negative mood can cause individuals to increase their standards for success, making it harder to resolve a goal discrepancy (Cervone, Kopp, Schaumann, & Scott, 1994), consistent with a control theory account of RT. In the context of RT, this analysis suggests that maladaptive beliefs about what is required to be a worthwhile person, such as high levels of dysfunctional attitudes, will lead to both harder-to-attain goals and reluctance to abandon these goals, trapping an individual in unconstructive RT, consistent with the observed findings (e.g., Ciesla & Roberts, in press).

Moreover, self-representations can influence the ability of individuals to disengage from an unresolved goal by substituting it with positive affirmations on another aspect of self that relates to the same superordinate goal. Affirming valued aspects of the self reduces RT about a frustrated goal (Koole, Smeets, van Knippenberg, & Dijksterhuis, 1999). However, individuals with reduced self-esteem and more dysfunctional self-beliefs, have reduced self-affirmational resources in response to difficulties (Koole et al., 1999; Steele, Spencer, & Lynch, 1993), making it harder to disengage from unconstructive RT about an interrupted or incomplete goal and move onto more constructive RT (Di Paula & Campbell, 2002; Kuhl & Beckmann, 1985; Kuhl & Helle, 1986), or to disengage from unsolvable tasks (Aspinwall & Richter, 1999). Since expectancies are examples of positive and negative thoughts, whilst beliefs and mood are

elements of intrapersonal context, control theory thus accommodates the structural aspects of RT identified earlier.

Second, and more pertinently, further elaboration of principles within control theory accounts for the finding that process aspects of RT such as level of construal influence the consequences of RT. Within control theory, it is hypothesized that goals and behaviors are hierarchically organized and can be processed at different levels of abstraction, with more abstract, superordinate goals and standards guiding and informing more specific, subordinate goals and standards. Within this hierarchical organization, pursuit towards abstract goals occurs by specifying reference values at the next lower level of abstraction, all the way down to the concrete representations required to specify the actual behaviors needed to progress towards the goal (Broadbent, 1977; Carver & Scheier, 1990; Carver & Scheier, 1998; Emmons, 1992; Powers, 1973a; Powers, 1973b; Vallacher & Wegner, 1987). Carver and Scheier (1990) proposed that the most abstract levels represent a global sense of idealized self, which in turn sets the broad principles that organize goals and behavioral standards across multiple situations (e.g., to be an honest person), corresponding to higher-level construals, whereas the more concrete levels represent the specific actions and behavioral programs necessary to implement the principles in a particular situation (e.g., telling the truth to a friend), corresponding to lower-level construals. Thus, this hierarchical organization affords the use of high and low level construals, consistent with the distinction between abstract versus concrete processing within RT.

Further, control theory hypothesizes that effective self-regulation requires flexible and balanced coordination between the different levels within the goal hierarchy, such that the superordinate level of control adaptively varies in response to situational and task demands.

Depending on context, a level of control that is too abstract, too concrete or that fails to link abstract levels to concrete levels is hypothesized to be detrimental (Carver & Scheier, 1998, chapter 13). Elaborating on key principles within control theory suggests that there are a number of distinct advantages and disadvantages for self-regulation when the level of control is located higher or lower in the goal hierarchy, corresponding to abstract versus concrete levels of construal, respectively.

Thus, one hypothesized advantage of higher-level, abstract control is increased consistency and stability of behavior towards long-term goals across time and across different situational demands, because higher-level control ensures that subordinate goals and actions remain directed towards personally important higher-level goals and minimizes interference from incidental influences (Carver & Scheier, 1998; Vallacher & Wegner, 1987; 1989). In contrast, low-level control is hypothesized to be more sensitive to contextual and situational detail resulting in increased impulsiveness and distractibility. Consistent with this hypothesis, a habitual tendency towards more abstract construals is associated with more persistent and stable behavior, greater self-motivation, less impulsiveness and fewer action errors (Vallacher & Wegner, 1989), and adopting high-level construals produces greater self-control on experimental tasks than adopting low-level construals (Fujita, Trope, Liberman, & Levin-Sagi, 2006). A second hypothesized advantage of higher-level control is that it provides more flexibility in responding to relatively low-level goals that are unattained, because processing at a higher-level affords more alternative sub-goals and behaviors to resolve the goal discrepancy (Brunstein & Gollwitzer, 1996). For example, if an individual is failing to progress on the daily goal of writing a poem, control at the level of an abstract subordinate level (e.g. “to be creative”) provides alternative goals and means to resolve this discrepancy (e.g., play music, draw, paint) that are not

available if the functionally superordinate goal is just to complete a poem. Thus, this analysis suggests that under some circumstances, for example, when considering long-term goals, RT characterized by higher-level, abstract construals will be constructive.

However, a logical elaboration from control theory is that higher-level abstract control will become disadvantageous under particular circumstances. First, because pursuit towards abstract goals occurs by specifying reference values at the next lower level, down to the actual concrete behaviors required, the aforementioned advantages of higher-level control/abstract construals will only occur when there is sufficiently operationalized specification from the higher-levels down to lower-levels of representation (see also Carver & Scheier, 1998). When programs and sequences of goal-related behaviors are straightforward, familiar, and practiced, an individual will have developed extensive procedural knowledge specifying the links between goals and behaviors across all levels, making higher-level control of self-regulation effective (Anderson, 1983; Vera & Simon, 1993). However, under circumstances of novelty, unfamiliarity, difficulty or stress, this specification of reference values down through the control hierarchy can break down, such that the advantages of controlling self-regulation at a higher level are lost. For example, adopting a high level of control focused on a goal such as “be punctual” would not be useful for either a learner driver still getting used to handling a car or for an experienced driver in hazardous, unfamiliar driving conditions such as a snowstorm, since in both cases, there is not well-established specification of how high-level reference values translate into sub-goals and concrete behavior. Instead, control of behavior needs to be located at low-levels in the hierarchy concerned with concrete and specific actions. Second, when the superordinate abstract goal is ill-defined and it is difficult to specify how it might actually be achieved, control at a higher-level in the goal hierarchy is going to be problematic. For example,

a goal like “be happy” may be too abstract and vague to provide clear guidance as to how an individual might specify subgoals towards attaining it. Third, processing at a more abstract level may interfere with goal disengagement: the more abstract the level at which a goal is represented in the hierarchy, the more important the goal becomes to the general sense of self, and the harder it becomes to disengage from the goal (Martin & Tesser, 1996; McIntosh & Martin, 1992; Millar et al., 1988). Such abstract construals will be unproblematic when there is sufficient progress toward the relevant goal. However, when a goal is difficult or impossible to attain, processing at too abstract a level will make it harder to relinquish the goal, trapping the individual in the invidious state where he or she can neither make progress toward the goal nor abandon it, leading to persistent but unconstructive RT. This analysis therefore suggests that under circumstances of novelty, unfamiliarity, difficulty or stress, RT characterized by higher-level, abstract construals will be unconstructive as it gives limited guidance as to what to do next.

The elaborated control theory therefore proposes that for more difficult and novel tasks, where full specification through the goal-action hierarchy is lacking, control of behavior at more concrete, lower-levels in the hierarchy is more functional. Shifting control down to lower-levels of abstraction, which corresponds to a more concrete level of construal, is hypothesized to ensure that goals and standards are translated into effective goal pursuit, because processing at a more concrete level serves the functions of determining the specific means and actions by which to best proceed and focuses attention on the immediate environment (Carver and Scheier, 1998; Vallacher & Wegner, 1987). Moreover, lower-level construals may provide more concrete indicators of progress than high-level construals (Emmons, 1992): it is easier to determine if one is being successful at pursuing a lower-level goal like “keeping your desk clean” than the associated higher-level goal of “being more organized”.⁵ Further, a more concrete level of

construal may make it easier to disengage from an unattainable goal by reducing its personal importance and self-relevance.

Thus, by logically elaborating on principles within control theory, it is hypothesized that higher-level, abstract construals promote effective goal progress for unproblematic, familiar or positive situations, but that lower-level, concrete construals are more constructive for difficult or novel situations and unattainable goals. Therefore, the elaborated control theory hypothesizes an interaction between structural aspects (valence) and process aspects (level of construal) in determining the consequences of RT. Critically, this account explains the observed pattern of findings in which adopting a more concrete level of construal during RT *about negative content or in the context of negative situations* (e.g., focusing on depressed mood, thinking about upsetting events, or planning for stressful events like exams) results in more constructive outcomes than RT characterized by a more abstract level of construal (e.g., Leary et al., 2006; Pham & Taylor, 1999; Vallacher et al., 1989; Watkins & Moulds, 2005a; Watkins & Teasdale, 2001, 2004; Webb & Sheeran, 2003). However, the corollary prediction that during RT *about positive content or in the context of positive situations* abstract construals will have more constructive outcomes than concrete construals, has not been extensively tested. Recent evidence consistent with this prediction is the finding that people with low self-esteem (LSE) who are induced to think abstractly about a recent compliment from a romantic partner, report greater state self-esteem and greater security in their relationship, than LSE people induced to think concretely about a recent compliment (Marigold, Holmes, & Ross, 2007).

A related prediction from the elaborated control theory is that by default individuals will adopt more abstract construals, but shift to more concrete construals when faced with difficulties (see also Wegner & Vallacher, 1987). Consistent with this hypothesis, individuals tend by

default to use more abstract construals, focused on the meanings, consequences and implications of actions (Wegner & Vallacher, 1987; Wegner, Vallacher, Kiersted, & Dizadji, 1986; Wegner, Vallacher, Macomber, Wood, & Arps, 1984), yet when faced with difficult, novel or complex situations, people often move towards more concrete levels of processing (Beckmann, 1994; Vallacher, Wegner, & Frederick, 1987; Wegner et al., 1984; Wong & Weiner, 1981), although there are exceptions including the tendency towards depressive rumination in response to sad mood (Nolen-Hoeksema, 1991) and occasions when more abstract construals are adopted in response to failure and goal frustration (Wicklund, 1986). Other evidence consistent with this hypothesis is the finding that in neutral and happy moods, people adopt a more global, abstract processing style but shift into a more local, concrete processing style in response to sad mood (Beukeboom & Semin, 2005; Beukeboom & Semin, 2006; Bless et al., 1996; Gasper & Clore, 2002; Isbell, 2004; Kurman, 2003; Storbeck & Clore, 2005b). This hypothesis predicts that RT will tend to be characterized by higher-level, abstract construals, when goal progress is unproblematic, but that RT will tend to be characterized by lower-level, concrete construals, when goal progress is blocked. Because the elaborated control theory hypothesizes that higher-level control is the default level-of-control, it also accounts for the finding that competence, practice, and expertise influence the consequences of RT, for example, the benefit of RT for depressive pessimists. When an individual is more familiar and skilled within a domain, he or she is more likely to have good specification from high-levels to low-levels in the goal-action hierarchy, reducing the likelihood of higher-level control breaking down.

The Control Theory Account: An Integrative Overview and Novel Predictions

One of the main strengths of this elaborated control theory account is its ability to account for the findings reviewed regarding the different consequences of RT, in particular, its

ability to accommodate both structural approaches to RT (valence, context) and to expand on these approaches to explain process approaches to RT (level of construal). Moreover, this control theory account of RT is consistent with the extensive literature linking goal discrepancy with RT. A further advantage of the control theory approach is that it can integrate the other theoretical approaches to RT and their associated findings within its conceptual framework. Control theory can explain the findings within cognitive processing accounts, since both theories propose that a key mechanism driving RT is the attempt to reduce discrepancies, whether between current outcome and desired goals or between current informational state and existing mental structures (Martin & Tesser, 1989). Within control theory, the adoption of a higher-level goal such as “making sense of events” or “reducing discrepant information” could account for the observations within the cognitive processing account, as explicitly outlined within models of posttraumatic growth (Tedeschi & Calhoun, 2004). Moreover, despite initial suggestions that discrepancies were not necessary for depressive rumination to occur (Nolen-Hoeksema, 1991), theoretical accounts suggest that focus on the causes and consequences of depressed mood is likely to involve focus on unresolved goal discrepancies (e.g., Brunstein & Gollwitzer, 1996; Oatley & Johnson-Laird, 1987). Moreover, recent findings within RST are consistent with the predictions of control theory: (a) the content of experimentally-induced rumination is characterized by thinking about unresolved personal problems (Lyubomirsky et al., 1999); (b) depressive rumination is associated with meta-cognitive beliefs that rumination is useful for understanding depression and solving problems, suggesting that depressive rumination is adopted with the intention of resolving goal-based or meaning-related discrepancies (Lyubomirsky & Nolen-Hoeksema, 1993; Papageorgiou & Wells, 2001; Watkins & Baracaia, 2001; Watkins & Moulds, 2005b); (c) experimentally-induced rumination and discrepancy-

focused thinking both increase anxiety and depressed mood to an equivalent degree and are indistinguishable in terms of flow of thought content (Nolen-Hoeksema, 2004a). Indeed, Treynor et al (2003, p. 256) interpreted brooding as “a passive comparison of one’s current situation with some unachieved standard”, consistent with a control theory account.

A further advantage of the control theory account is that it can account for the adoption of the different structural and process aspects of RT. For example, as noted earlier, there is evidence that in response to difficulties, individuals sometimes adopt a more concrete level of construal (Vallacher & Wegner, 1987) but sometimes adopt more abstract construals (Wicklund, 1986), as exemplified by the abstract RT found during depressive rumination/brooding. Thus, any theory of RT needs to explain the mechanisms underpinning whether RT involves (a) negative or positive thought content; (b) an abstract or concrete level of construal. Structural factors, such as valence, are relatively straightforward to explain across all models of RT: thought valence will be determined by the nature of the event and the context in which RT occurs, as well as by individual beliefs, expectancies and learning history. In addition, within control theory, goal progress at a rate faster than anticipated produces positive mood and cognition, whereas goal progress slower than anticipated produces negative valence (Carver & Scheier, 1990).

The elaborated control theory account hypothesizes that the level-of-construal is principally determined by adaptive regulation of level-of-construal in response to situational demands, such that construal typically becomes more concrete in response to difficulties, but that various situational, motivational, and cognitive factors can interfere with this regulatory process. First, the extent to which goal progress is blocked is hypothesized to influence the level of construal adopted (Martin & Tesser, 1996): when goal progress is moderately thwarted it is still adaptive to shift to lower-level construals (Vallacher & Wegner, 1987), whereas more severe

blockage, particularly for highly self-relevant goals, leads to higher-level construals (Wicklund, 1986), as individuals re-orientate to their higher-order concerns. Second, self-related beliefs are hypothesized to influence the preference towards more abstract or more concrete levels of construal. For example, meta-cognitive beliefs that it is important to understand and make sense of feelings and problems would encourage the use of higher-level construals. Likewise, low, unstable or contingent self-esteem leads to attempts to pursue self-esteem by trying to validate abilities and qualities (Crocker & Knight, 2005; Crocker & Park, 2004; Crocker & Wolfe, 2001), which typically involves evaluating one's self-worth at a trait level, that is, the use of more abstract construals (Baumeister & Tice, 1985; Lyubomirsky, 2001). Further, as the perceived probability of an event reduces, construals become more abstract (Wakslak, Trope, Liberman, & Alony, 2006) such that more negative expectations would engender more abstract construals. Third, effective regulation of level-of-construal in response to situational demands is hypothesized to require good cognitive and central executive control. Thus, individuals with deficits in executive/inhibitory control, either because of greater cognitive load or reduced cognitive resources, would be impaired at effectively regulating level-of-construal in response to situational demands. This analysis predicts that individuals with these vulnerability factors will be compromised in their ability to flexibly regulate level of construal in response to situational demands to the extent that they do not show the functional shift towards lower-level construals typically observed in response to difficulties (Bless et al., 1996; Gasper & Clore, 2002; Isbell, 2004; Kurman, 2003; Storbeck & Clore, 2005a). Given that patients with depression and depressive ruminators are observed to have such meta-cognitive beliefs (Lyubomirsky & Nolen-Hoeksema, 1993; Papageorgiou & Wells, 2001; Watkins & Baracaia, 2001; Watkins & Moulds, 2005b), reduced self-esteem, and deficits in executive/inhibitory control (Davis & Nolen-

Hoeksma, 2000; Gotlib, Yue, & Joormann, 2005; Hertel, 1997; Joormann, 2004; Joormann, 2006), this analysis suggests the *level-of-construal dysregulation hypothesis*, which predicts that depression-prone groups will be impaired at regulating their level-of-construal in response to difficulties, leading to an overly abstract level-of-construal and to RT that has unconstructive consequences. Consistent with this prediction, a recent study found that individuals with mild-to-moderate depressive symptoms generated counterfactual RT about a negative event characterized by more concrete construals than non-depressed individuals, whereas individuals with severe depressive symptoms generated counterfactual RT characterized by more abstract construals (e.g., global, characterological judgments). Thus, mild depressive symptoms are associated with the adaptive regulation of level-of-construal in response to mood, but more extreme depressive symptoms are associated with dysregulation of this process (Markman & Miller, 2006). Thus, this *level-of-construal dysregulation hypothesis* accounts for why the subset of individuals prone to depression and brooding show a tendency to adopt RT characterized by more abstract construals, despite it having unconstructive consequences.

The further test of the scientific utility of this elaborated control theory approach to RT is its ability to make unique testable predictions that can be evaluated in future research. The current analysis has generated a number of such testable predictions. First, as noted above, the *level-of-construal dysregulation hypothesis* predicts that whereas the majority of individuals will preferentially adopt higher-level construals in unproblematic, familiar, positive and neutral situations, but shift to lower-level construals in the face of difficulties and negative mood, individuals at risk for depression will continue to preferentially adopt higher-level construals even in the face of difficulties and negative mood. Second, as noted earlier, the elaborated control theory predicts an interaction between level of construal and valence in determining the

consequences of RT. Lower-level construals are predicted to be more adaptive during RT focused on negative content or occurring within a negative context, whereas higher-level construals are predicted to be more adaptive during RT focused on positive content or occurring within a positive context. Thus, the use of repeated training paradigms in which individuals learn to adopt a more concrete level of construal in response to emotional events would be predicted to reduce emotional vulnerability to a subsequent negative event but also to reduce positive response to a subsequent positive event. Likewise, since people construe nearer future events in more concrete terms than distant future events (Forster, Friedman, & Liberman, 2004; Liberman & Trope, 1998; Trope & Liberman, 2003), focusing on nearer future events during negatively-valenced RT is predicted to result in more constructive outcomes than focusing on distant future events, with the reverse pattern of findings predicted for positively-valenced RT.

Third, this approach has a number of implications for the treatment of psychological disorders, since RT has been demonstrated to contribute to both anxiety and depression (Harvey et al., 2004). It suggests that when an individual starts to dwell on a negative event or difficulty, shifts in how he does this could potentially move him from RT that exacerbates his difficulties to RT that helps his recovery. This analysis suggests that the goal of therapy for people with unconstructive RT should not be to reduce their RT, but rather to shift them to more constructive forms of RT. Targeting such changes could contribute to more effective and systematic treatments for psychological disorders. This analysis predicts that RT with constructive consequences can be facilitated by: (1) reducing the extent and accessibility of negative thought content, whilst increasing the extent and accessibility of positive thought content; (2) encouraging a shift into a more concrete level of construal when focused on difficulties and negative mood (see Teasdale, Segal, & Williams, 1995 for a related analysis). These predictions

are consistent with a number of psychological therapies empirically shown to be effective in treating depression and anxiety. Both cognitive behavior therapy (CBT) and behavioral activation implicitly encourage patients to be more concrete, specific and detailed in their description and analysis of activities. Further, in both therapies, patients work to build up success, mastery and pleasurable activities, and, thereby, improve self-esteem and strengthen and make more accessible positive cognition. Mindfulness-based cognitive therapy (MBCT), which has been demonstrated to significantly reduce rates of relapse in people with a history of recurrent depression in several trials (Ma & Teasdale, 2004; Teasdale et al., 2000), and to reduce depressive rumination (Ramel, Goldin, Carmona, & McQuaid, 2004), explicitly uses meditation practice to train patients away from abstract levels of processing and into a more concrete mode of processing (Segal, Williams, & Teasdale, 2002). Moreover, a recent adaptation of CBT that explicitly focuses on shifting processing towards lower-level construals has encouraging initial results in the treatment of residual depression, reducing symptoms and depressive rumination (Watkins et al., 2007).

These examples are illustrative rather than exhaustive. Nonetheless, they demonstrate how the control theory can generate unique, testable predictions, as well as account for current knowledge. The veracity of the account should be subject to evaluation by the rigorous testing of these and other relevant predictions.

Future Research

Areas for future investigation

The current review also highlights important gaps in the research on RT. First, the study of RT has been predominantly focused on depression, worry, and trauma. Future research needs to examine the processes of RT with respect to other psychological disorders, other triggering

events and other emotions. Recent findings linking RT prospectively to bulimia and substance abuse in female adolescents (Nolen-Hoeksema et al., 2007) and concurrently to bipolar disorder (Johnson et al., in press) suggests the value of further RT research in these disorders. Second, many of the prospective research of RT related to psychological disorders have not explicitly reported or controlled for previous episodes of the relevant disorder (e.g., major depression), which could potentially act as a common variable explaining why elevated RT predicts future symptoms. Third, there is a preponderance of research on RT with unconstructive consequences, which needs to be balanced by more research into the constructive aspects of RT. In particular, more prospective longitudinal studies and experimental studies are necessary to investigate the constructive consequences of RT, especially in the areas of cognitive processing and posttraumatic growth, where most of the evidence is still only cross-sectional. Fourth, such research requires behavioral, physiological or observer-rated outcome measures that reduce the risk of constructive outcomes resulting from inaccurate, biased or defensive self-reports.

Fifth, a valuable addition to research in this field will be the development of measures that can assess both constructive and unconstructive aspects of RT, as well as RT across a wider range of situations and moods. The limitations of the RSQ were noted earlier: Future research will usefully assess RT using alternative questionnaires (Siegle, Moore, & Thase, 2004) that do not confound RT with the degree of negative affectivity, and that can capture other potentially relevant dimensions such as the duration, controllability and repetitiveness of RT. Likewise, the assessment of RT through non-self-report measures is a priority, by developing on-line measures of RT, such as the use of thought-sampling, or cognitive-experimental and psychophysiological indices associated with self-reported RT, such as attentional bias (Joorman et al., 2006), sustained pupil dilation to negative information (Siegle, Granholm, Ingram, & Matt, 2001;

Siegle, Steinhauer, Carter, Ramel, & Thase, 2003), or sustained event-related fMRI amygdala activity in response to emotional words (Siegle, Steinhauer, Thase, Stenger, & Carter, 2002).

Sixth, the process of goal disengagement needs more detailed examination. Goal disengagement and goal reengagement is increasingly suggested to be important in determining wellbeing (Rasmussen, Wrosch, Scheier, & Carver, 2006; Wrosch, Dunne, Scheier, & Schulz, 2006; Wrosch & Heckhausen, 1999; Wrosch et al., 2003; Wrosch, Schulz, & Heckhausen, 2004) and, to date, is neglected in the study of RT.

Other possible moderators of the consequences of RT

This review focused on factors that were robustly demonstrated to moderate the consequences of RT. Nonetheless, there was tentative evidence that several other factors may moderate the consequences of RT. First, two correlational studies suggest that the purpose motivating RT may moderate its consequences: RT motivated by curiosity and by searching for new ideas and experiences was associated with less negative affect/depression than RT motivated by neurotic, threat-related concerns or by the need for certainty (Seegerstrom et al., 2003; Trapnell & Campbell, 1999). Prospective and experimental studies are necessary to explore whether purpose of RT may be a potential moderator. Second, rigidity of thought during RT (e.g., perseveration on the same content versus generation of many different ideas) may be a potential moderator of the consequences of RT. Several studies suggest that the generation of an increased number of different thoughts and ideas is associated with constructive consequences for RT (Cantor et al., 1987; El Leithy et al., 2006), whereas RT defined in terms of perseveration and stagnant deliberation is associated with increased depression (Ehring, 2007; Feldman & Hayes, 2005). Thus, RT that is highly repetitive, “stuck”, and perseverative may be unconstructive. This suggestion parallels Ingram’s (1990) proposal that pathological self-focus is

characterized by excessive frequency, sustained duration and rigidity. By extension, it may be useful to investigate whether frequency, duration, and repetitiveness of RT moderate the consequences of RT.

Conclusion

The analysis outlined here builds on many others and represents ongoing efforts to identify the key mechanisms that influence the different consequences of RT. In this article, I have reviewed evidence indicating that RT can have unconstructive and constructive consequences. In the course of reviewing the literature on RT, three factors emerged to account for the differential consequences of RT: the valence of thought content, the intrapersonal and situational context of the individual engaged in RT, and the construal level of the RT. Table 3 describes how each of the major classes of RT reviewed earlier can be characterized in terms of these moderating factors. Thus, depressive rumination (Nolen-Hoeksema, 1991) is characterized by negatively valenced thought content (RT about depression), a negative intrapersonal context (depressed mood, negative self-beliefs) and an abstract level-of-construal (thinking about meanings and implications), with accompanying unconstructive consequences. Several classes of RT have inclusive and broad definitions, such that they cannot be characterized by a particular value for each factor (e.g., Martin & Tesser's definition of rumination encompasses positive vs. negative content, abstract vs. concrete construals). Worry has been described as having unconstructive consequences and constructive consequences. Within the current analysis, all worry is characterized by negative valence (thoughts of a real or potential problem), but worry characterized by a concrete level-of-construal is constructive, whereas worry characterized by an abstract level-of-construal and negative intrapersonal context (e.g., low problem-solving confidence) is unconstructive. Moreover, although the valence of the context typically matches

the valence of thought content, there are exceptions; for example, in problem solving and defensive pessimism, thought content is negative (thoughts of a problem) but intrapersonal context is positive, reflecting high levels of optimism and positive self-belief. This analysis also suggests that there may be two routes by which cognitive processing could be constructive: Following a stressful event (negative situational context), it could be useful to either focus on finding benefits (positive content) in as abstract a way as possible, or to focus on the negative experience (negative content) in as concrete and detailed a way as possible. It is important to acknowledge that, although this mapping of function to classes of RT is consistent with all the evidence reviewed, it is not a definitive account, but rather a preliminary framework to organize findings across the RT literature, inform re-analysis of extant findings, and generate further hypotheses.

The key messages of this article are twofold. First, the article extends the explanatory power of previous theorizing about RT by elaborating on the original control theory account of rumination, and suggests that the process of RT can be best understood within this framework. As well as providing a theoretical framework to guide future research, this approach has considerable implications for understanding how thinking, action, and emotional state interact. Second, this analysis is of particular relevance to answering the important theoretical and applied question of how RT about upsetting events sometimes leads to effective cognitive processing and problem solving, yet at other times exacerbates depression and anxiety.

This review was not meant to be, and clearly, could not be, exhaustive. Given the breadth of the literature relevant to RT, it is likely that other factors not mentioned here are compatible with this analysis, or could influence the consequences of RT. Furthermore, this review has focused on the processes and mechanisms most directly linked to the different consequences of

RT, at the loss of detailed consideration of other factors potentially linked to RT. In particular, biological, interpersonal, neuropsychological and neurological factors, such as the role of neurotransmitters, functional deficits in inhibitory processes, and functional neuroanatomy have not been reviewed (e.g., Mayberg, 2006; Ray et al., 2005; Siegle et al., 2001). This is not to argue that these factors do not play a role in influencing RT; it is probable that they do; rather it reflects the fact that there is currently little evidence that these processes influence the consequences of RT, which was the focus of this review. Future research would usefully examine these factors in relationship to the consequences of RT and, in particular, with reference to the control theory elaborated here. Nonetheless, I hope that the integrative framework elucidated here provides a novel and useful theoretical organization that will facilitate research on the mechanisms underpinning RT, and provides the first tentative answers to the highly significant question of “What determines whether RT leads to constructive or unconstructive consequences?”

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Footnotes

¹Experiential rumination has some overlap with mindfulness meditation, conceptualized as “paying attention in a particular way, on purpose, in the present moment, non-judgementally” (Kabat-Zinn, 1990). However, it differs from mindfulness in that it does not involve a focus on acceptance, compassion or decentering (viewing thought and feelings as mental events), nor an explicit grounding in body state (focus on the breath or scanning the body). Moreover, this brief manipulation lacks the extensive formal and informal practice recognized as critical in engaging fully with the experience of mindfulness. Further, whilst mindfulness meditation can involve RT, it need not necessarily do so. Thus, these studies compare different forms of RT, rather than rumination to mindfulness.

²I am grateful to an anonymous reviewer for highlighting this distinction between structural versus process aspects of RT.

³It is important to note that the distinction between abstract and concrete levels of representation used here differs from accounts in which concrete levels of representation are associated with “hot” emotionally-arousing representations, whereas abstract levels of representation are associated with “cool”, less arousing representations (Ayduk, Mischel, & Downey, 2002 ; Kross, Ayduk, & Mischel, 2005 who report that distanced, non-emotionally immersed processing can be adaptive when focused on anger; for theoretical account see Metcalfe & Mischel, 1999). The level-of-construal and level of goal hierarchy accounts discussed here do not make links between level of processing and emotional arousal, rather degree of emotional arousal/distance is conceptualized as a separate dimension.

⁴Several theories of cognition and emotion share with the control theory account an emphasis on (a) self-related discrepancies driving RT, and (b) different levels of processing and

mental representation, notably the Self-Regulatory Executive Function model (SREF; Papageorgiou & Wells, 2003; Wells & Matthews, 1994) and the Interacting Cognitive Subsystems theory (ICS; Teasdale & Barnard, 1993). As many of the predictions and principles of these models can be subsumed within the broader control theory framework and are not exclusive to each particular theory, in the interests of conciseness, these theories are not further elaborated here.

⁵I am grateful to an anonymous reviewer for highlighting how more concrete levels-of-construal would facilitate the monitoring of goal progress.

Table 1
Studies demonstrating unconstructive consequences of repetitive thought

Author	Design & Sample	Measures	Main Findings
<i>Cross-sectional studies</i>			
Abbott & Rapee (2004)	54 socially anxious patients vs. 32 non-anxious controls	Post-event RT for 1 wk after impromptu speech	Post-event RT: Socially phobic > non-anxious
Abela et al. (2004)	260 3 rd & 7 th grade children	RSQ, CDI	RT positively correlated depression
Borkovec et al. (1983)	Study 1: 305 u/g's	STAI, BDI, % of day worrying.	Worry correlated anxiety, depression, social-evaluative fears.
Callander & Brown (2007)	62 women at recurrent miscarriage clinic	Thought listing, anxiety, depression	Upward counterfactuals positively correlated anxiety
Clohessy & Ehlers (1999)	56 ambulance service workers	PSS, GHQ, responses to intrusions (RT)	RT positively correlated with post-traumatic stress symptoms
Conway et al. (2000)	Study 2: 188 u/g's	RSS, distress about current concern, BDI, NEO-FFI	Rumination on sadness significantly positively correlated with BDI & neuroticism
Edwards et al. (2003)	High vs. low social anxious	Post-event RT for 1 wk after impromptu speech	Negative rumination: High anxious > low anxious
El Leithy et al. (2006)	46 victims of physical assault	IES-R, counterfactual fluency & frequency	Frequency of counterfactual thinking positively correlated with posttraumatic distress

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Eshun (2000)	194 college students, USA & Ghana	RSQ, suicidal ideation questionnaire	Gender and rumination accounted for significant variance in suicidal ideation
Feldman & Hayes (2005)	Study 3; 325 u/g's	MMAP, RSQ, PSWQ, SPSS-R, MASQ	Stagnant deliberation & outcome fantasy correlated with increased depression & anxiety; problem analysis correlated increased anxiety.
Grant et al. (2004)	622 low-income, African American adolescents	RSQ, depression, anxiety on YSR	Depression: girls > boys. Rumination correlated depression. Gender effect for depression mediated by extent of rumination
Harrington & Blakenship (2002)	199 u/g's	BDI, BAI, GRS	Rumination significantly positively correlated with depression and anxiety
Harvey (2000)	30 insomnia patients, 30 good sleepers	Semi-structured interview	Pre-sleep worry: Insomnia patients > good sleepers
Ito et al. (2003)	Retrospective, 106 parents following death of a child;	rumination, SCID, RSQ	Ruminative coping after loss was significantly associated with MDE
Johnson et al. (in press)	28 Bipolar Disorder patients, 35 MDD patients; 44 no mood disorder	RSQ, RPA	Depressive rumination: Bipolar=MDD > no mood disorder; positive rumination: Bipolar > MDD = no mood disorder.
Joorman et al. (2006)	64 MDD patients	RSQ, emotional facial dot-probe	Positive rumination positively correlated hypomania Brooding significantly correlated with attentional bias towards sad faces
Kocovski et al. (2005)	55 high vs. 57 low socially anxious u/g's	Vignettes of public mistakes	Report of rumination: High socially anxious > low socially anxious

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Kuyken et al. (2006)	High vs. low risk vs. MDD; 326 adolescents (age 14-18)	EPQ-N, BDI, RSQ, PHQ-A	Rumination: MDD > at risk (high N) > not at risk Rumination correlated depression in MDD group
Lam et al. (2003)	109 MDD patients	RSQ, BDI, ASQ, DAS	Rumination correlated depression scores, number of past depression episodes
Lyubomirsky et al. (2006)	Retrospective, 70 breast cancer survivors	RSQ, delay in seeking help	Time to presentation: High ruminators > low ruminators (on average 39 days longer)
Markman & Miller (2006)	58 u/g's divided into severe depression, mild-to-moderate depression, no depression, generated counterfactuals about recent negative academic event	Coding of counterfactuals, rating of negative event	Greater reduction in negative ratings following RT for less depressed. Uncontrollable, characterological counterfactuals: severe depression = no depression > mild-to-moderate depression.
Mellings & Alden (2000)	58 socially anxious; 58 non-anxious	Frequency of post-event RT following social interaction	Frequency of post-event RT: Socially anxious > non-anxious. RT predicted recall of negative self-related information, negative self-judgments when anticipating a further social interaction
Meyer et al. (1990)	Study 2: 405 u/g's	PSWQ, BDI, STAI	Worry positively correlated anxiety and depression
Nolen-Hoeksema & Jackson (2001)	740 community sample	RSQ, beliefs re controllability of emotions, mastery of negative events	Beliefs about controllability of emotions, mastery of negative events mediated gender difference in rumination
Papadakis et al. (2006)	223 girls between 7 th -12 th grade	RSQ, discrepancy between actual & ideal self, BDI	Rumination interacted with discrepancy to predict concurrent depression
Perini et al. (2006)	High vs. low socially anxious groups	Post-event RT for 1 wk after speech	Post-event rumination: Socially anxious > low anxious

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Rachman et al. (2000)	130 u/g's	BDI, social anxiety inventory, post-event RT	Post-event RT significantly positively correlated with social anxiety and depression
Richmond et al. (2001)	145 u/g's	IDD, RSQ	Increased rumination associated greater levels of current and past depressive symptoms
Riso et al. (2003)	Outpatients: 42 dysthymia; 27 nonchronic MDD; 24 controls	SCID, DAS, ASQ, RSQ, IDS	Ruminative response style: Dysthymia = nonchronic MDD > never-ill controls
Roberts et al. (1998)	Study 1: 13 CD; 13 PD; 19 ND; Study 2: 24 CD; 87 PPD; 149 BPD; 356 ND	RSQ, BDI, IDD, IDD-L	Study 1: Rumination: currently dysphoric (CD) = previously dysphoric (PD) > never-dysphoric (ND) Study 2: Rumination: CD = prolonged PD > brief PD > ND. Rumination: females > males. Rumination mediates effects of gender & N on dysphoria.
Rude et al. (2007)	Study 1: 232 u/g's. Study 2: 463 u/g's	Study 1: RSQ, STAI, Self-rating depression scale, Study 2: non-judging RSQ, RSQ, BDI	Study 1 & 2: both brooding & reflection positively associated depression, anxiety. Study 2: non-judging reflection not correlated with depression.
Schlotz et al. (2004)	219 pts	Worry & work overload, saliva on awaking & at 30, 45, 60 mins for 6 days	Increased worry associated greater increase and elevated mean levels of cortisol on weekdays
Schwartz et al. (2000)	recovery after anger recall; 30 general population	Thoughts related to anger recall, BP	Slower BP recovery after anger recall in women only

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Segerstrom et al. (2000)	Study 1: 110 u/g's; 40 CBT outpatients	Measure of RT, RSQ, PSWQ, BDI, BAI	Study 1: RT correlated RSQ, PSWQ, anxiety & depression
Smallwood et al. (2004)	Study 1: 30 u/g's. Examined mind wandering via thought probes during vigilance and word encoding tasks	CES-D	Mind wandering (task unrelated thought during probes) positively correlated with depression
Smallwood et al. (2007)	37 u/g's split into high vs. low dysphoric, thought probes during word encoding vs. word shadowing followed by word fragment completion recognition task	CES-D, RSQ	During word encoding, high dysphoric group showed an increase in mind wandering relative to low dysphoric group. Mind wandering associated slower reaction times, poorer recognition in the encoding condition.
Steil & Ehlers (2000)	2 Studies: 159 & 138 RTA survivors	PSS, cognitive strategies incl. rumination	Rumination positively correlated with PTSD severity
Suchday et al. (2004)	40 male students	Recovery of BP after provocation, angry rumination	Angry rumination associated slower recovery of BP
Thomsen et al. (2003)	126 students	ECQ-R, POMS, PSQI	RT positively correlated with depressive, anxious & angry mood, poorer sleep quality, longer sleep-onset.
Trapnell & Campbell (1999)	3 samples u/g's, n = 441, n = 570, n = 710	RRQ, NEO-FF, BDI	Rumination scale significantly positively correlated with depressive symptoms (r = .38, r = .36) and neuroticism (r = .64)
Verplanken et al. (2007)	Study 2: 142 u/g's; study 3: 97 u/g's	HINT, ATQ, RSE	Habitual negative self-thinking positively correlated negative thoughts, low self-esteem (study 2, 3),
Zieger & Kastner (2002)	201 adolescents	RSQ, CDI	Rumination elevated in girls relative to boys; rumination associated with depressive symptoms

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
<i>Longitudinal studies</i>			
Abela et al. (2002)	T2 = 6 wks; 130 3 rd & 184 7 th grade children	RSQ, CDI	RT at T1 predicted depressive symptoms at T2
Andrea et al. (2004)	T2 = 10 mths; 253 low vs. 204 high fatigue pts	PSWQ, self-reported fatigue	Worry & fatigue strongly positively correlated at T1. Worry at T1 predicted fatigue at T2, but only for low fatigue participants after controlling T1 fatigue
Broadbent et al. (2003)	T2 = 1 st 20 hrs after hernia surgery; 36 hernia patients	Pre-surgery worry, wound fluid	Greater worry predicted lower levels of matrix metalloproteinase-9 in wound fluid & self-reports of painful, poorer, and slower recovery
Burwell & Shirk (2007)	T1 = spring of 8 th grade, T2 = fall of 9 th grade, T3 = spring of 9 th grade (1 yr later); 127 adolescents (mean = 14 yrs)	CDI, RSQ, CDRS-R	Brooding predicted change in depression scores after controlling for T1 depression, but reflection did not
Butler & Nolen-Hoeksema (1994)	T2 = 2 wks; 125 male, 74 female u/g's	RSQ, BDI,	Rumination: female > male. Rumination predicted T2 BDI, controlling T1 BDI. Once rumination included, gender not predict depression.
Calmes & Roberts (in press)	T2 = 6-8 wks; 451 u/g's	BAI, BDI, PSWQ, RSQ	RT (worry & rumination) predicted T2 anxiety but not T2 depression, controlling for T1 symptoms. Symptom-focused rumination predicted T2 depression.
Ciesla & Roberts (in press)	Study 4: T2 = 6 wks; 169 u/g's	RSQ, BDI, RSE, LES	Study 4: RT at T1 predicted depressive symptoms at T2 only in pts with low self-esteem & high life stress
Ehlers et al. (1998)	T1 = 3mths after RTA, T2 = 1 yr after; 967 consecutive RTA patients	PSS, RT about RTA	RT at T1 predicted PTSD symptoms at T2 after controlling severity
Ehlers et al. (2003)	T2 = 6 mths; 81 Children aged 5-16 after RTA	PTSD symptoms, RT rating	Cognitive variables including RT at T1 predicted PTSD symptoms at T2

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Evers et al. (1998)	T2 = 1 year; 91 arthritis patients	Self-reported functional status, grip strength, worry	Worry on PCI at T1 predicted functional status & grip strength at T2, controlling for T1 scores
Feldman & Hayes (2005)	Study 4. T1 start 1 st semester; T2 end 1 st semester (13 wks); 110 1 st year law students	MMAP, RSQ, PSWQ, SPSSI-R, MASQ	Study 4: Stagnant deliberation & outcome fantasy at T1 predicted depression at T2, controlling for T1 depression
Fortune et al. (2003)	duration of photochemotherapy; 112 chronic psoriasis patients	PSWQ, HADS, Psoriasis area & severity index	Worry predicted time to clearance: psoriasis cleared 1.8 x slower in high worriers vs. low worriers
Holeva et al. (2001)	T2 = 6 mths; 265 RTA patients	TCQ, PTS	Use of worry to control thoughts at T1 predicted PTSD at T2
Hong (2007)	T2 = 1 mth; 241 u/g's	PSWQ, RSQ, MASQ, COPE	T1 worry predicted T2 anxiety & depression, controlling T1 symptoms. T1 rumination predicted T2 depression, controlling T1 symptoms
Ito et al. (2005, 2006)	T2 = 8 mths; 191 u/g's	RSQ, DAS, depression	Negative rumination was significant predictor of depression
Just & Alloy (1997)	Follow-ups every 6 weeks for 18 mths; 189 non-depressed u/g's at high & low risk for MDE	RSQ, BDI, SADS-L, DAS, CSQ	Rumination predicted onset of MDE & severity of episode
Kubzansky et al. (1997)	T2 = 20 years; 1759 men free CHD	Trait worry	Worry about social conditions predicts the onset of CHD
Kuehner & Weber (1999)	T2 = 4 wks, T3 = 4 mths after discharge; 49 unipolar MDD inpatients	PSE-10, IDD, RSQ	Rumination at T2 predicted (a) levels of depressive symptoms at T3; (b) MDE at T3 in those not remitted at T2

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Mayou et al. (2001)	T1 after RTA, T2 = 3mths, T3 = 1 yr; 773 consecutive RTA patients	HADS, PSS, cognitive variables incl. rumination	Rumination at T2 predicted depression, general anxiety and PTSD symptoms at T3, after adjustment other predictors (severity, previous mood)
Mayou et al. (2002)	T2 = 3 yrs; 546 RTA patients	PSS, emotional response, rumination	Rumination at 3 mths & 1 yr predicted PTSD severity at 3 yrs, though not after controlling for PTSD at 3 mths
Michael et al. (2005)	T1 12 wks post-assault, T2 6 mths; 73 assault survivors	PDS, BDI, Intrusions incl. rumination	Rumination about intrusive thoughts at T1 predicted PTSD symptoms at T2
Moberly & Watkins (in press)	between subsequent intervals (1.5 hrs) in ESM design; 93 adults	ruminative self-focus, negative affect 8 x daily at random intervals, RSQ	RSQ predicted momentary ruminative self-focus. Ruminative self-focus predicted negative affect at T2, controlling for negative affect at T2.
Morrison & O'Connor (2005)	T2 = 6 mths; 161 u/g's	RSQ, life events	Rumination at T1 interacted with reported stress to predict social dysfunction at T2
Murray et al. (2002)	T2 = 4 wks, T3 = 6 mths; 27 inpatient, 176 outpatient RTA patients	PDS, cognitive factors incl. rumination	Rumination at T1 predicted PTSD symptoms at T2 and T3
Nolan et al. (1998)	T2 = 8-10 wks; 135 u/g's	EPQ-N, IDD, RSQ	Rumination at T2 predicted PTSD symptoms at T3, even controlling for dissociation and injury severity
Nolen-Hoeksema (2000)	T2 = 1 year; 1,109 community sample	RSQ, HRSD, BDI, SCID, BAI	N & rumination predicted T2 depression controlling T1 depression, with this effect moderated T1 depression Rumination predicted: (a) onset of MDE in never-depressed; (b) levels of anxiety and depression at T2, controlling T1 symptoms

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Nolen-Hoeksema et al. (1997)	T2 = 1 year; 30 gay men, whose partners died from AIDS	Rumination from interview transcripts, IES, CES-D	Rumination predicted increased distress (intrusive & avoidant thoughts) but not depression, although not after controlling T1 IES
Nolen-Hoeksema et al. (1999)	T2 = 1 year later; 1,132 community adults	BDI, HRSD, RSQ, chronic strain, mastery	Rumination, chronic strain, & mastery mediated gender difference in depression.
Nolen-Hoeksema & Morrow (1991)	T2 = 10 days after quake (n=137), T3 = 7 wks after quake (n=41); 250 u/g's 2 wks before 1989 Loma Prieta earthquake	RSQ, IDD,	Rumination at T1 predicted depression and PTSD stress symptoms at T2 and T3, controlling for T1 symptoms. Rumination about earthquake at T2 predicted stress symptoms at T3
Nolen-Hoeksema et al. (1993)	79 u/g's	30 day diary of mood & rumination	More ruminative responses predicted increased duration of depressed mood, after controlling for initial severity of mood
Nolen-Hoeksema et al. (1994)	T2 = 6 mths; 253 adults, 1 mth after death of loved one	RSQ, HRSD, BDI, Social support	Rumination at T1 predicted level of depressive symptoms at T2 controlling T1 depression
Nolen-Hoeksema et al. (2007)	annually for 4 yrs; 496 female adolescents, 11-15 yrs old	RSQ, SADS for Children, Eating Disorder Examination, substance abuse	Rumination predicted increases in depression, bulimia symptoms & substance abuse over following yr; controlling for 1 year lag of symptoms. Depression and bulimic symptoms predicted increases in rumination over yr.
Raes et al. (2006)	T2 = 7 mths; 28 MDD patients	RSS, BDI, HRSD, AMT	Rumination on sadness at T1 predicted BDI at T2 & mediated relationship between memory specificity & BDI

Table 1 (continued).

Author	Design	Sample	Measures	Main Findings
Rector & Roger (1996)	T1 start of term, T2 = 8 wks later, 121 1 st year u/g's		ECQ-R, GHC, York self-esteem inventory	Anxiety, depression, insomnia on GHC at T2 predicted by rehearsal at T1
Robinson & Alloy (2003)	T2 = 2.5 yrs; 148 u/g's at high and low cognitive risk		Stress-reactive rumination, RSQ, BDI, DAS, CSQ, SADS-L	Stress-reactive rumination at T1 predicted future MDE at T2 in individuals with high DAS, CSQ but not low DAS, CSQ
Roelofs et al. (2006)	T2 = 6 mths; 331 at T1, 73 at T2 u/g's		RSQ, RRS, Zung depression scale, STAI	Joint factor "rumination on causes of sadness" interacted with T1 depression to predict T2 depression, after controlling T1 rumination & depression
Roger & Najarian (1998)	T1 = immediately after exam, T2 = 3 wks later; 51 student nurses		ECQ-R, urinary cortisol	Increases in cortisol T1 to T2 associated with increased RT
Rohan et al. (2003)	T1 = Oct-Nov, T2 = Jan-Feb; 20 SAD women; 20 controls		RSQ, BDI, SCID, HRSD	In SAD, RT assessed at T1 predicted depressive symptoms during winter at T2, after controlling for T1 depression
Sakamoto et al. (2001)	T2 = 2 mths; 98 u/g's		RSQ, Self-Rating Depression Scale	Rumination at T1 predicts ruminative responses and cognitive symptoms of depression at T2
Sarin et al. (2005)	T1 = grading of difficult midterm exam; T2 = 4-8 hrs later, T3 = 4 days later; 87 u/g's		RSQ, MASQ	Rumination at T1 predicts increases in anxiety at T2 and increases in both depression & anxiety at T3
Schmaling et al. (2002)	course of treatment; 96 dysthymia / minor depression		RSQ, BDI, HRSD	Rumination predicts more depression/poor treatment response across all 3 treatment conditions: PST, paroxetine or placebo
Schwartz & Koenig (1996)	T2 = 6 wks; 397 adolescents		RSQ, ASQ, CDI	Rumination at T1 predicted depression at T2
Seegerstrom et al. (1998)	2, 8, 15 weeks after Northridge earthquake 1994; 47 hospital workers		PSWQ, IES, POMS, NK cells	NK cells: Low worriers > high worriers Intrusive thoughts: High worriers > low worriers
Seegerstrom et al. (2000)	Study 2: T1 = prior midterm exam; T2 = 1 wk post-exam; 90 u/g's		Measure of RT, RSQ, PSWQ, BDI, BAI	shared variance between RSQ & PSWQ (repetitive thought) predicted maintenance of anxiety, after controlling for T1 anxiety (p < .07)

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Siegle et al. (1999)	Treatment outcome; 53 MDD or dysthymia patients	RSQ, weekly BDI during CBT	Rumination was associated with slower recovery from depression, in part mediated by initial depression
Smith et al. (2006)	T2 = 2.5 yrs; 137 u/g's with high vs. low cognitive risk	RSQ, BDI, DAS, CSQ, hopelessness, suicidal ideation	Presence & duration of suicidal ideation at T2 predicted by rumination at T1, with this effect partially mediated by hopelessness
Spasojevic & Alloy (2001)	Assessed every 6 weeks for 2.5 years; 137 u/g's with high vs. low cognitive risk	RSQ, BDI, DAS, CSQ, SADS-L	Rumination mediated effects of dysfunctional attitudes, past depression, self-criticism on onset of MDE.
Stanton et al. (2000)	T1 = 20 wks after treatment, T2 = 3 mths later; 92 female breast cancer patients	COPE, emotional processing & expression, POMS	Emotional processing at T1 predicted higher distress scores at T2, after controlling T1 distress and emotional expression
Thomson et al. (2004a)	T2 = 1 year; 96 20-35 yr olds, 110 70-85 yr olds	ECQ-R, self-reported physical problems	RT significantly predicted self-reported physical health only for 20-35 yr olds
Thomsen et al. (2004b)	immunological measures 7-14 days after T1, follow-up 1 yr; 196 20-35 yr olds; 314 70-85 yr olds	ECQ-R, POMS, MMSE, sleep quality. Health care use	RT associated sad mood & poor sleep quality. In 70-85 yr olds, RT predicted numbers of leukocytes and lymphocytes, and increased health care utilization, esp. telephone consultation
Treynor et al. (2003)	T2 = 1 yr; 1130 community sample	RSQ, BDI	Brooding subscale at T1 predicted more depression at T2 controlling for depression at T1

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Verplanken et al. (2007)	T2 = 9 mths; 1102 Norwegian citizens	HINT, HADS, DAS, life events	Controlling for T1 symptoms, dysfunctional attitudes & life events, habitual negative self-thinking predicted anxiety & depression at T2
Young & Azam (2003)	Sept to Nov (T1); Jan to March (T2); 18 SAD patients	14 day diary of mood & rumination, BDI	Diary measure of rumination in the fall (T1) predicted winter depression at T2, after controlling for T1 BDI
<i>Experimental studies</i>			
Andrews & Borkovec (1988)	Velten inductions: worry vs. depression vs. somatic anxiety vs. neutral; 128 u/g's	MAACL	For MAACL depression: Depression = Worry = Somatic anxiety > neutral. For MAACL anxiety: Somatic anxiety > worry > depression > neutral
Behar et al. (2005)	5-min counterbalanced worry vs. trauma recall vs. relaxation; u/g's Study 1: 78; Study 2: 43 +/- GAD, PTSD symptoms	depression & anxiety ratings	Study 1, 2: Worry = verbal thought, trauma recall = imagery. For anxiety: worry >= trauma recall > relaxation. For depression: trauma recall > worry > relaxation.
Blagden & Craske (1996)	Anxious mood induction then RUM vs. DIS, activity vs. passivity; 44 u/g's	POMS	Anxious mood: Rumination > Distraction
Borkovec et al. (1993)	30s relaxation vs. general-worry vs. thought-worry vs. image-worry vs. affect-worry, then public speaking image x 10; 75 female high speech anxious u/g's	HR, fear rating	HR during threat image: Relaxation > Thought-worry: other 3 conditions between but ns difference. Fear rating during public speaking image: All Worry conditions > Relaxation
Borkovec & Hu (1990)	Day 1: Neutral vs. relaxation vs. worry, day 2: imagine public speaking x 10 trials; 45 female high speech anxious u/g's	HR, fear rating	HR increase to imagery: Relaxation > neutral > worry. Fear report to images: Worry > neutral
Borkovec et al. (1983)	Study 3: 0 vs. 15-min vs. 30-min worry periods, with pre- & post-manipulation focus-breathing tasks; 60 u/g worriers vs. nonworriers	MAACL, HR	Anxiety, depression, hostility: Worriers > nonworriers Negative distracting thoughts: Increase in 15-min worry, decrease in 0-min, 30-min worry

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Brosschot & van den Doef (2006)	Postpone worry to 30-min period daily vs. no intervention; 171 high school students	6 day log of worry, somatic symptoms for 3 days pre-/post-intervention	Postponers fewer somatic complaints than control group, controlling for baseline complaints, with worry duration acting as mediator
Bushman (2002)	Anger induction (insult from other pt), then hitting punchbag thinking about other (rumination) vs. thinking about getting fit (distraction) vs. control; 602 u/g's	MAACL-anger, PANAS, Aggression measure: noise directed to other	Anger: rumination > distraction = control Aggression: rumination > control
Bushman et al. (2005)	Study 1 Provocation, then RUM vs. DIS vs. positive mood, then trigger vs. no trigger for irritation (poor vs. good performance of research assistant); 42 u/g's. Study 2: Provocation vs. no provocation, RUM vs. DIS, trigger vs. no trigger (positive vs. negative evaluations from other pt); 385 u/g's. Study 3: provocation then RUM vs. no-rumination, then 8hr later trigger vs. no trigger; 93 u/g's	anger ratings, aggression measure (evaluation research assistant/hot sauce allocated to confederate/noise directed at other)	Anger: rumination > distraction in all 3 studies Study 1: After trigger, aggression in RUM > DIS = positive mood; no difference after no trigger condition Study 2: Provocation X Rumination X Trigger interaction: for provoked participants, in the presence of trigger, more hot sauce allocated in RUM than DIS, with this effect mediated by negative affect in response to trigger. Study 3: After trigger, aggression in RUM > no-rum, no difference if no trigger
Ciesla & Roberts (in press)	Study 1: negative mood induction, followed by no-task delay period; 126 u/g's; Study 2: negative mood induction, then RUM vs. DIS; 132 u/g's	BDI, MAACL, RSQ, RSS, RSE, DAS, ASQ	Study 1: RT predicted post-delay dysphoria, controlling for post-induction dysphoria but only in low self-esteem/high DAS pts. Study 2: lower self-esteem/higher DAS associated higher levels of dysphoria, this effect stronger in RUM vs. DIS.
Conway et al. (2000)	Study 3: mood induction, then no delay vs. 5-min delay; 37 high vs. 24 low RSS scorers	RSS, distress about current concern, BDI	high RSS scorers more distressed in delay condition than no-delay condition

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Donaldson & Lam (2004)	RUM vs. DIS; 36 MDD, 36 controls	mood, MEPS	In MDD (not controls), more negative mood and poorer problem solutions in RUM > DIS.
Glynn et al. (2002)	Study 1: emotional vs. nonemotional stressor, high vs. low reactivity task, followed by rumination (= recall stressor vividly); 72 u/g's. Study 2: mental arithmetic task, then 10 mins delay (potential rumination) vs. DIS; 20 u/g's	Study 1: BP, HR. Study 2: BP, HR	Study 1: Elevated BP during rumination and slower BP recovery following the emotional stressor conditions (mental arithmetic, shock avoidance) but not following non-emotional stressors (physical exercise, cold-pressor). Study 2: Speed of BP recovery: Distraction > RT
Guastella & Moulds (2007)	Evening after mid-session exam RUM vs. DIS; 59 high vs. 55 low trait ruminators	RSQ, IES, Sleep Disturbance	Pre-sleep intrusive thoughts: High-trait ruminators > low-trait ruminators, RUM > DIS; Sleep quality: high-trait ruminators in RUM condition < other 3 groups
Hazlett-Stevens & Borkovec (2001)	Relaxation vs. control vs. worry prior to speech; 42 speech-anxious u/g's	Anxiety, HR, MSD of IBI	Anxiety before and during first speech: worry > control > relaxation. HR, MSD of IBI no difference across conditions
Hertel (1998)	RUM vs. DIS vs. waiting condition; 36 Dys vs, 54 Non-dys u/g's	BDI, stem-completion memory test	Controlled retrieval of target words: In Dys, DIS > waiting = RUM; no difference in Non-dys
Joorman & Siemer (2004)	(Study 1): Positive vs. negative mood induction, then RUM vs. DIS; 119 u/g's, Dys vs. Non-Dys on CES-D	mood ratings, time to recall memories to +/- cues	After negative induction, Non-Dys (not Dys) who ruminated recalled mood-incongruent (positive) memories faster. After positive induction, Dys who ruminated recalled mood-congruent (positive) memories slower than Non-Dys.
Kao et al. (2006)	RUM vs. DIS; 33 Dys u/g's (BDI > 14); 33 Non-dys u/g's (BDI < 6)	mood, MEPS, memory recall during MEPS	Post-manipulation dysphoria: Dys ruminators > other 3 groups. Effectiveness of problem solving: Dys ruminators < other 3 groups. Categorical memories: Dys ruminators = Dys distracters > other 2 groups
Kashdan & Roberts (2007)	Personal self-disclosure vs. small talk; 83 u/g's	Social anxiety, post-event rumination, BDI, PANAS	At higher levels of social anxiety, post-event rumination associated with increases in negative affect following personal disclosure, but decreases in negative affect following small talk.

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Lavender & Watkins (2004)	RUM vs. DIS; 30 MDD vs. 30 controls	Future thinking task, SCID	Within MDD patients, no. of negative future events generated, RUM > DIS; no effect in controls
Lyonfields et al. (1995)	within-subject, baseline vs. worry imagery vs. verbal worry; 15 GAD vs. 15 controls	HR, MSD of IBI, anxiety ratings	Vagal (parasympathetic) tone (MSD of IBI): GAD < controls. Little change in vagal tone across tasks in GAD group, but decline in vagal tone across tasks in controls. Anxiety: verbal worry > worry imagery
Lyubomirsky et al. (2003)	Study 1: RUM vs. DIS vs. planning, 45 Dys (BDI>15) vs. 46 Non-Dys (BDI <3) Study 2: RUM vs. DIS, 28 Dys vs. 26 Non-Dys. Study 3: RUM vs. DIS, 33 Dys vs. 32 Non-Dys.	Study 1: CIQ, reading task, Study 2: questions on videotaped lecture. Study 3: CIQ during puzzle, proof-reading	Study 1: dysphoric mood, time spend reading passage, interfering thoughts in Dys-ruminative group > other 4 groups. Study 2: dysphoric mood, time answering questions in Dys-ruminative group > other 3 groups Study 3: dysphoric mood, interfering thoughts, poorer proof-reading in Dys-ruminative group > other 3 groups
Lyubomirsky & Nolen-Hoeksema (1995)	RUM vs. DIS, Dys (BDI-SF>7) vs. Non-Dys (BDI-SF <3); Dys vs. Non-Dys u/g's - Study 1: 33 vs. 36; Study 2: 36 vs. 37; Study 3: 36 vs. 33	Mood ratings. Study 1: CBQ. Study 2: future predictions. Study 3: MEPS	All studies - dysphoric mood: Dys-ruminative group > other 3 groups. Study 1: depressed-distorted thoughts, pessimistic attributions: Dys-ruminative group > other 3 groups. Study 2: likelihood of positive future events: Dys-ruminative group < other 3 conditions. Study 3: problem-solving effectiveness: Dys-ruminative group < other 3 groups
Lyubomirsky et al. (1998)	RUM vs. DIS, Dys vs. Non-Dys then (Study 1) free recall memory task; (Study 2) cued memory task; (Study 3) frequency ratings for events; (Study 4) think aloud during manipulation. Dys vs. Non-Dys u/g's - Study 1: 38 vs. 34 ; Study 2: 25 vs. 24; Study 3: 39 vs. 33; Study 4: 20 vs. 20	Mood ratings Memory measures	Study 1, 2, 4: dysphoria, negativity of autobiographical memories in Dys-ruminative group > other 3 groups Study 3: dysphoria, reported frequency of negative events in Dys-ruminative group > other 3 groups

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
McLaughlin et al. (2007)	within-subject, worry vs. rumination counterbalanced Study 1: 60 u/g's. Study 2: 34 worrier /ruminator, 40 ruminator, 35 control	BDI, PSWQ, MASQ, PANAS, anxiety & depression ratings	In Study 1 & 2, both worry & rumination increased negative affect, anxiety, depression & reduced positive affect. Both involve a predominance of thought (versus imagery).
Moberly & Watkins (2006)	Repeated focus on emotional scenarios, abstract vs. concrete, prior to failure; 61 u/g's	PANAS, ACS-P, BDI	After failure, higher levels of trait RT were associated with lower levels of positive affect, but only in abstract condition, not in concrete condition
Morrow & Nolen-Hoeksema (1990)	sad mood induction then RUM vs. DIS, active vs. passive task; 35 male, 34 female u/g's	sadness, hostility & anxiety ratings	Reduction in sadness post-induction to post-task: Distracting-active>distracting-passive>ruminative-active>ruminative-passive
Nelson & Harvey (2002)	Speech threat prior to bed, think about speech verbally (worry) vs. imagery; 31 insomnia pts	Distress, sleep-onset latency	Initial distress: Imagery > Verbal worry
Nolen-Hoeksema & Morrow (1993)	RUM vs. DIS; 24 Dys vs. 24 Non-Dys u/g's	Mood ratings	Sleep-onset latency: Imagery < verbal worry Depressed mood increased for Dys participants who ruminated, but decreased in other 3 groups
Park et al. (2004)	RUM vs. DIS; Adolescents: 75 1 st episode MDD; 26 non-depressed psychiatric pts; 33 controls	Despondency, AMT	In MDD group, negative mood and categoric autobiographical memories: RUM > DIS
Peasley-Miklus & Vrana (2000)	Worry vs. relaxation then feared imagery for 24 trials; 51 Fearful female u/g's	HR, facial EMG	During 1 st phase for HR: worry > relaxation During imagery phase for HR: relaxation > worry
Rusting & Nolen-Hoeksema (1998)	Study 1: angry mood induction, then RUM vs. DIS; 41 u/g's. Study 3: anger induction then RUM vs. Dis vs. thought-listing; 60 u/g's	anger, depression, anxiety ratings	Study 1: RUM increased anger, DIS no change in anger Study 3 for anger: rumination > control (thought-listing) > distraction
Seegerstrom et al. (1999)	Exposure to phobic stimulus vs. no exposure; Snake/spider fearful: 7 worriers, 8 non-worriers. 6 controls	PSWQ, SCL, HR, immune function	Increased SCL, HR both worry groups; increase in NK cells in response to fear only in normal worry group

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
Thayer et al. (1996)	Baseline vs. relaxation vs. worry; 34 GAD patients, 32 controls	HR, IBIs, (MSD) of IBIs	Cardiac IBIs: GAD < controls. Worry < baseline = relaxation. Worry associated lower cardiac vagal control
Thomsen et al. (2004c)	mood induction; 56 u/g's	ECQ-R, mood ratings	Trait RT positively correlated with post-induction stress, anxiety, anger & helplessness, controlling pre-induction mood
Watkins (2004a)	Failure then 3 x expressive writing, abstract (why?) vs. concrete (how?); 69 community sample	ACS-P, BDI, MAACL, IES	Higher levels of trait RT associated with higher levels of negative mood 12 hr after failure in the abstract but not the concrete writing condition
Watkins & Brown (2002)	Within subject, RUM vs. DIS counterbalanced; 14 MDD, 14 controls	Random number generation task	For count score (index of less randomness), MDD ruminators > other 3 conditions i.e., DIS improved randomness in MDD
Watkins & Teasdale (2001)	Analytical RUM vs. experiential RUM vs. DIS vs. abstraction; 36 MDD patients	despondency, AMT pre-, post-manipulation	Post manipulation despondency: Analytical, Experiential RUM (high self-focus) > DIS, abstraction (low self-focus). Increase in specificity of autobiographical memory:
Watkins & Teasdale (2004)	Analytical RUM vs. experiential RUM; 28 MDD patients	despondency, AMT	Experiential RUM, DIS (low analytical) > analytical RUM, abstraction (high analytical)
Watkins et al. (2000)	RUM vs. DIS ; 48 Dys sample	despondency, AMT	Increase in specificity of autobiographical memory pre-to post manipulation: Experiential RUM > Analytical RUM
Wells & Papageorgiou (1995)	Watch upsetting film, then control vs. imagery vs. distraction vs. worry about film vs. worry usual concerns; 70 u/g's next 3 days	PSWQ, STAI, anxiety VAS, intrusive image diary	Post-manipulation despondency: RUM > DIS. Increases in specificity of autobiographical memory pre to post-manipulation: DIS > RUM Number of intrusive images: worry about film > control, all other groups not significantly different

Table 1 (continued).

Author	Design & Sample	Measures	Main Findings
York et al. (1987)	Velten inductions worry vs. somatic anxiety vs. neutral, then breathing-focus task; 36 u/g's	Negative intrusions, MAACL, HR	Increases in negative intrusions during breathing-focus: Worry > Neutral, Somatic anxiety ns different from both. Increase in HR: Worry=Somatic Anxiety > Neutral

Note. ACS-P = Action Control Scale-Preoccupation; AMT = Autobiographical Memory Test; ASQ = Attributional Style Questionnaire; ATQ = Automatic

Thoughts Questionnaire; BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; BP = blood pressure; BPD = brief previous dysphoric group; CBQ

= Cognitive biases questionnaire; CBT = cognitive-behavioral therapy; CD = currently dysphoric group; CDI = Childrens Depression Inventory; CDRS-R =

Children's Depression Rating Scale-Revised; CES-D = Centre for Epidemiological Survey-Depression; CHD = coronary heart disease; CIQ = Cognitive

Interference Questionnaire; COPE = the COPE scale; CSQ = Cognitive Styles Questionnaire; DAS = Dysfunctional Attitudes Scale; DIS = distraction

manipulation; Dys = dysphoric participants; ECQ-R = Emotional Control Questionnaire-Rehearsal; EPQ-N = Eysenck Personality Questionnaire-Neuroticism

scale; ESM = Experience Sampling Methodology; GAD = generalized anxiety disorder; GHC = general health checklist; GHQ = General Health questionnaire;

GRS = Global Rumination Scale; HADS = Hospital Anxiety and Depression Scale; HINT = Habit index of negative thinking; HR = heart-rate; HRSD =

Hamilton Rating Scale for Depression; IDD = Inventory to Diagnose Depression; IDS = Inventory of Depressive Symptoms; IES = Impact of Event Scale; LES

= Life Experiences Survey; MAACL = Multiple Affect Adjective checklist; MASQ = Mood and Anxiety Symptom Questionnaire; MDE = major depressive

episode; MDD = patients with major depressive disorder; MEPS = Means Ends Problem Solving task; MMAP = Measure of Mental Anticipatory Processes;

MMSE = mini-mental state examination; MSD of IBI = Mean Successive Differences of Heart Interbeat Intervals; N = neuroticism; ND = never-dysphoric

group; NEO-FFI = NEO-five factor inventory of personality; NK = natural killer cells; Non-Dys = non-dysphoric participants; PANAS = Positive & Negative

Affect Scale; PCI = Pain Control Inventory; PD = previously dysphoric; POMS = Profile of Mood States scale; PPD = prolonged previously dysphoric group;

PSE-10 = Present State Examination-10; PSS = post-traumatic stress symptom scale; PST = Problem-solving therapy; PSQI = Pittsburgh Sleep Quality Index; PSWQ = Penn State Worry Questionnaire; pts = participants; RRQ = Rumination & Reflection Questionnaire; RSE = Rosenberg Self-Esteem questionnaire; RSQ = Response Styles Questionnaire; RSS = Rumination on Sadness Scale; RT = repetitive thought; RTAs = road traffic accidents; RUM = rumination manipulation; SAD = seasonal affective disorder; SADS-L = Schedule for Affective Disorders and Schizophrenia –Lifetime; SCID = Structured Clinical Interview for DSM; SCL = skin conductance; SPSI-R = social problem solving inventory-revised; STAI = state trait anxiety inventory; TCQ = Thought Control Questionnaire; T1 = initial baseline assessment, T2 = follow-up assessment, u/g's = undergraduates; VAS = visual analogue scale

Table 2
Studies demonstrating constructive consequences of repetitive thought

Author	Design & Sample	Measures	Main Findings
<i>Cross-sectional studies</i>			
Belzer et al. (2002)	353 u/g's	PSWQ, Catastrophic worry questionnaire, STAI, SPSI	Rational problem solving (constructive) & impulsiveness/carelessness (unconstructive) positively correlated with worry, after controlling trait anxiety & problem orientation
Calhoun et al. (2000)	54 u/g's with traumatic event in past 3 yrs	PTGI, rumination (items derived existing measures)	Early event-related rumination after trauma positively correlated with post-traumatic growth
Cryder et al. (2006)	46 children evacuated for Hurricane Floyd	Rumination, competency beliefs, PTGI	Rumination correlated positively with competency beliefs but not with post-traumatic growth, although competency beliefs correlated with post-traumatic growth
Davey et al., (1992)	Study 1: 105 u/g's; Study 2: 108 u/g's; Study 3: 94 u/g's & p/g's	All studies: STAI, Student Worry Scale. Study 1, 2: Coping with stress, Study 3: Miller Behavioral Style scale-monitoring	Study 1, 2: Worry correlated with trait anxiety. When trait anxiety controlled, worry positively correlated self-reported strategies of active behavioral coping, information-seeking, affective regulation. Study 3: When trait anxiety held constant, worry positively correlated monitoring
El Leithy et al. (2006)	46 victims of physical assault	IES-R, fluency & frequency of counterfactuals	Fluency of counterfactual thinking positively correlated with generation of behavioral plans
Feldman & Hayes (2005)	Study 3; 325 u/g's.	MMAP, Reflection, SPSI-R, MASQ	Study 3: Plan rehearsal negatively correlated depression, positively correlated well-being.
Perkins & Corr (2005)	68 salespeople	PSWQ, ability, job performance	Worry correlated with better job performance but only in high ability individuals

Table 2 (continued).

Author	Design & Sample	Measures	Main Findings
Schorr & Roemer (2002)	141 students reporting trauma/loss	PGTI, "searching for a way to make sense of experience"	Attempts to make sense (RT) associated post-traumatic growth
Segerstrom et al. (2003)	Study 1: 978 u/g's; Study 2: 25 u/g's Study 3: 62 women in breast cancer prevention trial	Study 1: Emotional processing, IES, PSWQ, RSQ, RRQ, NEO-FFI Study 2, 3: self-generated descriptions of RT, ratings of affect Study 3, CES-D, quality of life, IES, STAI	Study 1: Multidimensional scaling revealed Valence dimension (positive vs. negative), Purpose dimension (openness to experience vs. clarity & worry). Study 2: Independent sorting of descriptions resulted in dimensions of Valence (positive vs. negative), Content (achievement vs. interpersonal), Purpose (searching vs. solving). Valence dimension associated affect ratings. Study 3: More negative RT associated more negativity, worse mental health, more anxiety, more physical symptoms. When thought valence positive, searching decreased ratings of physical health and positivity; when thought valence negative, searching increased ratings of physical health and positivity A large % of worry involved problem-solving attempts, sometimes leading to satisfying solutions Reflection scale not correlated with depressive symptoms ($r = .04$, $r = .08$) but correlated with openness to experience ($r = .61$) Reflective pondering related to current depression, self-rated creative interests & creative fluency originality and elaboration.
Szabo & Lovibond (2006)	39 u/g's	7 day diary of worry episodes	
Trapnell & Campbell (1999)	u/g's: n = 441, n = 570, n = 710	RRQ, NEO-FF, BDI	
Verhaegen et al. (2005)	99 u/g's	Reflection from RSQ, CES-D	

Table 2 (continued).

Author	Design & Sample	Measures	Main Findings
<i>Longitudinal studies</i> Bower et al. (1998)	Bereavement interview at T1, then blood samples every 6 mths for 2-3 years. 40 HIV seropositive men after AIDS-related bereavement	Interview transcripts: cognitive processing, discovery of meaning, CES-D, CD4 T-cells, mortality	Cognitive processing significantly associated with discovery of meaning. Discovery of meaning at T1 associated decrease in rate of CD4 decline T1 to T2 and decreased rate of AIDS-related mortality.
Cantor et al. (1987)	Transition to college. T1 = 1 st semester, T2 = 2 nd semester; 147 u/g's	DPQ, GPA, reflectivity = no. of ideas generated for coping plans	Reflectivity at T1 positively associated GPA at T2; higher reflectivity predicted higher GPA in DP but lower GPA in OP.
Ciesla & Roberts (2002)	response to group treatment; 32 MDD patients	RSQ, DAS, RSE, BDI	Rumination interacted with cognitive style to predict change in depression: in high self-esteem, low DAS group, rumination predicted better outcome
Dijkstra & Brosschot (2003)	T2 = 8 mths; 380 smokers, 324 ex-smokers	T1 : worry about health, self-efficacy, disengagement beliefs. T2 smoking behavior	In smokers, increased worry at T1 predicted more quit attempts T1 to T2, more so in group with high self-efficacy.
Feldman & Hayes (2005)	Study 4. T1 start of 1 st semester; T2 end of 1 st semester after 13 weeks; 110 1 st -year law students.	MMAP, Reflection, SPSP-R, MASQ	In ex-smokers, worry predicted relapse, especially in low self-efficacy, high disengagement beliefs group Study 4: plan rehearsal at T1 predicted reduced depression at T2, although no longer sign when controlling T1 depression
Hay et al. (2006)	Meta-analysis of 12 prospective studies; 3342 high-risk & general population women.	Breast cancer worry at T1, T2 breast examination, mammography use	Breast cancer worry has small but reliable ($r = 0.12$) positive correlation with breast cancer screening behavior; greater worry predicts greater likelihood of screening

Table 2 (continued).

Author	Design & Sample	Measures	Main Findings
<i>Longitudinal studies</i>			
Siddique et al. (2006)	T1 = law school orientation; T2 = 1 mth prior to 1 st semester final exam, T3 = post 1 st semester final exam; T4 = 1 mth prior oral argument; T5 = oral argument, 2 nd semester; 184 1 st year law students	PSWQ, self-efficacy, STAI, final exam scores, performance rating for oral argument	After controlling for trait anxiety, T1 worry significantly predicted better T3 exam performance & better T5 oral argument performance, & higher state anxiety at T2, T3, T4
Treynor et al. (2003)	T2 = 1 yr; 1130 community sample	RSQ, BDI	Reflective pondering subscale at T1 predicted less depression at T2 controlling for depression at T1
Yamada et al. (2003)	T2 = 6 mths after pharmacotherapy; 105 MDD patients	HRSQ, rumination questionnaire	Rumination at T1 predicted reduced depression at T2
<i>Experimental studies</i>			
Lyubomirsky et al. (2003)	(Study 1): RUM vs. DIS vs. planning, 45 Dys u/g's (BDI>15) vs. 46 Non-dys (BDI <3) u/g's	Ratings sadness & depression, reading task, interfering thoughts (CIQ)	Study 1: dysphoric mood, time spend reading passage, interfering thoughts in dysphoric: Repetitive planning =distraction < rumination
Moberly & Watkins (2006)	Training to focus on emotional scenarios, abstract vs. concrete, prior to failure; 61 u/g's	PANAS, ACS-P, BDI	After failure, higher levels of trait RT were associated with lower levels of positive affect, but only in abstract condition, not in concrete condition
Norem & Illingworth (1993)	Study 1: thought-listing re positive & negative outcomes (reflection) vs. distraction; 26 DP vs. 30 OP. Study 2: Rate goal progress vs. no progress; nursing students, 13 DP vs. 11 OP	DPQ. Study 1: POMS, STAI, mental arithmetic task. Study 2: ESM 4 times a day for 7 days, rating affect	Study 1: Negative mood & anxiety: For DP, distraction>thought-listing; for OP, thought-listing>distraction Math performance – for DP, thought-listing >distraction Study 2: DP who rated progress felt more positive and rated situations as easier than those who did not; OP who rated progress felt made less progress than those who did not.

Table 2 (continued).

Author	Design & Sample	Measures	Main Findings
Pham & Taylor (1999)	Process vs. outcome vs. combined simulation vs. control, all daily for 1 wk. 101 u/g's 1 wk before midterm exam	No. of study hours, planning, worry, confidence, grades	Negative emotion: Process-simulation < no-process-simulation. Planning, number of hours of study, exam grades: Process-simulation > no-process-simulation. Exam grades: Outcome simulation < no-outcome simulation
Rimes & Watkins (2005)	Experiential RUM vs. analytical RUM; 30 MDD patients, 30 controls	BDI, RSQ, VAS ratings of mood & global negative self-judgments	In MDD patients, analytical RUM increased post-manipulation global judgments of worthlessness relative to experiential RUM. No effect of condition in controls.
Rivkin & Taylor (1999)	process-simulation on how problem arose and unfolded vs. outcome simulation vs. control; 77 u/g's designate ongoing stressful event	emotional self-ratings, COPE immediately after and 1 wk later	Immediate positive affect: Process > outcome = control One week later, positive reinterpretation, use of social support: Process > outcome = control
Showers (1992)	Concrete positive-outcome-focus vs. concrete negative-outcome-focus on upcoming conversation Study 1: 40 OPs vs. 38 DPs in social situations Study 2: 27 OP, 31 DPs	Study 1: Time talking during conversation, confederate & participant ratings, Study 2: thought listing as anticipate conversation	Study 1: Negative-focus DP talked more, rated more positively by confederate than positive-focus DP, no effect of focus on Ops Study 2: negative-focus DPs reported more positive self-relevant thoughts than positive-focus DPs, no effect of focus on Ops
Spencer & Norem (1996)	Coping imagery vs. mastery imagery vs. relaxation 97 u/g's, DP vs. OP	DPQ, performance on darts	Dart performance – for DPs: Coping imagery > mastery imagery = relaxation.; for OPs: Relaxation > mastery imagery = coping imagery

Table 2 (continued).

Author	Design & Sample	Measures	Main Findings
Taylor et al. (1998)	Study 1, 3 Process-simulation vs. outcome simulation vs. control for 5-7 days. Study 1; 77 u/g's 1 wk before 1 st midterm exam. Study 3; 84 u/g's with project to complete next wk. Study 4: process-simulation on how problem arose and unfolded vs. outcome simulation vs. control; 77 u/g's with ongoing stressful event	Study 1: Anxiety, time spent studying, exam grades Study 3: planning fallacy (project began on time, finished on time) Study 4: emotional self-ratings, COPE immediately after and 1 wk later	Study 1: Hours of study, exam grades: Process-simulation>outcome-simulation.= control Study 2: % began on time: Process-simulation =outcome-simulation>control %finish on time: process>outcome>control Study 4: Immediate positive affect: Process>outcome=control One week later, positive reinterpretation, use of social support: Process > outcome = control
Ulrich & Lutgendorf (2002)	Writing about stressful event (cognitions & emotions vs. emotions alone) vs. non-expressive writing: 122 u/g's completed journals for 1 mth	Ratings of post-traumatic growth	Reported post-traumatic growth: Writing cognition & emotion> emotions alone =non-expressive writing
Watkins (2004a)	Failure then 3 x expressive writing, abstract-evaluative (why?) vs. concrete (how?); 69 community sample	ACS-P, BDI, MAACL, IES	Higher levels of trait RT associated with higher levels of negative mood 12 hr after failure in the evaluative condition but not in the concrete writing condition
Watkins & Baracaia (2002)	no questions vs. abstract Why? Questions vs. concrete, process, How? Questions during concurrent MEPS; 32 CD; 26 RD; 26 ND	SCID, BDI, RSQ, MEPS	Problem-solving effectiveness: In no question condition, never-depressed (ND)= recovered depressed (RD) >currently depressed (CD). In abstract Why condition, ND > RD=CD
Watkins & Moulds (2005a)	abstract RUM vs. concrete RUM; 40 MDD patients; 40 controls	despondency, MEPS	In concrete, process condition, ND=RD=CD In MDD group, for problem-solving effectiveness, concrete RUM > abstract RUM. No effect of condition in controls
Watkins & Teasdale (2001)	Analytical RUM vs. experiential RUM vs. DIS vs. abstraction; 36 MDD patients	despondency, AMT, BDI	Despondency: Analytical RUM, experiential RUM (high self-focus) > DIS, abstraction (low self-focus). Increase in specificity of autobiographical memory: Experiential RUM, DIS (low analytical) > analytical RUM, abstraction (high analytical)

Table 2 (continued).

Author	Design & Sample	Measures	Main Findings
Watkins & Teasdale (2004)	Analytical RUM vs. experiential RUM; 28 MDD patients	despondency, AMT	Increase in specificity of autobiographical memory: Experiential RUM > Analytical RUM

Note. ACS-P = Action Control Scale-Preoccupation; AMT = autobiographical memory test; ASQ = Attributional Style Questionnaire; BDI = Beck Depression Inventory; CD = currently depressed group; CES-D = Centre for Epidemiological Survey-Depression; CIQ = Cognitive Interference Questionnaire; COPE = COPE coping measure; DAS = Dysfunctional Attitudes Scale; DIS = distraction manipulation; DP = Defensive pessimist; DPQ = Defensive Pessimism Questionnaire; Dys = dysphoric participants; ESM = experience sampling methodology; GOI = Goal Orientation Inventory; HRSD = Hamilton Rating Scale for Depression; IES = Impact of Event Scale; MAACL = Multiple Affect Adjective checklist; MASQ = Mood and Anxiety Symptom Questionnaire; MDE = major depressive episode; MDD = major depressive disorder; MEPS = Means Ends Problem Solving task; MMAP = Measure of Mental Anticipatory Processes; ND = never-depressed group; NEO-FFI = NEO-five factor inventory of personality; NLEQ = negative life events questionnaire; Non-Dys = non-dysphoric participants; OP = Optimist; PANAS = Positive & Negative Affect Scale; POMS = Profile of Mood States scale; PSWQ = Penn State Worry Questionnaire; pts = participants; PTGI = Post-traumatic growth inventory; RD = recovered depressed group; RPA = Response to Positive Affect questionnaire; RRQ = Rumination & Reflection Questionnaire; RSE = Rosenberg Self-Esteem questionnaire; RSQ = Response Styles Questionnaire; RT = repetitive thought; RUM = rumination manipulation; SCID = Structured Clinical Interview for DSM; SPSI-R = social problem solving inventory-revised; STAI = state trait anxiety inventory; T1 = initial baseline assessment, T2 = follow-up assessment, u/g's = undergraduates; VAS = visual analogue scale.

Table 3.

Major classes of RT classified by valence, context, and level-of-construal

Class of RT	Valence	Context	Construal	Consequence
Depressive rumination	-	-	A	-
Rumination (Martin & Tesser)	+/-	+/-	A/C	+/-
Worry	-	-	A	-
	-	+/-	C	+
Perseverative cognition	-	-	A	-
Cognitive/emotional	+	-	A	+
Processing	-	-	C	+
Planning/problem-solving	-	+	C	+
Counterfactuals	+/-	+/-	A/C	+/-
Defensive pessimism	-	+	C	+
Reflection	+	+	A	+?
Mind wandering	+/-	+/-	A/C	+/-
Post-event rumination	-	-	A	-
Positive rumination	+	+ BPD	A?	-
	+	+	A	+
Habitual negative self-thinking	-	-	A	-

Note: Valence = valence of thought content. Context = situational and/or intrapersonal context. Construal = level of construal.

Consequences = consequences of RT. - refers to negative valence/context or unconstructive consequence; + refers to negative valence/context or constructive consequence, +/- means that valence, context, or consequence is mixed or underspecified, e.g., class of RT can have both constructive and unconstructive consequences. A = abstract level-of-construal, C = concrete level-of-construal, ? = unclear/unknown, BPD = vulnerability to bipolar disorder.