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EMOTIONALITY AND WORKING MEMORY:
FEELINGS TAKE CONTROL

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BY

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Table of Contents

List of Tables

List of Figures

Abstract

Three studies examined the relationship between working memory capacity (WMC) and individual differences in emotionality. Applying a *flexible cognition* approach, conditions of cognitive narrowing (low WMC) and cognitive broadening (high WMC) were predicted based on (1) the motivational properties of affect states (action-deliberation tradeoff) and (2) negative-positive emotionality. Namely, high-arousal states (anxiety/excitement) were predicted to restrict WMC (*action focus*) whereas low-arousal states (sadness/calm) were proposed to expand WMC (*deliberation focus*) in highly emotional individuals (negative/positive emotionality). In Study 1, behavioral inhibition and neuroticism were associated with generally high WMC under baseline conditions. Thus, negative emotionality was associated with high cognitive-control ability. In studies that followed, participants mentally relived a past emotional event (mood induction) prior to completing the automated operation span task (WMC measure). In Study 2, high trait anxiety was associated with low WMC in an anxious (but not calm) mood condition. Thus, anxious conditions compromised WMC in anxiety-sensitive individuals. In Study 3, negative (positive) emotionality was associated with low (high) WMC in a nervous condition but high (low) WMC in a sad condition. Additionally, positive emotionality was associated with low WMC in an excited condition. Calm mood had no discernible effect on WMC. These findings highlight a dynamic relationship between emotion and executive functioning, and implications for self and emotional experiences are addressed. Importantly, these data suggest that executive functioning, considered critical to successful emotion regulation, is modulated by emotional states themselves.

Emotionality and Working Memory: Feelings Take Control

The current investigation examines the influence of mood states on working memory capacity (WMC) across three studies. Mood was hypothesized to have its strongest effects on the cognition of individuals high in emotionality (e.g., high extraversion or neuroticism) whose cognitive-affective experiences are rooted in motivation-based temperaments (e.g., approach or avoidance; Elliot & Thrash, 2002). The cognitive-control abilities described as important in regulating emotions (Ochsner & Gross, 2005) should be altered by current emotional state, which aligns with a primacy-of-affect hypothesis (Zajonc, 1980). Moreover, these underlying processes are theorized to have important implications for the self. Overall, this approach applies a relatively functionalist perspective that treats cognitive-affective reactions as more or less "optimal" based on the emotional context (e.g., Campos, Mumme, Kermoian, & Campos, 1994; Mischel & Shoda, 1995). It also challenges a general view that cognitive control, emotional stability, and positive emotionality are unambiguously positive traits.

Emotional Experience

The present research borrows from Barrett's (2006a, 2011, 2013) constructivist approach to emotion, which utilizes *conceptual act theory* (CAT). In CAT, emotion generation involves a *core affective system* and a *conceptual system*. The core affective system is described by the circumplex model (Russell & Barrett, 1999), which treats qualities of valence and arousal as two separate (orthogonal) dimensions of affect (see Figure 1). Thus, at each moment, a person feels relatively pleasant-unpleasant at some level of arousal. Affect states play critical roles in motivation (Carver & Scheier, 1998)

and are not restricted to human experience (LeDoux, 1996; Panksepp, 1998). Affect can operate automatically and unconsciously (e.g., Clore, Storbeck, Robinson, & Centerbar, 2005; Öhman, 1999; Winkielman & Berridge, 2004), influencing the *quality* and *content* of cognitive processing (Forgas, 1995, 2013; Schwarz & Clore, 2007). Affect, therefore, plays an important supporting role in cognitive structure, although its contribution often goes unnoticed (Zajonc, 1980, 1984). Importantly, affective arousal serves to "interrupt" cognitive processing by capturing attention (Simon, 1967), which makes salient current feelings (Barrett, 2011) and prioritizes goals (e.g., approach or avoidance motivation; J. A. Gray & McNaughton, 2000). Indeed, high-arousal states (anxiety, excitement) are often regarded as motivationally intense whereas low arousal states (sadness, calm) are rather amotivational (e.g., Carver, 2006; Harmon-Jones, Price, & Gable, 2012).

Emotional experience is formed in the conceptual system (cf. Barrett, Wilson-Mendenhall, & Barsalou, in press), which involves the categorization of an experience into a discrete emotion. An emotion has a cognitive-affective signature, prototypic features, and connected situational cues. These associated features provide the bases for semantic categorization, including the verbal labeling of an emotion (Barrett, 2006a). The categorical features of an emotion are established and defined by social norms, which allow shared conceptual knowledge about emotions to transcend culture. For example, the emotion label "sad" is associated with feelings (e.g., negative affect; feeling "blue"), behavioral characteristics (e.g., frowning expression, tears), and associated cognitions (e.g., low self-esteem, hopelessness). Accordingly, while qualities of emotions vary across individuals (e.g., intensity), emotional experiences are assumed

to be qualitatively consistent (e.g., everyone experiences sadness basically in the same way).

Emotion concepts not only allow people to identify and label an emotional experience in a top-down fashion, but the process also works in reverse. Contextual features of an event activate emotions "bottom-up" (e.g., Bargh & Williams, 2007; Niedenthal, Barsalou, Ric, & Krauth-Gruber, 2005). Functionally, this allows individuals to "take on" an appropriate emotion based on social norms. Contextual cues automatically trigger emotion regulation. By contrast, *emotion dysregulation* refers principally to the inability to control emotions to meet normative standards (e.g., sadness [or joy] in situations that do not call for sadness [or joy]).

Individual differences in emotionality are postulated to initiate in the core affective system (i.e., temperament) and give rise to dissociable emotional experiences. Emotionality is characterized by high sensitivity to positive and/or negative stimulation (Larsen & Diener, 1987) and prepotent motivational drives (e.g., approach/avoidance orientation; Corr, 2004). Sensitivity potentiates frequent and intense affective reactions that, upon onset, modulate cognitive processing (discussed below) and guide attention toward emotion-relevant content (e.g., emotion identification and self-evaluation). Thus, this perspective implicates self in emotional experience by assuming that emotion often is categorized and generated by the *dialogical self* (Hermans, Kempan, & van Loon, 1992). The self asks, "How do I feel?" and, "How should I feel?" (see also, self-guides; Higgins, 1987, 1997). Lastly, a singular environmental cue (e.g., loss or failure) is posited to engender disparate cognitive-affective reactions; therefore, semantic labels for emotions (e.g., sadness) are attached to qualitatively distinct emotional experiences

(e.g., sadness in actuality is *not* felt the same in each individual). Thus, affective feelings accord with the affect circumplex (i.e., affect has valence and arousal), but people's conceptual representations of affect states do not. After all, individuals' labels for affective experience (person-level representations) do not map directly onto the circumplex structure (group-level representations; e.g., Barrett, 2004; Feldman, 1995). Consequently, affective experiences can be mislabeled or misattributed (Schachter & Singer, 1962) and experienced as mixed (Larsen & McGraw, 2011). Thus, introspection paints a rather imprecise picture of core affect differences (e.g., self-report issues; Baumeister, Vohs, & Funder, 2007; Kahneman, 1999; Nisbett & Wilson, 1977; Robinson & Clore, 2002) that more likely reveal themselves in cognitive-affective reactions.

Executive Functioning and Cognitive Control

Humans place great value on self-control, which largely refers to the self's agency over emotions (*emotion regulation*; Gross, 2011) and impulses (*self-regulation*; Carver & Scheier, 1998; Metcalfe & Mischel, 1999; Vohs & Baumeister, 2011). Emotion regulation ability typically refers to the capacity to up-regulate positive emotion and down-regulate negative emotion (Gross & Johns, 2003). Because negative attitudes are rooted in negative feelings (Eagly & Chaiken, 1993; LaPiere, 1934), generally negative emotionality should promote chronic access to negative self-beliefs in the self-concept (e.g., DeMarree, Petty, & Brinol, 2007; Markus & Wurf, 1987; Strachman & S. Gable, 2006). This is consistent with research showing that "online" self-esteem judgments (evaluation of the experiencing self) generally are based on how positively one feels at the moment (Brown, 1993; Kahneman & Riis, 2005; Leary &

Baumeister, 2000; Schwarz & Clore, 1983). Consequently, abilities to down-regulate negative emotions appear key in becoming "master of one's psychological domain," a so-called optimal self characterized by stable high self-esteem (Kernis, 2003; Kernis, Paradise, Whitaker, Wheatman, & Goldman, 2000).

Self-control is managed through executive functioning (Baumeister, Schmeichel, & Vohs, 2003), which presumably takes place in the central executive of working memory (Baddeley, 1986). As with Freud's (1923/1960) personality executive (*Ego*), the self is the captain of working memory, managing incoming information (e.g., threat) with stored knowledge (e.g., self-beliefs) in order to regulate behavior. Indeed, self-regulation literature is influenced heavily by models of *ego depletion* (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister, Vohs, & Tice, 2007), a strength model positing that self-control requires mental energies (or resources) that become taxed from prolonged control efforts, which leads to limited self-control on subsequent tasks (for a review, Hagger, Wood, Stiff, & Chatzisarantis, 2010). That is, the brain essentially acts like a muscle pushing away impulses until it reaches fatigue. More recently, Inzlicht and Schmeichel (2012) offer an alternative model by describing self-control failure in attentional and motivational terms. They suggest that individuals are motivated to control the self on tasks early in a lab session but are less inclined to do so in later tasks unless there are added incentives. That is, people's willingness to exercise restraint at Time 1 (e.g., behavioral inhibition) is replaced by reward seeking at Time 2 (e.g., behavioral approach). Self-control in fact does maintain across tasks when a person is given added incentives (Muraven & Slessareva, 2003), affirms the self (Schmeichel & Vohs, 2009), or believes willpower is unlimited (Job, Dweck, &

Walton, 2010), which would be impossible if finite mental resources truly were tapped. Hence, as feelings change, self-regulation motives change as well.

Similarly, research on delay of gratification in children suggests that successful self-control is aided by cognitive distraction or abstraction, because focusing on the rewards of an immediately gratifying action arouses appetitive drives that are difficult to inhibit (Mischel & Baker, 1975). Importantly, preschool children better able to "cool" their "hot" desires for immediate gratification cognitively via attentional strategies (e.g., thinking about something else or abstractly envisioning the benefits of restraint) are particularly adept both socially and cognitively later on in life (Mischel, Shoda, & Rodriguez, 1989). This suggests a trait-based component of self-control arises from cognitive factors (viz., attentional strategies) that effectively manage affective drives.

Along these lines, as a means to capture natural control abilities, social-personality researchers borrowed from the cognitive literature measures of working memory capacity (WMC), which tap into executive functioning abilities (cf. Barrett, Tugade, & Engle, 2004; Hofmann, Schmeichel, & Baddeley, 2012). One popular measure of WMC is the operation span task (OSPAN; Turner & Engle, 1989; Unsworth, Heitz, Schrock, & Engle, 2005). The OSPAN is a complex-span task that captures cognitive-updating ability based on how effectively an individual remembers a number of items (e.g., letters) while simultaneously performing a secondary task (calculating mathematical operations). To achieve high WMC, one must be able actively to maintain and manipulate a number of items in working memory through directed attention to goal-relevant stimuli (e.g., current to-be-remembered items and

current math problems) and to disengage from goal-irrelevant stimuli (e.g., old items and distractors); for reviews, see Rosen and Engle (1998) and Unsworth and Engle (2007). Hence, WMC is more specifically a reflection of one's ability to control attention effectively than an index of cognitive space *per se* (Engle, 2002; Kane, Bleckley, Conway, & Engle, 2001).

Trait-based WMC measures have been shown to moderate a number of phenomena requiring self- and emotional-control (Schmeichel & Tang, 2014). High WMC mitigates the detrimental effects of resources lost from self-control (Schmeichel, Volokhov, & Demaree, 2008), automatic/inference-based processing (Hofmann, Gschwender, Friese, Wiers, & Schmitt, 2008), stereotype threat (Régner, Smelding, Gimmig, Thinus-Blanc, Monteil, & Huguet, 2010), and anxiety (Johnson & Gronlund, 2009). Moreover, individual differences in emotionality, namely trait *inabilities* to control negative emotion, are described as a consequence of ineffective cognitive control strategies in Gross's emotion-regulation model (Gross & Thompson, 2007; Ochsner & Gross, 2005). Effective self-regulators have greater ability to *think negative feelings away*. Specifically, successful regulators cognitively reappraise emotions before they get out of hand. For example, reappraisers may disengage with the source of negative emotions (e.g., a failed relationship) and focus instead on a new goal (e.g., the opportunity to enter into more fulfilling relationship), leading to better emotional and behavioral outcomes. Consistent with this notion, emotion-reappraisal ability is positively correlated with WMC (McRae, Jacobs, Ray, John, & Gross, 2012). In addition, WMC correlates positively with traditional intelligence measures (Conway,

Kane, & Engle, 2003). Collectively, a theme converges on a hypothesis that self-control extends from traits related to cognitive ability.

Overall, research indicates that the controlled attentional processes necessary to achieve high WMC scores are important in establishing and maintaining a controlled, emotionally stable, and rational self. Such an inference is problematic, however, because individual difference research is correlational. First, the connection between high WMC and other control outcomes may extend in part from differences in effort rather than natural abilities, wherein some participant volunteers simply are more motivated to work harder on difficult and tedious tasks across an experimental session (viz., more neurotic individuals). Second, it is debatable whether WMC reflects stable trait abilities or instead varies as a function of contextual features (cf. Ilkowska & Engle, 2010). This introduces the possibility of WMC instability or, more intriguingly, WMC *flexibility*. Namely, feelings (e.g., emotion and impulses) usually are treated as constants in studies of cognitive control, which ignores the role of affect in shaping cognitive processing (cf. Schwarz & Clore, 2007). For example, high-arousal emotions may override sophisticated cognitive functions in a fashion relatable to the strength model of self-control. Moreover, affect conveys motivational properties (e.g., high/low approach *or* avoidance orientations; Carver, 2006) that systematically influence executive functioning (e.g., decreasing *or* increasing WMC) via attention-based processes (e.g., narrowed *or* broadened attentional focus; Förster & Dannenberg, 2010). In that case, more highly emotional individuals likely show cognitive-affective benefits in circumstances in which emotionally-stable individuals display signs of unresponsiveness and cognitive inflexibility.

The current perspective assumes that the cognitive-affective foundation of the self varies in emotionality, such that some individuals have more control over their emotions because their emotions are relatively low in strength. As such, the control advantage goes to low-emotional individuals, but this is not "optimal" functioning. Individuals high in emotionality have an emotional advantage such that affective sources guide cognitive processing and, in a sense, losing control of self is a great strength. In other words, there is no single optimal cognitive-affective self, but rather a number of circumstances in which emotionality produces advantageous or disadvantageous outcomes (cf. Campos et al., 1994; Campos, Frankel, & Camras, 2004; Zajonc, 1965).

Cognitive-Affective Processing

A basic assumption in the current perspective is that *controlled* working memory processes are rooted in attentional effects that operate *automatically* in response to different emotion states (cf. Pessoa, 2009). Engle (2002) proposes that working memory is a process of "executive attention," which here is said to be influenced by affect-mediated attention, just as in global-local processing (Förster & Dannenberg, 2010; Gable & Harmon-Jones, 2010). This process allows for flexibility with *cognitive scope* adjusting from broad-to-narrow focus (Harmon-Jones, Gable, & Price, 2012) in order to meet situational demands.

Affect influences cognitive processing in several ways (cf. Schwarz & Clore, 2007), but most germane to the current topic is the fact that affect states sometimes *broaden*, but other times *narrow*, cognition. On the attentional level, broadening is associated with global-orientation (seeing the forest) whereas narrowing is associated

with local-orientation (seeing the trees). Gasper and colleagues showed that global- and local-orientation increased under conditions of positive (happy) and negative (sad) moods, respectively (Gasper, 2004; Gasper & Clore, 2002). In addition, negative emotionality (e.g., high trait anxiety or depression) is associated with baseline local-orientation whereas positive-emotionality (e.g., optimism) is associated with global-orientation (Basso, Schefft, Ris, & Dember, 1996; Derryberry & Reed, 1998)

Global-local orientations have implications for processing everyday stimuli and executive functioning as well. High-arousal emotion has long been theorized to localize attention (e.g., *cue utilization theory*; Easterbrook, 1959), especially toward the source of an anxiety-provoking threat; for example, angry faces (Öhman, Lundqvist, & Esteves, 2001), weapons (E. Loftus, G. Loftus, & Messo, 1987), and worries (Beck & Clark, 1997). In fact, chronic localization ("locking onto") negative thoughts (e.g., worries) may be the most problematic symptom of trait anxiety (M. Eysenck, 1992). By contrast, Fredrickson (1998, 2001) suggests that positive emotions provide an affective context in which cognition *broadens-and-builds*. Positive moods are associated with creative problem solving by increasing access to a relatively broad set of items for use in categorization (cf. Isen, 1999). Global-local orientation also appears to influence memory. Storbeck and Clore (2005) found that negative-mood inductions (e.g., local-orientation) decrease the rate of false memories in comparison to positive-mood inductions (e.g., global-orientation) on Deese-Roediger-McDermott ("DRM") lists (Roediger & McDermott, 1995), which was proposed to extend from directed attention toward each sequentially presented item during encoding when participants were in negative moods (item-specific processing).

Recent models of motivation reflect this increased importance placed on cognitive broadening and narrowing by incorporating global-local processing to goal pursuit. In Förster and Dannenberg's (2010) *global versus local model*, regulatory focus influences cognitive scope. Prevention focus (avoidance orientation) narrows cognition and promotion focus (approach orientation) broadens cognition perceptually (global-local processing) and conceptually (creativity and categorization), and at state- and trait-levels (e.g., Förster & Higgins, 2005; Friedman & Förster, 2001, 2005). Alternatively, Harmon-Jones and colleagues (2012) argue in their *motivational intensity model* that states high in motivational intensity (high approach or high avoidance) produce narrowed cognition (local orientation) whereas less intense states (low approach or low avoidance) produce broadened cognition (global orientation). Evidence for their model primarily extends from attentional broadening/narrowing in positive states. For example, Gable and Harmon-Jones (2008) showed that pictures of desserts (high approach) increased local-orientation, whereas pictures of cute cats (low approach) increased global-orientation. Similarly, individuals anticipating winning money early in a task (pre-goal; high approach) had local-orientations that flipped to global-orientations after the money was won (post-goal, low approach; Gable & Harmon-Jones, 2011). These effects are demonstrated at the neurological level as well. Local-orientation during motivationally intense positive states corresponds with asymmetric left-hemispheric brain activation (Harmon-Jones & Gable, 2009), which is associated with approach-orientation (Davidson, 1993; Harmon-Jones, 2003). Lastly, local-orientation during high-approach states is moderated by behavioral approach sensitivity (BAS; Carver & White, 1994). Approach-orientated individuals are

particularly sensitive to reward cues that elicit intense motives that narrow cognitive scope (Experiment 3, Gable & Harmon-Jones, 2008).

Action-Deliberation Tradeoff. Executive functioning traditionally is believed to process information in a manner conceptually similar to a cognitive scope, such that emotionally arousing states restrict cognition in a narrowed fashion (e.g., optimal-arousal; Yerkes & Dodson, 1908). The evolutionary advantage of complex cognitive abilities (e.g., comparing the utility of a number of potential choices) becomes disadvantageous in times of threat. The creature evaluating whether fight, flight, or fleeing is the optimal defense in the face of predation is eaten while the creature whose automatic reaction to flee scurries away. Presumably, (1) fear restricts attention in working memory to direct attention toward the source of the threat and (2) retrieves from memory the quickest reasonable solution to the current problem (e.g., Klein, 1993). The motivation to avoid a negative outcome (avoidance drive) efficiently overrides the inclination to deliberate over an optimal solution (i.e., activate alternative solutions from long-term memory). Motivational intensity affect states cognitively lock people onto their goals, promoting action over deliberation. Working memory restrictions viewed as functional for avoidance goals presumably extend to approach goals as well. Approach-oriented affect (e.g., excitement and enthusiasm) focuses an individual on a goal (acquiring rewards), and acting on a reasonable solution overrides deliberation. For example, over-deliberating on the best way to acquire friendship from a new acquaintance may have its disadvantages compared to approaching new persons with heuristically tried-and-true interpersonal strategies (e.g., Eaton & Funder, 2003; Lucas, Diener, Grob, Suh, & Shao, 2000; Srivastava, Angelo, & Vallereux, 2008).

Disruptions in working memory reasonably underlie cognitive performance decrements, especially on complex problem-solving tasks (e.g., intelligence and scholastic aptitude examinations), which include WMC tasks. Presumably, executive functioning is compromised during an examination when anxiety restricts the breadth of possible problem solutions in working memory. At the same time, the brain favors intuitive over rational solutions (Evans & Stanovich, 2013), which is problematic if the person is not well initiated with the examination content (e.g., completing novel puzzles). Moreover, if worries pervade cognition, they compete for attention that would be better spent on the task at hand (i.e., serve as distractors). Worry commonly is described as a major component in anxiety's role in poor cognitive performance, however, as noted by M. Eysenck, Darakshan, Santos, and Calvo (2007), "Worry is seldom manipulated explicitly, it is often assessed only retrospectively, and the relationship between worry and attention has not been investigated systematically. In view of these limitations, relatively little research on worry, anxiety, and performance has provided a direct test of the theory (pp. 338)." In agreement, worries are believed to have minimal effect on cognitive-task performance in the current designs. An excited and equally unprepared person should show similarly poor performance on complex cognitive tasks (e.g., WMC tasks), because working memory in both cases systematically restricts in accordance with the current action-oriented motivational state.

The "localizing" of WMC seems consistent with the view that high-arousal emotions produce cognitive restrictions, while mostly untouched is the intriguing possibility that certain emotional contexts may "globalize" WMC by producing optimal

conditions for executive functioning in working memory. This essentially constrains Fredrickson's (2001) broaden-and-build hypothesis to low-arousal positive states, but also expands her hypothesis to include low-arousal negative emotions that provide similar cognitive-broadening effects, in a manner consistent with Harmon-Jones et al. (2013). Namely, calm and sadness are predicted to produce high WMC scores when experienced as low motivationally intense states (promotes deliberation over action), whereas anxiety and excitement are predicted to produce low WMC when experienced with high motivational intensity (promotes action over deliberation).

In order for individuals to show cognitive narrowing or broadening effects for different emotions, they must experience the appropriate emotional state (e.g., mood) to a sufficient level, which is proposed to be largely a matter of temperament. Hence, the extent to which an individual shows cognitive narrowing (broadening) to anxious (sad) and excited (calm) states is dependent on the person's general tendencies to be sensitive to, and motivated by, those states. Because some individuals may be sensitive to a host of valenced states (e.g., anxiety and sadness), then it is possible that a single emotionality variable (e.g., negative emotionality) may be predictive of conditions in which WMC is low (during anxiety) and high (during sadness), supporting a flexible-cognition hypothesis.

Emotionality and Temperament

The term *emotionality* is used to refer to the integration of feeling (affect) with thinking (cognition) in the conscious self, which not only includes the affective qualities of emotional states and awareness thereof, but also the role affect plays in *what* and *how* information is processed (cf. Schwarz & Clore, 2007). Affective sources shape self-

judgments (Brown, 1993; Ditzfeld & Showers, 2013a; Leary & Baumeister, 2000; Schwarz & Clore, 1983) and cognitive processing more broadly (Bower, 1981; Bower & Forgas, 2000; Niedenthal, Halberstadt, & Innes-Ker, 1999). Furthermore, emotionality is key in shaping individual differences in personality, which are assumed to vary due to biological factors (e.g., H. Eysenck, 1967; J. A. Gray & McNaughton, 2000) and set the stage for shaping the self developmentally through interactions with the environment epigenetically.

Temperaments are inborn genetic differences that predispose individuals to feeling particular affect states, or clusters of states, more or less frequently and/or intensely (e.g., Larsen & Diener, 1987). In the current view, emotionality comes pre-coded from birth, which plays an important role in the heritability of personality in humans (Jang, Livesley, & Vermon, 1996; Stein, Jang, Livesley, 2002) and other animals (Gosling, 2001; Weiss, King, & Figuerdo, 2000), as well as shaping regulatory and motivational styles (Rothbart, 2011; Rothbart, Ahadi, & Evans, 2000). For instance, Kagan (2010) notes that a number of infants (about 20% in the U.S.) display emotional traits of *high-reactance* (e.g., nervous, shy), complete with discrete physiological markers (e.g., greater activation in subcortical region of the brain, viz., amygdalae). Importantly, reactance generally extends into at least adolescence (Schwartz, Snidman, & Kagan, 1999), suggesting that emotionality is an enduring trait. Similar rates of high-reactance are shown in other animals as well; such as monkey, rats, and dogs (e.g., Kagan, Reznick, & Snidman, 1988). Hence, signs of emotionality exist prior to the development of cognitive faculties needed to regulate emotions, and also in animals unlikely to develop sophisticated executive functioning abilities at all. Note,

temperament does not preclude a person from expressing a personality inconsistent with their basic emotionality at the phenotypic level. For example, social anxiety may be mitigated through socialization (Kagan, 2010). However, non-human primate research suggests that these cases are due to situation factors (e.g., habituation) rather than physiologically eliminating or changing the baseline reactance level (Suomi, 1997).

Nevertheless, traits generally endure because emotionality influences behavior and therefore signs of temperament persist into adulthood. For example, neuroticism promotes neurotic behavior from an early age (e.g., social anxiety drives avoidance of social situations, eliminating the possibility of mitigating threat through habituation) and heredity influences nurturing (e.g., neurotic parents promote anxious-behavioral tendencies in their reactive children). This is a passive interaction between genes and environment (cf. Plomin, DeFries & Loehlin, 1977). Temperament-based traits are promoted through genetic variability, with variability existing because all types of emotionalities (even those considered less desirable) provide evolutionary advantages in some contexts, even if they are disadvantageous in others. For instance, large and ornate peacock feathers confer reproductive advantages and therefore persist despite those features increasing the animal's vulnerability to predation (Petrie, Halliday, & Sanders, 1991). For example, in terms of emotionality, one advantage of neuroticism is that chronic anxieties and worries can initiate actions that successfully serve avoidance goals; therefore, anxiety motivates preparatory actions, even though these feelings may disrupt performance in high-pressure situations. The current studies explore the emotional contexts that provide cognitive advantages and disadvantages in emotional people.

Emotionality Differences

The first assumption is that some people are more "emotional" than others, resulting in greater sensitivity to emotional states that initiate cognitive broadening/narrowing processes. Emotional people differentiate themselves based on their dispositions toward positive and negative affect states as well as their cognitive associates (e.g., self-beliefs). For example, individuals with negative emotionality frequently may experience a host of negative feelings (e.g., anxiety and sadness), which then activate (or are activated by) negative thoughts (e.g., worry and self-doubt) that contribute to relatively negative global self-views, such as low self-esteem and low self-determination (e.g., depression). The first issue is whether negative and positive emotionality runs on a continuum in which emotional individuals tend to experience exclusively a host of positive *or* negative emotions (e.g., predisposed vacillations in anxiety *and* depression; e.g. negative affectivity; Watson & Clark, 1984), or whether emotionality variables are best represented as separate factors (e.g., approach and avoidance orientation; Elliot & Thrash, 2002; J. A. Gray & McNaughton, 2000; Carver & White, 1994).

Negative emotionality. Research on avoidance-orientation, extending largely from J. A. Gray's (1981, 1991) *reinforcement sensitivity theory*, suggests that negative-emotionality individuals respond with more anxiety or stress when confronted with obstacles that potentially stand in the way of goals. In other words, avoidance-orientated individuals are highly sensitive to threat. However, bred from avoidance research is the common misconception of a simple cognitive-affective model that explains avoidance-orientated behavior: Threat elicits anxiety, which creates self-doubt, and doubts

subsequently lead to goal abandonment or self-handicapping; a *stress-as-debilitating* model (cf. Crum, Salovey, & Anchor, 2013). However, this is a more simplified model than the one J. A. Gray finally articulated (J. A. Gray & McNaughton, 2000). Namely, anxiety does not always lead to goal abandonment or failure. Humans (and other animals) often use anxiety to motivate behaviors set toward successful goal acquisition. For example, common among humans is the habit of working harder around a deadline, when stress prioritizes the immediacy of behaviors necessary for goal acquisition. This procrastination habit generally is considered a less-than-ideal strategy (Ferrari & Tice, 2000) that extends from poor self-control (Ariely & Wertenbroch, 2002). Interestingly, many of those not inflicted by the habit of procrastination reasonably are those whose anxieties kick in before potential failure becomes imminent; namely, individuals for whom anxiety and worry are chronic but successfully promote actions to avoid failure (e.g., high-functioning neuroticism).

The rationale in averaging emotionality to include a number of traits that are often dissociated (e.g., trait anxiety and depression) extends from the potentially important interactive roles of anxiety and sadness in negative emotionality (e.g., Clark, Beck, & Stewart, 1990). Anxiety is driven by the threat of potential failure, and failure is accompanied by the feeling of sadness. Hence, anxiety serves as the mechanism through which individuals avoid sadness. Note that for this to be a successful process, an individual must have the requisite belief that failure is avoidable. Individuals who come to believe otherwise become "debilitated" by learned helplessness and an external locus of control (Hiroto, 1974; Seligman, 1975).

The current study samples consist of college students who are not clinically depressed or anxious, but rather are relatively high-functioning young adults. There is little reason to describe college students as experiencing dysfunctional or debilitating levels of negative emotion. In fact, some of these individuals' successes may be due in large part to their anxieties instead of in spite of them. Elliot and Thrash (2002) describe individuals with *avoidance temperaments* as motivated primarily by performance-avoidance goals (driven by concerns over appearing incompetent). While Elliot and colleagues describe avoidance-motivation as undesirable (Roskes, Elliot, & De Dreu, 2014), they also show that avoidance goals can promote high levels of success (Elliot & Harackiewicz, 1996). In these folks, the potential to underperform relative to their peers motivates actions to avoid such outcomes. Their cognitive abilities may offer them the foresight to see a number of potential threats to success (i.e., they see what *might* go wrong), which activates anxieties that can lead to behaviors set to avoid those negative outcomes, such as in perfectionism (Hewitt & Flett, 1991) and defensive pessimism (Norem, 2001; Showers & Ruben, 1990).

Interestingly, low-threat conditions may provide optimal conditions for deliberating on the potential actions necessary to meet avoidance goals, which then serves to up-regulate anxieties that potentiate behavioral action once a plan is initiated. Hence, one possibility is that negative emotionality is associated with relatively high overall executive functioning abilities, which individuals use to up-regulate anxieties that systematically narrow cognition (restrict WMC) in the service of goal-focus. Consistent with this notion, general anxiety disorder was shown to be positively associated with intelligence (Coplan, Hodulik, Mathew, Mau, Hof, Gorman, & Shungu,

2012). Moreover, people high in avoidance-orientation may outperform others on tasks because their worries lead to higher and more sustained effort, at least to the extent that their anxieties do not compromise performance. Reasonably, the "neurotic" participant works hard on tasks because they are concerned about the outcomes of poor performance (e.g., evaluation anxiety), thereby providing their own incentives for self-control across study tasks.

Positive emotionality. Positive emotionality describes individuals with generally positive affectivity and positive engagement with life (Elliot & Thrash, 2002; Watson, 2002). These individuals are driven by the possibility of reward (e.g., excitement), which promotes the positive feelings that arise from progress toward goal acquisition (e.g., "flow"; Nkamura & Csikszentmihalyi, 2002); they appreciate the feelings of accomplishment they experience following successes (e.g., satisfaction). Individuals high in positive emotionality may not be naturally happier, but their drives successfully lead to outcomes that earn rewards (e.g., respect and high self-esteem). For example, individuals high in extraversion are not dispositionally happy, rather they are motivated to seek positive stimulation (Smillie, Cooper, Wilt, & Revelle, 2011), generally through meeting and being accepted by new people, which leads to higher well-being. The more successful individuals are socially, the more their everyday lives tend to be filled with positive feelings because their basic belongingness needs are met (Maslow, 1954), which usually translates into higher levels of self-esteem (Leary & Baumeister, 2000).

Social status and happiness are highly coveted traits, especially in individualistic Western cultures. As such, positive emotionality is idealized because it acts both as

cause and consequence of successful goal achievement. Western cultural norms support the belief that people are supposed to be happy and enjoy what they do (e.g., Mauss, Tamir, Anderson, & Savino, 2011). Positive-emotionality fits the mold. However, even positive emotions have a darker side when not experienced in moderation (e.g., Gruber, Mauss, & Tamir, 2011). Positive emotionality is related to impulsivity, especially in regard to seeking immediately gratifying rewards from social situations (Hirsh, Guindon, Morisano, & Peterson, 2010). Moreover, positive emotionality traits accord with narcissistic and antisocial personalities (e.g., Bushman, Baumeister, Thomaes, Ryu, Begeer, & West, 2009; Paulhus & Williams, 2002). Just as too much negative emotionality leads to emotional-behavioral dysfunction (e.g., depression or anxiety disorders), too much positive emotionality (e.g., overabundance of dopamine) is suspected to contribute to mania in bipolar disorder (Gruber, Eidelman, Johnson, Smith, & Harvey, 2011) and symptoms of schizophrenia (Davis, Kahn, Ko, & M. Davidson, 1991). Lastly, individuals placing high value on happiness actually have more difficulty achieving happiness (Mauss et al., 2011) and feel lonelier (Mauss, Savino, Anderson, Weisbuch, Tamir, & Laudenslager, 2011), which suggests that the desire for positive emotionality can have undesirable emotional consequences.

One caveat to experiencing the positive emotional "ups" when life is going well is the possibility that that same individuals may experience negative emotional "downs" when life is turned upside down (e.g., *affect intensity*; Larsen & Diener, 1987). Namely, if individuals with positive emotionality are approach-orientated, then they are motivated by positive emotions and positive beliefs. These individuals presumably experience minimal worry and anxiety because they focus very little on potential failure

(low avoidance orientation). In fact, some anxiety might produce optimal cognitive conditions (e.g., cool under pressure). For example, anxiety might initiate low approach orientation, which broadens cognition in order to deliberate on the best course of action. Nevertheless, their motivations do not preclude them from failure and sometimes loss is unpreventable. Under these conditions, positive-emotionality individuals may take failure and loss hard (e.g., Shepperd & McNulty, 2002). Strong sadness may narrow cognition in order to attend to the source, focusing attention on the potential cause of their negative outcomes (e.g., fault of the self). Hence, positive-emotionality individuals may not be put off by the potential for failure, and often successfully avoid it through approach-orientation behaviors, but they may experience extreme feelings of failure or loss when their motivational style fails to produce desired outcomes.

Summary and predictions. Using traditional personality measures as indices of emotionality ("emotional" people), the prediction is that high emotionality extends from sensitivities toward positive and negative states at the affective core, which includes, but extends past, approach-avoidance orientations. Negative (positive) emotionality is defined by its sensitivity to a number of negative (positive) emotional states. In negative-emotionality, anxiety is hypothesized to narrow (or localize) cognition, producing low WMC scores, whereas sadness is hypothesized to broaden (or globalize) cognition, producing high WMC scores. In positive emotionality, excitement is hypothesized to narrow (or localize) cognition, producing low WMC scores, whereas calm is hypothesized to broaden (or globalize) cognition, producing high WMC scores. Moreover, if positive-emotionality is accompanied by a broader emotional repertoire (e.g. affect intensity), then these individuals also may respond to negative emotional

states, but in the opposite fashion as do negative-emotional individuals: Anxiety may broaden (high WMC) and sadness narrow (low WMC) cognition. Lastly, some individuals' emotionality may be sensitive to a more restricted range of emotional sources (e.g., strictly approach- or avoidance-orientated), in which case narrowed cognition (low WMC) is predicted only in their dominant motivational state (e.g., low WMC in approach *or* avoidance states).

Self-Concept Organization

The last connection to emotionality in the current research is the role of cognitive-affective responses in shaping the self-concept, namely in the expression of negative self-beliefs across everyday contexts. Showers's (1992) model of evaluative self-organization highlights two main types of evaluative self-structures: Integration and compartmentalization (cf., Showers & Zeigler-Hill, 2012). The evaluative organization model treats the self-concept as multifaceted (Markus & Wurf, 1987), consisting of a multiple selves (*self-aspects*). Each self-aspect represents an important self context, including roles, domains, and states, among others. For each self-aspect, an individual has a number of self-beliefs (*self-attributes*), which are either positively or negatively valenced. Evaluative self-integration refers to individuals whose self-aspects contain a combination of both positive and negative self-beliefs throughout their multiple selves. Evaluative compartmentalization refers to individuals who segregate their negative from positive self-beliefs into separate self-aspects. Examples of these two evaluative self-concept organizations are presented in Table 1.

Evaluative compartmentalization. In compartmentalization, individuals' self-beliefs are separated by valence into positive *or* negative self-aspect groups. For

example, Tim might view himself positively in his role as a scholarly academic (e.g., *capable*, *intelligent*, *comfortable*), but entirely negative (e.g., *irritable*, *insecure*, *tense*) following a crushing defeat at his favorite leisure activity, competitive street basketball. Accordingly, Tim's emotionality vacillates according to the contextual qualities of the situation, so that he experiences strong positive-to-negative feelings about self, and rarely experiences feelings that fall more moderately in between. Compartmentalization has been described previously (Ditzfeld & Showers, 2013a) as a possible index of *affect intensity* (Larsen & Diener, 1987), because individuals with this structure appear to respond more extremely to both positive and negative stimulation.

Evaluative integration. In integration, self-beliefs are not separated by self-aspect group. Instead, individuals with this structure have both positive *and* negative self-beliefs in their multiple selves. For example, Alex too might have a scholarly academic self-aspect, but sees himself with positive (e.g., *capable* and *intelligent*) and negative (e.g., *indecisive* and *disorganized*) qualities within that domain. The same is true of him in his favorite leisure activity, attending *Star Wars* conventions (e.g., *happy* and *friendly*, but at times *irritable* and *insecure*). Overall, Alex may not experience the same extreme "highs" as does Tim when positive beliefs are salient, but he also does not experience as extreme "lows" when negative beliefs are salient. Whereas Tim takes defeat on the basketball court harshly, Alex mitigates threat more effectively, such as when another conference attendee shows up in a more realistic *Star Wars* costume than his own (e.g., focuses on enjoying time with friends).

Although the organization of positive and negative self-beliefs is the main feature of the evaluative organization model, two additional features, proportion of

negative self-beliefs and differential importance of self-aspects, play important roles as well. The proportion of negative self-beliefs assesses the overall degree of negative content in the self-concept. Differential importance (Pelham & Swann, 1987) is an index of the relative importance of people's positive and negative self-aspects. Although an abundance of negative self-beliefs typically is detrimental to well-being, the impact of negative self-beliefs on the overall self-concept may be mitigated by isolating ("compartmentalizing") negative beliefs into relatively unimportant self-aspects. Specifically, individuals with relatively positive self-concepts (high DI or low neg) are labeled *positively compartmentalized* or *positively integrative* and those with relatively negative self-concepts (low DI or high neg) are labeled *negatively compartmentalized* or *negatively integrative*.

Origins of Evaluative Self-Organization

Motivational origins. Early evaluative organization research focused on how individuals cope with negative self-beliefs, which reflected a motivational-origins approach (Showers, 1992, 1995). Evaluative organizations may represent distinct psychological defenses (e.g., Hart, 2014), such that compartmentalization accords with self-enhancement (e.g., focus on positives while dismissing negatives) and integration accords with a kind of rationalization (e.g., minimizes short-comings by weighing them against strengths). In this view, evaluative organizations reflect different styles for utilizing positive self-characteristics in in the service of emotion regulation.

Affective origins. Alternatively, recent research has examined the possibility that evaluative self-concept organizations arise from differences in affective reactivity. Compartmentalization may extend from strong affective reactions that engender

valence-congruent categorization processes (Ditzfeld & Showers, 2011, 2013b, 2014). That is, self-contexts evoke strong positive *or* negative affect, which give rise primarily to positive *or* negative self-beliefs, respectively. Thus, self-beliefs come into cognition in a top-down fashion akin to *affect-as-information* (J. Brown, 1993; Schwarz & Clore, 1983, 2007). Consequently, representation of the self-concept in memory is sorted into good-me *or* bad-me categories (e.g., Sullivan, 1953/2013). By contrast, integrative individuals may have muted affective reactions and, therefore, self-beliefs are not anchored by a particular valenced state. Evaluative compartmentalization and integration, at least in part, may be the product of high or low emotionality, respectively.

A number of findings are consistent with the affective-origins view (Ditzfeld & Showers, 2013a), and indicate that compartmentalization is closer conceptually to affect intensity than to defensiveness (e.g., Rhodewalt, Madrian, & Cheney, 1998). Compartmentalized individuals may self-enhance and dismiss negative beliefs "offline" (Thomas, Ditzfeld, & Showers, 2013), but they do not appear to do so in the heat of an emotional event. In fact, in conditions of self-threat, compartmentalized individuals actually appear emotionally *responsive* (e.g., Canevello & Crocker, 2010). For instance, Zeigler-Hill and Showers (2007) showed that positively compartmentalized individuals' self-esteem lowered dramatically following social rejection, which is in direct contrast to the compensatory self-esteem reactions expected from defensiveness (Tesser, 2000). These authors also found in a diary study that compartmentalized individuals' mood fluctuated in accordance with positive and negative daily events. This emotional fluctuation may extend from the fact that compartmentalization is

associated with high contingencies of self-worth and inauthentic self-aspects (Showers, Ditzfeld, & Zeigler-Hill, 2014). Taken together, compartmentalized individuals seem to recognize their needs (e.g., belongingness), adjust socially to meet those needs, and assume personal responsibility when their needs are not satisfied (i.e., feel the affective brunt of failure). Compartmentalized individuals may be apt to listen to their affect (e.g., C. Brown & McConnell, 2009), largely because their affect is difficult to ignore.

Compartmentalization *Process*: Affective Reactivity Hypothesis

An alternative model wherein evaluative organizations are rearticulated as categorization "styles" that arise from cognitive-affective processes is tested in the current research. In this model, a *compartmentalization process* is triggered by strong affective reactions to emotional contexts, which simultaneously initiates emotion-categorization and self-categorization, and restricts working memory processes. Hence, emotion categorization implicates the self, which gives affect states *personal meaning*. As with emotion categorization, self-categorization comes into focus particularly during high-arousal affect states (Barrett, 2011). Valence of the high-arousal state serves as a cue that makes accessible primarily positive *or* negative self-beliefs from secondary memory (e.g., Unsworth & Engle, 2007), particularly when situations call for self-evaluation. Same-valence self-beliefs are brought to attention while, at the same time, opposite-valence self-beliefs are restricted from access (e.g., opponent processing). Thus, the compartmentalization process makes self-evaluation within a domain unambiguously positive *or* negative. By contrast, muted affective reactivity predisposes individuals to low-arousal affect "home bases" (e.g., Kuppens, Oravecz, & Tuerlinckx, 2010), which do not provide an affective anchor to make accessible same-valence self-

beliefs and, therefore, promotes access to a mixture of valenced self-beliefs in an "integrative" fashion.

Compartmentalization is postulated to be associated with the following characteristics: (1) a core affective system prone to high-arousal affect; (2) use of emotional valence as a basis for categorization; and (3) restrictions in WMC under conditions of high-arousal affect. Evidence for the first two conditions was established in previous research and the third is a basis for the current studies.

Previous support. First, compartmentalized (integrative) individuals report typically experiencing high-arousal (low-arousal) affect and report preferences for high-arousal (low-arousal) positive states (Ditzfeld & Showers, 2014). Second, Ditzfeld and Showers (2011, 2013b) showed that compartmentalized individuals more readily categorize stimuli based on shared emotional features (*emotional response categorization*; Niedenthal, Halberstadt, & Innes-Ker, 1999). For example, compartmentalized individuals are more likely than integratives to associate puppy (target word) with parade (happy link) than with beetle (semantic link). Importantly, emotion-based categorization appears contingent on emotional reactions, not simply "cold" cognitive activation (cf. Innes-Ker & Niedenthal, 2002). Indeed, although compartmentalization was associated with emotion-based categorization for sad concepts regardless of mood (perhaps demonstrating an acute sensitivity to sadness), both happy and fear concept-categorizations were moderated by life stress (Ditzfeld & Showers, 2011). Stress decreased the number of happy-based connections while increasing the number of fear-based connections. To summarize, compartmentalized

individuals experience and prefer high-arousal affect states as well as respond to emotional qualities of stimuli, which they use as a basis for categorization.

Current focus and predictions. The present designs set out to complete the puzzle by examining the relationship between evaluative self-organizations and WMC. The prediction is that compartmentalization will be associated with low WMC in high-arousal moods, specifically in conditions of excitement and sadness (similar to positive emotionality). Although sadness generally does not fall discretely into a high-arousal category in circumplex representation of affect states (Russell & Barrett, 1999), compartmentalized individuals appear particularly sensitive to sadness (Ditzfeld & Showers, 2011; Showers & Kling, 1996). After all, at the root of compartmentalization is self-evaluation, which largely is a gauge of current self-standing (e.g., Srivastava & Beer, 2005). Evaluative organization taps primarily into the assessment of selves in personally meaningful contexts (current roles, domains, etc.). Temporal selves (e.g., future/possible selves) represent only a small proportion (~5%) of participants' reported self-aspects (cf. McConnell, 2011), thus self-organization measures do not capture qualities related to approach- or avoidance-orientation. Compartmentalized individuals report high satisfaction or high dissatisfaction with current selves, but it is unclear whether they are anxious about these or future selves. Indeed, whereas emotionality measures are expected to capture affect-mediated motivational factors (i.e., role of "black box" core affective system on cognitive processing), evaluative self-organization is expected to reflect self processes at the conceptual level (e.g., how "self comes to mind"; Damasio, 2010). Compartmentalized individuals are hypothesized to "lock into" strictly positive *or* strictly negative self-views, in part, because their high-arousal affect

states restrict WM processes. Accordingly, compartmentalization is hypothesized to be associated with low WMC in excited and sad states.

Overview of Present Research

Three studies examined the relationship between executive functioning and individual differences in emotionality. Study 1 examined the relationship between emotionality variables and baseline WMC; namely, it tested the hypothesis that negative emotionality is associated with higher WMC (e.g., over-controlled cognition). Study 2 tested whether indices of negative emotionality (viz., avoidance-orientation) were associated with low WMC in an anxious (but not calm) mood condition. Study 3 (focal study) examined the relationship among emotionality variables and WMC across a number of emotional contexts (mood conditions). A major methodological focus was on the mood-induction procedure, which allowed individuals to up-regulate mood idiosyncratically through reliving personally-relevant emotional experiences. Mood inductions set out to produce emotional states varying in motivational quality and generally adhere to a two-dimensional valence-arousal circumplex model of affect (Russell & Barrett, 1999): *nervous* (high avoidance; high-arousal negative), *excited* (high approach; high-arousal positive), *calm* (low approach; low-arousal positive), and *sad* (low approach; low-arousal negative). Most notably, negative emotionality was predicted to be associated with low WMC in the anxious condition but high WMC in the sad condition. Positive emotionality was predicted to be associated with low WMC in the excited condition and high WMC in the calm condition; as well as potentially with low WMC in the sad condition and high WMC in nervous condition. Lastly, the

possible connection between emotionality and WMC variability with self-concept structure was examined, exploring the roles of these factors in shaping the self.

STUDY 1

The first study examines bivariate correlations between WMC and emotionality measures in order to establish baseline relationships prior to introducing mood into the design. Negative emotionally, to some degree, may extend from *over*-controlled cognition. This is consistent with clinical data showing that generalized anxiety is associated with high intelligence (Coplan et al., 2006) and, more broadly, the positive relationship between stress regulation and brain development in social-cognitive evolution (Sapolsky, 2004). Accordingly, negative emotionality (e.g., avoidance-orientation, neuroticism) was hypothesized to be associated with relatively high baseline WMC.

Note, negative emotion and executive functioning typically are construed as negatively related (e.g., Goldin, McRae, Ramel, & Gross, 2008). For example, McRea and colleagues (2012) show that emotion-reappraisal ability is negatively associated with WMC. However, this position assumes that negative emotions are unwanted and therefore the product of dysregulation. By contrast, the current approach favors an instrumental account of negative emotion wherein people sometimes choose to up-regulate negative emotions to accomplish intrapersonal and interpersonal goals (cf. Tamir, 2009). Lastly, up-regulation of negative emotion implicates the same brain regions (prefrontal cortex and anterior cingulate cortex) deemed responsible for down-regulating negative emotion (Ochsner, Ray, Cooper, Robertson, Chopra, Gabrieli, & Gross, 2004). Thus, high cognitive control ability promotes access to everyday negative

emotion, particularly in individuals motivated by negative emotions and therefore not inclined to down-regulate them.

Method

Participants

Sixty-two students (38 female; M_{age} = 19.16) from the University of Oklahoma participated voluntarily for course credit. Ethnic/racial composition was 69% White, 11% Black, 11% Asian, 5% Native American, 2% Hispanic, and 2% other.

Measures and Tasks

Working Memory Capacity (WMC)

Unsworth et al.'s (2005) Automated Operation Span (AOSPAN) Task was used to measure WMC. Participants' goal in the AOSPAN is to maintain attention to a variable number of to-be-remember letter sets while simultaneously solving math problems correctly. On each trial, a single letter is flashed on the screen for 800 msec. Then a two-operation math problem (e.g., 12 – 4 = 7?) is displayed on screen along with the option of selecting whether the statement is "true" or "false" using the mouse cursor. Following the answer, the next to-be-remembered letter is displayed, followed by another math problem, and so on. Trials contain 3-to-7 to-be-remembered letters, with longer sets requiring greater WMC to remember successfully. At the end of each set, a 4 x 3 letter matrix is presented on screen, with which participants are to select the correct letters in the same order as presented. Each participant receives the same letters-operations sets, but sets are presented in random order. AOSPAN scores are the sum of the total number of letters from perfectly recalled sets across all trials. Scores range from 0 to 75.

Practice trials were completed at the beginning of the session. Within practice trials answer duration for math operations performed outside of the memory task were recorded by the computer as a measure of each person's baseline speed. If the computation duration extended beyond 2.5 sec *SD*s above baseline later in the experimental trials, the program automatically moved forward and recorded a math error. Maintaining 85% overall math accuracy was required throughout experimental trials.

Questionnaires

Affect Valuation Index (AVI): Trait and state affect. Tsai's (2007) AVI includes 24 affect states that vary in valence and arousal quality in order to represent octants of the affect circumplex (see Figure 1; cf. Russell & Barrett, 1999). Participants indicated the degree to which they experience each affect state on a scale from 1 (*very slightly*) to 5 (*very much*). At different stages of the study participants used the AVI items to report *trait affect* ("report how you feel typically") and *state affect* ("report how you feel right now"). Affect scores were calculated by averaging ratings for positive states and negative states separately (cf. PANAS; Watson, Clark, & Tellegen, 1988).

Beck's Depression Inventory II (BDI-II). The BDI-II (Beck, Steer, & Brown, 1996) is a questionnaire containing 21 depressive symptoms (e.g., *sadness*) that individuals rate according to experienced severity over the past two weeks (e.g., 1 = *I do not feel sad*; 2 = *I feel sad much of the time*; 3 = *I am sad all the time*; 4 = *I am so sad or unhappy that I can't stand it*). Responses were summed and then squared in order to reduce skew, which results from the majority of individuals in a non-clinical

sample having relatively low scores on the scale. High scores indicate relatively high levels of non-clinical depression.

Behavioral Inhibition/Activation Systems (BIS/BAS). The BIS/BAS (Carver & White, 1994) is a 24-item questionnaire that includes one subscale for Behavioral Inhibition (e.g., "I feel pretty worried or upset when I think or know somebody is angry at me") and three subscales for Behavioral Activation, including Drive (e.g., "When I want something I usually go all-out to get it"), Fun Seeking (e.g., "I'm always willing to try something new if I think it will be fun"), and Reward Responsiveness (e.g., "When I get something I want, I feel excited and energized"). Participants rate agreement with each statement on a 1 (*very true for me*) to 4 (*very false of me*) scale. Each subscale was calculated such that high values indicate high levels of that trait.

Eysenck Personality Inventory (EPI). The EPI (H. Eysenck & S. Eysenck, 1964) is a 57-item questionnaire that includes items for Neuroticism (e.g., "Do you often worry about things you should not have done or said?") and Extraversion (e.g., "Can you usually let yourself go and enjoy yourself a lot at a party?"). Participants determine if the statements are characteristic of themselves by indicating "yes" or "no" to each item. High scores reflect high levels of neuroticism/extraversion.

Perceived Stress Scale (PSS). The PSS (Cohen, Kamarck, & Mermelstein, 1983) measures a person's level of life stress in the past month. The PSS is a 10-item questionnaire (e.g., "In the past month, how often have you felt difficulties were piling up so high that you could not overcome them?") on which participants rate experiencing each stressor from 1 (*never*) to 5 (*very often*). High scores indicate high perceived life stress.

Rosenberg Self-Esteem Scale (RSES). The RSES (Rosenberg, 1965) measures level of perceived self-worth using a 10-item questionnaire (e.g., "On the whole, I am satisfied with myself"), on which participates rate agreement from 1 (*strongly disagree*) to 5 (*strongly agree*). High scores indicate high trait self-esteem.

Trait Anxiety Inventory (TAI). The TAI (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) contains 20 statements related to dispositional anxiety (e.g., "I worry too much over some things that really don't matter") to which participants rate experiencing on a scale from 1 (*almost always*) to 4 (*almost never*) scale. High scores indicate high trait anxiety.

Self-Descriptive Card Sort

The card-sort task was developed by Zajonc (1960), utilized for measuring self-complexity (Linville, 1985, 1987), and then adapted for measuring evaluative self-concept organization by Showers (1992). In the self-descriptive card-sort task, participants are given 40 cards, each with a potentially self-descriptive attribute printed on them. One half of the cards display positive attributes (e.g., *friendly*, *organized*) and the other half displays negative attributes (e.g., *insecure*, *irritable*). Participants are asked to, "Think of the different aspects of yourself and your life and sort the cards into groups where each group describes an aspect of yourself and your life." Participants are to create as many groups as they feel are representative of the self. Because some attributes may be descriptive of the self in several (or none) of their groups, participants are allowed to re-use an attribute in multiple groups or not use it at all. Table 1 displays examples of participants' card sorts.

Evaluative self-organization (phi). Compartmentalization is an index of the organization of positive and negative self-content in the card sort, measured by the phi-coefficient (ϕ or Cramer's V; Cramer, 1945/1975; Everitt, 1977). Scores are based on a chi-square statistic, such that organizations of positively and negatively valenced attributes are compared to the distribution that would be expected by chance. That is, a completely "ordered" card sort has positive and negative attributes separated into homogeneous groups (perfectly compartmentalized) and a completely "unordered" card sort has a mixture of positive and negative attributes evenly distributed across aspects (perfectly integrative). Scores range from relatively integrative (*phi* = 0) to relatively compartmentalized (*phi* = 1.0). See Showers and Kevlyn (1999) for additional details.

Differential importance (DI). Differential importance, adapted from Pelham and Swann (1989), is an index of positivity/negativity of a person's important self-aspects. Following the card sort, participants report how positive, negative, and important they view each self-aspect that they created on a 7-point scale. DI is the correlation between positivity (positive minus negative ratings) and importance ratings across all self-aspect groups. Scores range from -1 (negative self-aspects rated most important) to 1 (positive self-aspects rated most important).

Self-concept negativity (neg). Neg measures the amount of negative content in the self by dividing the number of negative attributes a person uses in the card sort by the total number of attributes used.

Model assumptions: Sample exclusions and moderator variables. The focus in the evaluative organization model generally is on how self-organization relates to how people deal with negative self-beliefs. Therefore, when testing the model, participants

are excluded when they report especially low negative self-content (fewer than 3 negative self-beliefs) or fewer than three self-aspect groups (cf. Showers & Kevlyn, 1999). Analyses for the model examines the moderating effect of DI and neg on evaluative self-organization, with these moderators having different effects based on the context and sample (Ditzfeld & Showers, 2013a). In the current investigation, DI is the cognitive process of weighting positive self-aspects as relatively more or less important than negative self-aspects (viz. emotional control). Neg may represent the susceptibility of experiencing negative emotional states because greater amounts of negative content in important self-aspects generally relates to a greater probability of experiencing chronic negative emotion.

Procedure

Participants attended a 1.5 hour session in groups of 1-to-5. Upon arrival, participants were led to a small hall with cubicles on both sides. Each person was directed to an assigned cubicle and listened to initial instructions from an experimenter as a group. The session began with (1) the self-descriptive card-sort task. Card-sort instructions were read to the group and then participants completed the card sort in their private rooms. Once everyone finished, general instructions for the remainder of the study were read aloud and cubicle doors were closed for privacy. Thereafter, the study was computer automated through Inquisit software. The program led participants through tasks in the following order: (2) RSES, (3) trait-affect ratings (AVI typical affect), (4) affect evaluation task (not discussed here; cf. Robinson, Storbeck, Meier, & Kirkeby, 2004), (5) AOSPAN practice trials, (6) AOSPAN experimental trials, (7) state-affect ratings (8 AVI state affect items: *inactive*, *sluggish*, *sad*, *nervous*, *aroused*,

elated, *happy*, *calm*), (8) affect similarity ratings (cf. Ditzfeld & Showers, 2014), (9) BIS/BAS, (10) TAI, (11) EPI, (12) PSS, and (13) BDI-II. Lastly, participants completed demographics before being thanked, debriefed, and dismissed.

Sample. Analyses included the full 62 participant sample, except for correlations involving PSS and BDI-II (1 participant failed to complete these scales) and evaluative self-organization (4 participants were excluded for values invalid to the model as described above).

Results and Discussion

Intercorrelations and descriptive statistics for WMC and emotionality variables are presented in Table 2. Two indices of negative emotionality were associated with relatively high executive-functioning ability. Behavioral inhibition (BIS) was positively associated with WMC (r = .29, p = .021) and neuroticism was somewhat positively associated with WMC (r = .21, p = .103). Relatively high cognitive ability may contribute to chronic up-relation of anxiety: *over*-controlled cognition. Alternatively, generally anxious individuals may have worked harder on the WMC task due to self-presentation concerns (e.g., Schlenker & Leary, 1982) or because there was no risk of damaging mood from task engagement (cf. *hedonic contingency*; Wegener & Petty, 1994).

The relationship between WMC and evaluative self-organization was tested using hierarchical multiple regression. WMC was set as the criterion and the procedure entered compartmentalization (phi), differential importance (DI), and self-concept negativity (neg) main effect variables on Step 1 and the three two-way interaction terms on Step 2. No main effect or interaction terms significantly predicted WMC ($|\beta|$s $\leq$ .20,

*p*s > .220). Evaluative self-organization was not associated with baseline executive functioning. This puts doubt to a possible third variable explanation in which the affective reactivity predisposing compartmentalized individuals to high-arousal affect (Ditzfeld & Showers, 2013a, 2014) extends from baseline *inabilities* to control emotions cognitively (e.g., poor coping skills).

State mood was unrelated to WMC, although individuals with high WMC scores felt relatively happy (r = .20, p = .201) and calm (r = .19, p = .140) following the AOSPAN task. Controlling for these ratings had little influence on the WMC correlations with BIS (r[57] = .25, p = .061) and neuroticism (r[57] = .24, p = .067).

STUDY 2

The primary goals of Study 2 were to establish the effectiveness of the mood-induction procedure and provide preliminary tests of the hypothesis that anxiety narrows cognition (restricts WMC) in negative-emotionality individuals. Although it seems axiomatic to say that anxiety disrupts cognitive processing, the anxiety literature has produced a rather surprising limited number of circumstances in which anxious individuals actually show executive functioning deficits under stress. Using *attentional control theory* (ACT), M. W. Eysenck and colleagues (2007) suggest that trait-anxious individuals do not show performance deficits on tasks like the AOSPAN because this task requires central-executive *updating*. All components of the AOSPAN task are relevant to success (a person must correctly remember letters and correctly solve math problems) and anxious individuals evidentially are most sensitive to task-irrelevant distracters, namely threatening stimuli. By contrast, high-anxious individuals struggle in tasks that require *inhibition* and *shifting*. In fact, M. W. Eysenck cites unpublished data

(Santos & M. W. Eysenck, 2005) showing that even adding ongoing performance feedback by an experimenter did not produce discernably low WMC scores in high-anxious individuals (cf. non-automated OSPAN; Turner & Engle, 1987). ACT proposes that high-anxious individuals cognitively are *effective* but rather *inefficient*. Thus, high-anxious individuals' comparable performance to low-anxious individuals is theorized to be due to especially high cognitive effort, which makes up for inefficiencies. Anxious individuals simply mentally work harder. The ACT cognitive-inefficiency hypothesis is supported by neurological studies showing that high-anxious individuals have greater activation in brain regions related to cognitive effort while performing WMC tasks (J. R. Gray & Braver, 2002; J. R. Gray, Burgess, Schaefer, Yarkonki, Larsen, & Braver, 2005). Along these lines, the relatively high WMC scores achieved by negative-emotionality individuals in Study 1 perhaps was due to high levels of cognitive effort, and this was possible because the AOSPAN task alone did not produce disruptive levels of anxiety.

Previous failures to show WMC restrictions on updating tasks such as the AOSPAN by high trait-anxious individuals possibly extends from typical mood manipulations not providing the appropriate affective context for WMC restrictions. For example, evaluation anxiety and scary film clips evoke anxiety broadly and perhaps are ineffective in producing the kinds of emotional experiences common to, and characteristic of, negative-emotionality individuals. For instance, a researcher studying phobias presumably would not use a single stimulus (e.g., pictures of dogs) for a sample that included a broad range of phobias (e.g., fear of dogs, spiders, social situation, etc.). Accordingly, one goal in the current studies was to produce mood states that gel more

idiosyncratically with the emotionality of an individual. To do so, participants mentally and emotionally relived their own past emotional experience, an anxious or calm event, under the backdrop of classical music. This procedure was validated previously to produce appropriate mood states and influence attentional processing (cf. Jefferies, Smilek, Eich, & Enns, 2008).

In Study 2 participants were induced into an anxious or calm mood prior to completing the experimental trials of the WMC task (AOSPAN). As a preliminary study, negative-emotionality variables were restricted to trait anxiety (TAI) and behavioral inhibition (BIS). Positive-emotionality variables were restricted to the behavioral approach system (BAS) subscales. These variables were selected because they are the commonly used in cognitive-affective studies of this nature (e.g., M. W. Eysenck et al., 2007; J. R. Gray et al, 2005). Negative emotionality was hypothesized to be negatively associated with WMC in the anxious condition, but not in the calm condition.

Method

Participants

Forty-seven students (40 female; M_{age} = 19.21) at the University of Oklahoma participated voluntarily for course credit. Ethnicity/race was 70% White, 11% Black, 9% Asian, 6% Hawaiian, 2% Hispanic, and 2% other.

Measures and Tasks

Mood Conditions: Reliving Emotional Events

Mood-induction. Mood states were induced using procedures from Jefferies et al. (2008). Participants were asked to re-experience a time in their lives when they felt *anxious* or *calm* by mentally reliving a life event for 5 min. Before beginning the mood-induction trial, participants read a cover story informing them that most people can intensify, lessen, and end their mood states. In addition, they were informed that they would be listening to classical music pieces shown previously to help place people into anxious mood (*Uranus the Magician* by Karajan) or calm mood (*Venus, the Bringer of Peace* by Karajan and *Carnival of the Animals: The Swan* by Saint- Saenss). Participants were ensured they would be returned to a generally positive mood at the conclusion of the study.

After reading instructions, participants placed on headphones and recorded the event they planned to relive in a textbox embedded in the computer program. After pressing "OK" to indicate readiness, the computer program moved to the mood-induction stage. At that point, the program initiated playing the classical music piece. Participants viewed a gray screen that displayed text reminding them which mood to relive and a time-bar that gradually filled across 5 min. With 30 sec remaining, participants were alerted that the next task was about to start and instructed to carry their mood into that task. The music discontinued playing at the end of the trial.

Mood check and reinstatement. Following the initial mood-induction stage, participants reported current mood level in regard to valence (*positive*, *negative*), arousal (*energized*, *intense*), and condition mood (*anxiety* or *calm*) on 1 (*not much*) to 7 (*very much*) scale. After reporting state affect, mood was reinstated. Participants re-

entered the same mood as before by re-living the calm or anxious event again for an additional 3 minutes. As before, with 30 sec remaining participants were alerted that the next task was about to start and instructed to carry their mood into that task. Participants then moved directly into the experimental trials of the AOSPAN.

Mood recovery. At the conclusion of the study, all participants went through a 3 min calm-mood induction (same procedures as above), which included the classical music piece *Rodeo: No. 2 Corral Nocturne* by Copeland.

Procedure

Sessions were run in groups of 1-to-5 participants. Upon arrival, participants were led to a small hall with cubicles on both sides. Each person was directed to an assigned cubicle and listened to instructions from an experimenter as a group. Following general instructions, cubicle doors were closed for privacy. Thereafter, the study was computer automated though Inquisit software. The program included the following tasks and progressed in the order as listed: (1) WMC task (AOSPAN) practice trials, (2) affect evaluation task (not discussed), (3) mood induction (randomly assigned to *anxious* or *calm* condition; 5 min), (4) mood check and mood reinstatement (3 min), (5) WMC task (AOSPAN) experimental trials, (6) state-mood ratings (AVI items), (7) BIS/BAS, (8) TAI, (9) demographics, and (10) concluded with the mood-recovery session (3 min calm-mood induction). Once finished, participants were thanked, debriefed, and dismissed by the experimenter.

Results

Condition Analyses

Mood-check ratings. Individuals in the anxious condition reported feeling more *negative* (M_{anx} = 4.52, M_{calm} = 1.75; t[45] = -7.03, p < .001, d = -2.05), less *positive* (M_{anx} = 3.35, M_{calm} = 5.75; t = 5.65, p < .001, d = 1.65) and marginally more *intense* (M_{anx} = 4.78, M_{calm} = 4.00; t = -1.86, p = .070, d = -.54) than did those in the calm condition. Both groups felt equally *energized* (M_{anx} = 4.00, M_{calm} = 3.96, t = .08, p = .934, d = .02).

In addition, a *mood-level variable* was calculated by creating an index of condition-mood ratings; that is, participants' anxiety *or* calm rating for respective mood conditions. Not surprisingly, individuals reported more fully recreating feelings of calm (M = 5.79, SD = 1.02) than anxiety (M = 5.00, SD = 1.17), t(45) = 2.38, p = .017, d = .70.

WMC. Mood condition had no direct effect on WMC scores, which were nearly identical in anxious (M = 42.96, SD = 14.89) and calm (M = 43.79, SD = 13.75) conditions, t(45) = .20, p = .835, d = .06. Thus, any predictable variability in WMC scores based on mood condition required a moderator variable.

Self-Reported Mood and WMC

Pre-WMC-task mood. The next analytic step involved testing whether self-reported mood during the manipulation check (pre-AOSPAN) was predictive of WMC scores. Mood-level rating was not associated with WMC scores in the anxious (r = .22, p = .308) or calm condition (r = -.08, p = .697). The only significant WMC predictors were in the anxious condition. WMC was positively related to feeling *energized* (r =

.61, p = .002) and *intense* (r = .42, p = .046) prior to the task. This suggests an important role of mood framing in WMC-task performance.

Post-WMC-task mood (state affect). High WMC scores were associated greater positive affect in the anxious condition (r = .43, p = .040) and somewhat greater positive affect in the calm condition (r = .29, p = .175). Negative affect ratings were not associated with WMC in the anxious (r = -.02, p = .939) or calm condition (r = .09, p = .680). Follow-up analyses tested the possible interaction between mood condition and state-affect ratings using hierarchical multiple regression. Positive and negative affect in tested as moderators in separate analyses. The only significant finding was a main effect of positive affect (β = .37, p = .012). Top WMC-task performers felt more positive following the AOSPAN, irrespective of mood condition, and despite not receiving any objective performance feedback.

Emotionality and WMC

Negative emotionality. Bivariate correlations between emotionality variables and WMC were calculated for anxious and calm conditions separately (Table 3). Despite a significant positive relationship between trait anxiety and behavior inhibition (r = .44, p = .002), these two measures diverged in predicting WMC, particularly in the anxious condition. Consistent with predictions, trait anxiety was negatively associated with WMC in the anxious condition (r = -.40, p = .057), but not in the calm condition (r = .04, p = .852). A follow-up hierarchical multiple regression analysis tested main effects for trait anxiety and mood condition, along with the interaction term. The interaction was non-significant (β = -.21, p = .162), which indicates that trait-anxious individuals in the calm condition did not have substantially higher WMC scores than

those in the anxious condition. Behavioral inhibition (BIS) was not associated with WMC in the anxious condition (r = .17, p = .427) or calm condition (r = .04, p = .850). A follow-up regression analysis produced no main effects or an interaction involving BIS.

Positive emotionality. The three behavioral activation subscales were unrelated to WMC in the anxious (rs > .19, ps > .200) and calm ($|r|$s ≤ .08, ps > .720) conditions. For consistency with previous research, a BAS*g* score was calculated by standardizing and averaging scores on the three BAS subscales (cf. J. R. Gray & Braver, 2002). BAS*g* did not produce a significant correlation with WMC in the anxious (r = .29, p = .181) or calm (r = -.02, p = .933) condition. Follow-up multiple regression analyses provided no significant main effects or interactions involving BAS*g* or any of the BAS subscales.

The last set of analyses examined whether the relationship between trait anxiety and WMC in the anxious condition could be explained by differences in self-reported mood. Using a multiple regression procedure, the variables of trait anxiety, pre-WMC-task *energized*, pre-WMC-task *intense*, and post-WMC-task positive affect were entered as simultaneous predictors of WMC. The only unique predictor was *energized* ratings (β = .48, p = .049). Trait anxiety (β = -.24, p = .243), *intense* ratings (β = .12, p = .551), and positive affect (β = .04, p = .882) all failed to explain unique variance. Nevertheless, a follow-up mediation analysis (Hayes, 2013) indicated that the correlation between trait anxiety and WMC in the anxious condition was not fully or partially mediated by self-reported energized feelings (95% CI for indirect effect: -.5847, .1376).

Discussion

Study 2 provided evidence that the mood-induction procedure was effective not only in establishing anxious- and calm-mood states, but also in influencing WMC. Specifically, high trait-anxious individuals performed more poorly in an anxious-mood condition than did low trait-anxious individuals. This finding should not be understated, as previous research generally fails to show WMC restrictions in trait-anxious individuals on cognitive updating tasks (e.g., M. W. Eysenck, 2007). The current findings presumably diverge from previous research because the mood-induction procedure allowed anxious individuals to reflect on a personally relevant emotional event and this established an appropriate affective context for up-regulating their personal brand of anxiety.

Despite high-anxious individuals relatively low WMC scores in the anxious condition, trait anxiety and self-reported anxiety were unrelated (r = -.25, p = .249). Thus, high-anxious individuals did not set themselves up for poor performance by claiming extreme levels of anxiety prior to completing the WMC task. The possibility that the anxious-mood induction produced worries that distracted high-anxious individuals cannot be ruled out; however, for a number of reasons, this explanation seem unlikely. One, WMC task itself offers a built-in opportunity to distract people from worries (e.g., Showers & Kling, 1996). Two, past negative emotional events lose intensity over time (Walker & Skowronski, 2009) and become relatively "closed" psychologically (e.g., Beike & Wirth-Beaumont, 2005). Hence, past worries become rather obsolete.

Interestingly, individuals feeling energized by the anxious-mood induction performed particularly well on the WMC task. These individuals not only were not put off by anxiety, but they actually thrived cognitively in that state. One possibility is that these individuals do not conceptualize anxiety as a particularly negative state, and thus experience a qualitatively different affect state than other people. Accordingly, two small methodological adjustments were made prior to moving into the larger focal investigation. First, the word "anxious" was replaced by "nervous" in the mood-induction procedure to help ensure that individuals up-regulated a high-arousal negative states (and not a high-arousal positive stated) in an attempt to decreasing variability that may have extended from differences in semantic representations of anxiety (viz., low-anxious individuals may see anxiety as excitement). Secondly, self-reported mood ratings examining the effectiveness of the mood manipulations were moved to end of the study session, thus made retrospectively. Making features of people's moods salient through self-report may have provided an artificial means to appraise and regulate mood prior to entering the WMC task.

STUDY 3

Study 3 set out to investigate the major themes covered in the general introduction, namely testing WMC variability as function of emotionality and mood condition. As such, the complete package of tasks and measures were included. Most notably, individuals were placed into one of four mood conditions, which varied by valence and arousal (*sad*, *nervous*, *excited*, and *calm*). In addition, also included were two questionnaires assessing self-reported regulatory control abilities in emotion regulation (Gross & Johns, 2003) and self-control (Tangney, Baumeister, & Boone,

2004). Study 3 is presented in two analytical phases: Phase 1 establishes the factor structure of the emotionality variables and Phase 2 tests the role of emotionality and mood on WMC variability. Following description of study methodology, each phase is presented with a mini introduction, results, and discussion section.

Method

Participants

One hundred ninety-five students (162 females; M_{age} = 18.90) at the University of Oklahoma participated voluntarily for course credit in a two-session study. Ethnicity/race was 73% White, 8% Asian, 8% Black, 5% Hispanic, 4% Native American, and 2% other.

Measures and Tasks

Mood Conditions: Reliving Emotional Events

Using the mood-induction procedure from Study 2, participants were asked to re-live emotionally a time in their lives when they were *nervous* (Uranus the Magician by Karajan), *sad* (Adagio in G Minor by Albioni), *excited* (Slavonic Dances by Dvorak), or *calm* (Venus, the Bringer of Peace by Karajan and Carnival of the Animals: The Swan by Saint-Saens). The task lasted 5 min. With 30 sec remaining, participants were alerted that the next task was about to start and instructed to carry their mood into that task. The music discontinued playing at the end of the trial.

Retrospective mood ratings. In order to move participants directly into the WMC task, and to avoid making the cognitive features of emotions salient before doing so (cf. Schwarz & Clore, 2007), mood ratings were made at the end of the focal study (Study 3). Participants retrospectively rated how *positive*, *negative*, *intense*, *tired*,

nervous, *sad*, *calm*, and *excited* they felt when reliving their past mood event on a scale from 1(*not at all*) to 7 (*very much*).

Additional Questionnaires

Emotion Regulation Questionnaire (ERQ). The ERQ (Gross & John, 2003) measures self-reported strategies that people use to regulate their emotions. The ERQ is a 10-item questionnaire that includes subscales for Reappraisal (e.g., "When I want to feel more positive emotion, I change the way I'm thinking about the situation") and Suppression (e.g., "I control my emotions by not expressing them"). Participants rate agreement to each item on a 1 (*strongly disagree*) to 5 (*strongly agree*) scale. High scores indicate high self-reported reappraisal ability and greater tendency to suppress emotions, respectively.

Self-Control Scale (SCS). The SCS (Tangney et al., 2004) measures self-reported self-control ability in everyday situations based on a 36-item questionnaire (e.g., "I am good at resisting temptation"), on which participants rate agreement to each item on a 1 (*not at all*) to 5 (*very much*) scale. High scores indicate high self-reported trait self-control.

Procedure

After selecting the study via the online departmental experimental registration system, participants arrived at the laboratory to participate in a two-session study. The second session was scheduled to take place the following week at the same time and in the same location. Each session was 1 hr long.

Session 1. After arriving at the waiting room, participants were run in groups of 1-to-5. Upon arrival, participants were led to a small hall with cubicles on both sides.

Each person was directed to an assigned cubicle and listened to instructions from an experimenter as a group. Following general instructions, cubicle doors were closed for privacy. Thereafter, the study was computer automated by Inquisit software. Tasks and questionnaires were administered fully on computers in the following order: (1) AOSPAN practice trials, (2) affect evaluation task (not discussed), (3) mood induction (5 min; randomly assigned to nervous, sad, excited, or calm condition), (4) AOSPAN experimental trials, (5) state affect ratings (current level of select AVI items; *elated*, *happy*, *calm*, *inactive*, *sluggish*, *sad*, *nervous*, *aroused*), (6) BIS/BAS, (7) TAI, (8) demographics, (9) retrospective affect ratings, and (10) affect recovery (3 min calm mood induction). Once finished, participants were thanked, reminded to return the following week, and dismissed.

Session 2. Participants returned at the same time one week later. After arriving at the waiting room, participants were escorted as a group to a single room that contained partition-dividers placed between each person. The session began with the experimenter giving instructions for the self-descriptive card-sorting task to the group collectively. Participants completed the card-sort by themselves within their partition. Once everyone completed card-sorting task, participants were instructed to move onto a questionnaire packet containing RSES, AVI, PSS, EPI, SCS, ERQ, and BDI-II, in that order.[1] When finished, participants were thanked, debriefed, and dismissed.

[1] After recording AVI trait-affect, participants then went back through 24 affect-state items and reported much they *ideally* experience each state (affect valuation; Tsai, Knutson, & Fung, 2006). Preliminary analyses indicate that people generally show preferences for the same states they report experiencing more often.

Sample

The full sample of 195 participants was used for analyses involving questionnaire measures. In analyses involving the evaluative self-organization variables, the sample was reduced to 182 due to exclusion criteria for the model, which included reporting an insufficient number of card-sort groups (3), using fewer than 3 negative self-attributes (4), or missing card-sorting task data (6).

Analytic Phase 1: Emotionality Factors

The 15 questionnaire variables and three self-organization measures were submitted to a principle components analysis in order to examine the reduced factor structure of the emotionality variables. Intercorrelations and descriptive statistics for emotionality variables are reported in Table 4. The principle component analysis produced five factors with eigenvalues greater than one (Table 5). Factor 1 was labeled *negative-positive emotionality*, as high scores represent generally high levels of negative cognitive-affective traits (depression, neuroticism, anxiety, stress, and negative affectivity) and low scores represent high levels of positive cognitive-affective traits (self-esteem and positive affectivity). Factor 2 was labeled *approach orientation* because it included the three behavioral-approach-system subscales, extraversion, and low self-control (e.g., impulsivity). Factor 3 included only the behavioral inhibition (BIS) measure and was labeled *avoidance orientation*. Factor 4 included all three self-organization measures (compartmentalization, self-concept negativity, and differential importance). Factor 5 included the two emotion-regulation variables of reappraisal and suppression. New scores were computed for negative-positive emotionality (Factor 1) and approach orientation (Factor 2) variables by averaging *z*-score values for scales

contained within each factor (self-esteem and positive trait affect were reverse-scored for the Factor 1 calculation).

Preliminary analyses examining the correlations among factors provided a number of noteworthy findings. Negative-emotionality was separable from, but associated with, avoidance orientation ($r = .36$, $p < .001$) and low emotion-reappraisal ($r = -.32$, $p < .001$). Approach- and avoidance-orientation each were unique factors, which suggest that neither motivational orientation leads directly to positive or negative emotionality at the trait level. Interestingly, self-control loaded negatively onto the approach-orientation factor, indicating that individuals high on this variable (e.g., extraverts) are attracted to immediate gratification and are sensation-seekers. Nevertheless, approach-orientation was associated with high emotion-reappraisal ability ($r = .18$, $p = .010$), which indicates that these individuals do report an ability to control their emotions (i.e., up-regulate positive feelings and down-regulate negative feelings).

To test the possible relationships involving negative-positive emotionality, approach orientation, avoidance orientation, emotion suppression, and emotion reappraisal with evaluative self-organization, a series of hierarchical multiple regression analyses were performed with self-organization variables set as predictor variables. Each criterion was entered separately. On Step 1, the main effect variables of compartmentalization (phi), negative self-content (neg), and different importance (DI) were mean-centered and entered. On Step 2, all two-way interaction terms for those variables were entered. On Step 3, the three-way interaction term was entered. The analysis on the negative-positive emotionality variable provided a significant main effect of neg ($\beta = .41$, $p < .001$) that was qualified by a significant Phi x Neg interaction

(β = -.16, p = .041). As predicted values (cf. Aiken & West, 1991) in Figure 2 illustrate, negative integrative self-organization was associated with especially high negative emotionality. Compartmentalization was associated with moderate levels of emotionality, presumably because both positively and negatively compartmentalized individuals are prone to a combination of positive and negative emotions across everyday contexts in a fashion akin to affect intensity (Ditzfeld & Showers, 2014). In addition, there was main effect of neg for emotion reappraisal ability (β = -.22, p = .006). Individuals with high amounts of negative content in their self-concepts fail to regulate their emotions through reappraisal.

Discussion

The factor analysis provided five separate factors. Most interestingly, a negative-positive emotionality factor emerged that indicates that some individuals experience negative feelings and thoughts *at the exclusion* of positive feelings and thoughts (or vice versa) on a single dimension, and this emotionality is to some degree separable from approach- and avoidance-orientation. Emotion regulation variables also loaded onto their own factor, which suggests that emotionality does not extend entirely from control factors: Temperament and cognitive control appear conceptually distinct. Note, however, that Gross and John's (2003) reappraisal measure taps into people's ability to produce positive emotion and minimize negative emotion. It remains unclear whether individuals high on the measure are better at controlling their emotions, or if some individuals (e.g., high positive emotionality and/or high approach orientation) experience relatively weak negative emotions that require little regulation.

Lastly, while self-organization variables loaded on their own factor, negative evaluative integration was associated with high negative emotionality. This finding likely extends from these individuals' chronic access to negative self-beliefs across a number of important self-contexts. This differs from negatively compartmentalized individuals who experience positive emotional "ups" from time to time (Ditzfeld & Showers, 2013a; Showers, Zeigler-Hill, & Limke, 2006). As such, negatively compartmentalized individuals' instability leads to more moderate scores on trait measures of negative emotionality than found with negative integration, wherein negative feelings are less intense but rather unrelenting.

Analytic Phase 2: Role of Emotionality and Mood in Working Memory Capacity

The next phase of the analysis examined the effect of mood on working memory processing by testing the roles of (1) valence and arousal qualities and (2) individual differences in emotionality. As a reminder, mood conditions included four different moods, each with unique motivational properties: *nervousness* (high avoidance; high-arousal negative), *excitement* (high approach; high-arousal positive), *calm* (low approach; low-arousal positive), and *sadness* (low avoidance/approach; low-arousal negative).

Following the factor analysis, specific predictions were made in regard to the emotionality factor variables. Individuals with negative emotionality were hypothesized to have relatively low WMC when nervous but high WMC when sad. Individuals with positive emotionality (and compartmentalized self-concept organization) were hypothesized to have relatively low WMC when excited and high WMC when calm. Moreover, positive-emotionality individuals were hypothesized to have low WMC

when sad and high WMC when nervous. Approach orientation was predicted to be associated with especially low WMC when excited (default motivationally intense state) whereas avoidance orientation was predicted to be associated with especially low WMC when nervous (default motivationally intense state).

Emotion reappraisal ability was included as a measure of emotional control in order to delineate to what degree WMC in mood states is predicted by indices more greatly related to "feeling" (temperament-based emotionality measure), "thinking" (control-based regulation measure), or whether these factors interact with each other. Also, the emotion reappraisal measure previously was shown to be positively associated with baseline working memory ability (McRae et al., 2011), and therefore served as an important covariate in the analyses.

Mood Conditions

To test the effectiveness of the mood manipulations, four one-way ANOVAs were run on retrospective mood ratings for *nervous*, *sad*, *excited*, and *calm* items (dependent variables) based on condition (independent variable). All four ANOVAs were significant, $25.50 < F\text{s}(3, 191) < 52.25$, $p\text{s} < .001$, $.29 < \eta^2 < .47$. Participants reported experiencing the appropriate mood state to a significantly greater degree than did those in the other three conditions; all Bonferroni pair-wise comparisons were significant ($p\text{s} < .001$). In addition, a second analysis entered mood level (retrospective mood rating for the condition mood; $M = 5.17$; $SD = 1.46$) into a 2 (Valence; positive, negative) x 2 (Arousal; low, high) ANOVA in order to test whether some condition moods were easier to relive than others. This analysis produced main effects of valence, $F(1, 191) = 4.55$, $p = .034$, $\eta^2 = .023$, and arousal, $F = 4.78$, $p = .030$, $\eta^2 = .024$.

Individuals reported feeling the condition mood more completely in positive (M = 5.40) than in negative (M = 4.96) conditions; and more completely in low-arousal (M = 5.40) than in high-arousal (M = 4.95) conditions. Not surprisingly, participants found it easier to reproduce moods that were more positive and lower in arousal (consistent with Study 2).

In order to test the effect of mood condition on WMC, AOSPAN scores were entered into a 2 (Valence: positive/negative) x 2 (Arousal: low/high) ANOVA. This analysis produced no significant main effects or interactions, Fs(1, 191) < .65, ps > .425, η^2s $\leq$ .003. As in Study 2, any variability in WMC scores across mood conditions must extend from individual difference factors (i.e., moderator variables).

Moderator-variable analyses begin with self-reported mood because affect introspection provides the most direct index of mood experience. Those analyses are followed by tests of emotionality-variable moderation. Associations with emotionality variables were expected to influence WMC indirectly because individuals are presumed to have little insight into the cognitive-affective processes produced by emotional context.

WMC = Self-Reported Mood x Mood Condition

Pre-WMC-task mood: Retrospective mood-level ratings. Participants' retrospective ratings for condition mood (mood-level variable) was not associated with WMC (r[193] = .02, p = .805), nor did mood level interact with condition valence or condition arousal in a follow-up hierarchical multiple regression analysis (|β|s < .11, ps $\geq$ .150). Moreover, ratings for condition mood when analyzed separately also were not associated with WMC (*nervous*, r = .08; *excited*, r = .18; *sad*, r = -.10; *calm*, r = -.07; all

*p*s > .200). There was no statistical evidence that individuals were aware of the connection between their mood and their WMC scores. Importantly this means that, in retrospect, low WMC scores were not blamed on mood (e.g., "I felt too nervous to concentrate").[2]

Post-WMC-task mood (state mood). To test whether WMC scores were associated with positive mood (*elated*, *happy*, *calm*), negative mood (*sluggish*, *sad*, *nervous*) or arousal (*inactive*, *aroused*) ratings immediately after the task, eight separate hierarchical regressions were run in which each state-mood item was entered with the valence- and arousal-condition variables in steps up to the three-way interaction. As in the previous studies, individuals with higher WMC scores reported feeling happier after the task (main effect; $\beta = .22$, $p = .003$), in addition to reporting low levels of inactiveness (main effect; $\beta = -.15$, $p = .040$). In other words, individuals who performed relatively well on the WMC task reported feeling happy and upbeat afterward.

An Arousal Ratings x Condition Arousal interaction ($\beta = .17$, $p = .021$) showed that individuals reporting an appropriately high level of arousal in high-arousal

[2] A second set of analyses were run with hierarchical regressions that regressed WMC onto self-reported retrospective ratings of valence and arousal, along with the condition variables of valence and arousal, in steps up to the four-way interaction. Self-reported positive and negative mood ratings were highly correlated ($r = -.83$, $p < .001$) and therefore combined into a single mood-valence rating score (positive minus negative rating). Arousal-based mood ratings of intensity and tiredness also were significantly correlated, albeit more modestly ($r = -.17$, $p = .017$). After preliminary analyses indicated similar results when the two measures were examined separately, a single mood-arousal rating score (intense minus tired rating) was computed and used. Emerging from the analysis was a significant Arousal Ratings x Condition Valence x Condition Arousal interaction ($\beta = .25$, $p = .041$). Interestingly, individuals feeling (appropriately) high levels of arousal in the nervous condition had especially high WMC scores ($M_{pv} = 55.48$) in comparison to individuals feeling (inappropriately) high levels of arousal in the sad condition who had especially low scores ($M_{pv} = 39.71$; $\beta = .46$, $p = .054$). The opposite pattern arose in positive mood conditions such that individuals feeling greater arousal in the calm condition had especially high WMC scores ($M_{pv} = 57.48$) and those feeling high arousal in the excited condition had especially low WMC scores ($M_{pv} = 37.40$; $\beta = -.58$, $p = .031$).

conditions had higher WMC scores (M_{pv} = 49.72) than did those reporting relatively low arousal (M_{pv} = 41.98; β = .23, p = .020). Conversely, individuals reporting appropriately low levels of arousal in low-arousal conditions had higher WMC scores (M_{pv} = 48.14) than did those reporting relatively high arousal (M_{pv} = 43.83; β = -.13, p = .277). High WMC appears contingent on a person fully immersing themselves in the appropriate arousal-level for the mood condition, especially during nervousness and excitement.

Lastly, there was a significant Sluggishness Ratings x Condition Valence x Condition Arousal interaction (β = .15, p = .052), which showed that feeling sluggish was negatively associated with WMC scores in all conditions (βs = -.24 to -.15; .085 ≤ ps ≤ .300) except with sadness, in which these variables were positively related (β = .33, p = .075). Hence, the low-arousal negative feeling of sluggishness was associated with high WMC in the appropriate mood context (sadness), but not under any other circumstance.

WMC = Emotionality x Mood Condition

The first three analyses tested the extent to which negative-positive emotionality, approach orientation, and avoidance orientation were associated with WMC as a function of mood condition. These analyses utilized hierarchical multiple regression by regressing WMC scores onto emotionality factor (variables entered separately), mood valence (0 = negative, 1 = positive), mood arousal (0 = low, 1 = high), and emotion reappraisal (continuous). On Step 1, all four main effect variables were mean-centered and entered. On Step 2, all six possible two-way interaction terms were entered. On Step 3, all four possible three-way interaction terms were entered. On

Step 4, the 4-way interaction term was entered. Correlations between WMC and questionnaire measures within mood-conditions are displayed in Table 6. Regression analyses are displayed in Table 7.

Negative-positive emotionality. There was a significant three-way interaction of Negative-Positive Emotionality x Condition Valence x Condition Arousal (β = .20, *p* = .012; Figure 3). In negative-mood conditions, negative emotionality was associated with *low* WMC (M_{pv} = 41.82) in the nervous condition, but *high* WMC (M_{pv} = 51. 31) in the sad condition (β = -.28, *p* = .066). By comparison, negative emotionality was associated with WMC that was moderate and indistinguishable between excited (M_{pv} = 45.54) and calm (M_{pv} = 45.67) conditions (β =.00, *p* = .980). Negative mood states had the opposite effect on the WMC of individuals with positive emotionality, wherein positive emotionality was associated with *low* WMC (M_{pv} = 42.20) in the sad condition, but *high* WMC (M_{pv} = 53. 95) in the nervous condition (β = .34, *p* = .021). Positive emotionality was associated with similarly *low* WMC (M_{pv} = 40.89) in the excited condition (as the sad condition), but did not differ significantly from the moderately high WMC (M_{pv} = 47.14) scores in the calm condition (β = -.18, *p* = .239). Altogether, these findings suggest that sadness and nervousness have diametric effects on WMC in those with negative and positive emotionality. Moreover, whereas negative emotionality was associated with working memory restrictions during only nervousness, positive emotionality showed working memory restrictions during sadness and excitement, which suggests that theses latter individuals are emotionally responsive to a broader range of emotional states.

The analysis also provided a significant interaction of Negative-Positive Emotionality x Emotion Reappraisal x Condition Arousal (β = -.17, p = .040). As Figure 4 illustrates, the extent to which high-arousal mood influenced the WMC of high negative-emotionality individuals was dependent on emotion-reappraisal tendencies. In high-arousal moods, negative-emotionality was associated with high WMC (M_{pv} = 54.94) when the person's emotion-reappraisal ability was high, but with low WMC (M_{pv} = 39.90) when emotional-reappraisal ability was low (β = -.32, p = .019). Whereas some individuals high in negative emotionality appear to have cognitive control over high-arousal states (excitement and nervousness), perhaps down-regulating arousal to open up working memory resources, others with negative emotionality either do not have these controlled regulation abilities or choose not to use them, allowing emotions to take control of cognition.

Approach orientation. The analysis including approach orientation as a moderator variable provided a significant four-way Approach Orientation x Emotion Reappraisal x Mood Valence x Mood Arousal interaction (β =.16, p = .041). Figure 5 displays predicted values for this interaction, and show that the statistical action largely was in excited and nervous conditions. In the excited condition, approach-orientated individuals low in emotion appraisal had especially low WMC (M_{pv} = 29.77) in comparison to the other approach-appraisal combinations (collapsed M_{pv} = 48.54). In the nervous condition, low approach-orientated individuals high in emotion appraisal had especially high WMC (M_{pv} = 60.74) in comparison to individuals with other approach-appraisal combinations (collapsed M_{pv} = 46.09). Individuals high in approach orientation appear to experience excitement to a level that restricts working memory

only when excited feelings truly take over and are not (or cannot be) regulated. Alternatively, one advantage of low-approach orientation may be the ability to have working memory resources available in stressful circumstances (e.g., cognitively cool under pressure), however this advantage appears restricted to those who successfully regulate their emotions via reappraisal.

Avoidance orientation. BIS was not a significant main-effect predictor of WMC when the task was preceded by mood inductions ($\beta = .03$, $p = .661$), and none of the interactions involving BIS was significant ($|\beta|s \leq .10$, $ps > .200$). Not surprisingly, BIS and negative-positive emotionality variables were similar in predicting WMC in negative-mood conditions; only correlations involving BIS were statistically weaker (*nervous*: High BIS was associated with low WMC [$r = -.14$]; *sad*: High BIS was associated with high WMC [$r = .15$]). Indeed, the factor loading for BIS on the negative-emotionality variable was relatively high (Table 5), BIS typically is included in negative-emotionality measures (cf. Elliot & Thrash, 2002), and including BIS in the negative-positive emotionality variable did not influence the reported WMC findings. Consequently, BAS is treated as another basic feature of negative emotionality.

Evaluative self-organization. In order to test the self-organization model, a hierarchical multiple regression was used to regress WMC onto self-organization (phi), differential importance (DI), self-concept negativity (neg), condition valence, and condition arousal in steps: Step 1 entered main effect terms, mean centered; Step 2 entered two-way interaction terms; Step 3 entered three-way interaction terms; and Step 4 entered four-way interaction terms.[3] Note that emotion reappraisal was not included

[3] A five-way interaction term was not entered on a Step 5 of the regression analysis due to insufficient statistical power ($N = 182$)

as a moderator because this variable is conceptually redundant with the coping mechanisms described to be at the root of the evaluative self-organization model (cf. Showers & Zeigler-Hill, 2011). The regression analysis is displayed in Table 8.

The analysis produced a significant Phi x Neg x Condition Valence x Condition Arousal interaction ($\beta = -.25$, $p = .032$). As illustrated in Figure 6, predictable variability in WMC was found primarily in calm and excited conditions. In the calm condition, negative integration was associated with especially low WMC ($M_{pv} = 16.63$) in comparison to all other self-organizations (collapsed $M_{pv} = 46.48$); namely, integration was associated with significantly lower WMC than was compartmentalization in individuals with high negative self-concept content ($\beta = -.93$, $p = .023$). In the excited condition, negative compartmentalization was associated with lower WMC ($M_{pv} = 60.84$) than was positive compartmentalization ($M_{pv} = 38.88$; $\beta = -.65$, $p = .023$). Overall, compartmentalization was not associated with especially strong reactions to mood manipulations that restrict WMC, and therefore findings were inconsistent with predictions. Explanations are saved for the Phase 2 discussion section.

Follow-up Analyses: Emotionality and Self-Reported Mood

Mood-level correlates. First, regressions were performed on the mood-level variable (ratings for condition mood) to determine whether emotional individuals reported experiencing more extreme moods during the mood induction, thus explaining why mood had a more dramatic effect on their WMC. The previous four hierarchical regressions again were performed after substituting WMC scores with mood-level ratings as the criterion. Three significant findings emerged from these analyses (outside of the previously reported main effects of condition valence and arousal). An Emotion

Reappraisal x Condition Valence interaction was significant in regressions involving approach (β = .15, *p* = .036) and avoidance orientation (β = .18, *p* = .014), but was slightly mitigated by negative-positive emotionality (β = .12, *p* = .108). Overall, individuals high in emotion reappraisal reported experiencing especially high levels of positive mood (excitement and calm), but reported equivalent levels of negative mood (nervous and sad) as low appraisers. This suggests that emotion reappraisal more specifically captures the ability to up-regulate positive emotions than abilities to down-regulate negative emotions. An Avoidance Orientation x Condition Valence interaction (β = .15, *p* = .051) indicated that individuals high in avoidance orientation experienced disproportionally high levels positive mood. Avoidance-orientated individuals, despite their anxious disposition, appear (1) capable of experiencing strong positive emotion and (2) not particularly overwhelmed by negative emotion. Lastly, there was a Phi x Neg x DI interaction (β = -.22, *p* = .033). Individuals with "genuine" positive compartmentalization (high DI *and* low neg) and genuine negative compartmentalization (low DI *and* high neg) reported experiencing higher levels of the condition mood than did compartmentalized individuals with high negative self-beliefs but viewed their positive self-aspects as most important (and vice versa). Integrative individuals with high DI (view their positive selves as relatively important) but with high neg (relatively high amounts of negative self-content) reported disproportionately high levels of the condition mood, relative other integrative individuals. Integratives who are especially secure with their negative qualities experience strong mood states, presumably because they are more comfortable with emotionally letting go of the self than are other integratives.

Negative-positive emotionality was not associated with reported mood level; however, this possibly was due to the fact that both positive-emotionality and negative emotionality individuals (i.e., highly emotional people *in general*) experience a number of positive and negative moods rather strongly or intensely. Therefore, the negative-positive emotionality variable was transformed by squaring scores so that high scores represented high emotionality irrespective of valence. There was a main effect of this general high emotionality variable on mood level ($\beta = .16$, $p = .025$) that was not moderated by mood condition. Emotional people reported experiencing stronger moods across conditions, despite displaying disparate cognitive-affective reactions to those moods in the WMC task. This suggests the intriguing possibility that positive- and negative-emotionality individuals experience strong, intense moods across conditions, but those states actually are experienced as qualitatively distinct emotions. For example, when positive-emotionality individuals feel strong sadness, they actually experience a different form of sadness than do negative-emotionality individuals.

WMC analyses controlling for mood level. Mood level was not associated with WMC ($r = .02$), thus it was unlikely that these mood ratings could explain (i.e., mediate) the WMC variability predicted by emotionality variables. Indeed, analyses that controlled for mood level had no influence on the interactions reported for WMC with negative-positive emotionality (first listed, $\beta = .20$, $p = .012$; second listed, $\beta = -.17$, $p = .039$), approach orientation ($\beta = .16$, $p = .040$), and evaluative self-organization ($\beta = -.26$, $p = .029$). Moreover, controlling for all four retrospective ratings of excited, calm, nervous, and sad mood also had negligible influences on the reported findings (e.g.,

feeling excited when nervous could not explain fully the negative correlation between WMC and negative-positive emotionality in the nervous condition).

WMC analyses excluding low mood-level participants. To ensure that WMC findings were not influenced unduly by participants unable or unwilling to get into condition mood states, another set of regressions were performed after excluding individuals reporting a mood level of "1" (*not at all*; $n = 2$) or "2" ($n = 11$). These exclusions had no influence on the reported interactions: Negative-positive emotionality (first listed, $\beta = .23$, $p = .004$; second listed, $\beta = -.19$, $p = .028$), approach orientation ($\beta = .20$, $p = .015$), and evaluative self-organization ($\beta = -.23$, $p = .059$). Interestingly, the previously non-significant main effect of approach orientation ($N = 195$; $\beta = -.11$, $p = .139$) was significant in the restricted sample ($N = 182$; $\beta = -.18$, $p = .017$). Thus, high approach orientation was associated with low WMC in individuals experiencing sufficiently high levels of the condition mood state, irrespective of mood type.

Predicting post-WMC-task mood. A final set of analyses tested whether the relationship between WMC scores and post-task low-arousal happiness ratings could be explained by emotionality variables. First, a multiple regression analysis entering happiness and inactivity ratings simultaneously showed that happiness ratings uniquely predicted WMC ($\beta = -.15$, $p = .049$) but inactive ratings did not ($\beta = .07$, $p = .366$). Consequently, the focus was placed on explaining happiness ratings statistically. Happiness ratings were correlated only with the variables of positive-negative emotionality ($r = -.27$, $p < .001$) and emotion reappraisal ($r = .13$, $p = .070$), so these factors were the prime candidates for predicting happiness ratings. To test this possibility, post-task happiness ratings were entered on the step following the three-way

interactions (Step 4) in the positive-negative emotionality regression to determine if happiness ratings explained unique variance that the negative-positive emotionality and emotion reappraisal interactions did not. Happy ratings remained a significant predictor on Step 5 of the regression ($\beta = .18$, $p = .028$), which indicates that happiness ratings arrive from sources outside of emotionality, such as task enjoyment.

Discussion

The conditions in which executive functioning produce high WMC scores varied as a function of mood state and individual differences in emotionality (e.g., affective temperament). Most notably, these data indicate that WMC is not a stable, trait-based ability, at least in highly emotional individuals. The cognition of high emotionality individuals is flexible, shifting from narrowed to broadened WMC as a function of emotional context. Thus, these findings are consistent with motivational intensity model (Harmon-Jones et al., 2013) and suggest that the attentional processes underlying global-local orientation also contribute to more sophisticated cognitive processes involving executive attention (Engle, 2002). Listed below are some of the major implications of Phase 2 findings, focusing on the role of emotions in regulating cognitive processes.

Emotions restrict cognitive executive processing based on the motivational strength of an emotion

Positive- and negative-emotionality individuals had *different* cognitive-affective reactions to the *same* moods, presumably because these moods activate different motivational qualities. Negative-emotionality individuals are sensitive to nervousness whereas positive-emotionality individuals are sensitive to excitement, presumably

because these moods evoke these individuals' dominant motivationally intense states; WMC restricts in the service of avoidance and approach goals, respectively (promotes action orientation). These reactions likely are functional for the individuals a number of contexts, but provide suboptimal conditions for performance on the WMC task. Interestingly, positive emotionality also was associated with especially low WMC in the sad condition, which suggests sadness may be a particularly aversive state to these individuals. This may be due to positive-emotionality individuals not being particularly accustomed to feelings of failure and loss. Collectively, high negative-emotionality individuals (e.g., high in neuroticism) appear particularly sensitive to the *potential for* failure or loss (nervousness) whereas positive-emotionality individuals are more greatly influenced *by* failure or loss (sadness).

Emotional people must be "in the mood" for high WMC

Interestingly, while nervousness and sadness provided *suboptimal* WMC conditions for some high emotionality individuals, these same states provided *optimal* conditions for others. Positive-emotionality individuals had relatively high WMC scores in the nervous condition and negative-emotionality individuals had relatively high WMC scores in the sad condition. Executive functioning may be optimized by opening up resources to attend to information more broadly (or globally) because these states are not particularly motivating for these individuals (e.g., Carver, 2006; Gable & Harmon-Jones, 2012). These states may allow individuals to regroup, sort out their experiences, plan, and reprioritize goals until the requisite emotion that motivates action (excitement or anxiety) is initiated. Positive-emotionality individuals perhaps are relatively cognitively "cool under pressure" because they do not experience nervousness

as a particularly negative state (e.g., do not anticipate negative outcomes). Indeed, in the nervous condition, positive emotionality was associated with calm (r = -.21, p = .031) and low sadness (r = .29, p = .043); although these ratings did not statistically mediate the interaction. On the other hand, capacity advantages for negative-emotionality individuals extended from sadness. This mechanism may serve to increase their accuracy in understanding themselves in relation to their social worlds (cf. depressive realism; Alloy & Abramson, 1988), as well as lead to the up-regulation of anxiety once a goal is prioritized. Accordingly, anxiety and sadness may swing in a self-perpetuating cycle, which is particularly effective in driving successful goal acquisition when anxiety potentiates action toward goals (e.g., high-functioning neuroticism) or especially ineffective when anxiety leads to actions away from goals (e.g., withdrawal) or inaction (e.g., inhibition or learned helplessness).

Excitement is good for motivation, but bad for WMC, in approach-orientated individuals

The traditional "appetitive" reaction that motivates reward-seeking behavior in high approach-orientated individuals appears exaggerated in individuals low in emotion reappraisal. These individuals become fully entrenched in excitement, their default motivational state, but apparently do not do so through controlled cognitive means. Instead, they may simply seek-out and react to potential reinforcers in their environments (e.g., sensation seekers; Zuckerman, 2009), with little planning or cognitive framing (i.e., do not cognitively up-regulate excitement), which may explain their low levels of trait self-control. On the other end of the spectrum, low approach-orientated individuals who are prone to emotion reappraisal appear especially well

calibrated for dealing with anxious situations, wherein they experience ideal conditions for executive functioning. These individuals may be adept at thinking under circumstances that outwardly seem stressful.

Introspection fails to account for WMC variability in high-emotionality individuals because they experience moods differently

The WMC variability predicted by emotionality variables was not explainable through self-reported mood ratings, which indicates that these cognitive-affective reactions are not detectable through introspection or attributed to one's feelings. Namely, people did not blame their affect for poor performance. First, individuals likely are unable truly to know the objective strength of their emotional reaction. For instance, a person does not know if his sadness is a little more or less potent than others' sadness. Second, the mood inductions seemingly created qualitatively distinct emotional experiences in individuals differing in negative- and positive-emotionality: The same emotional context (mood condition) produced completely separable cognitive-affect effects, particularly in negative- and positive-emotionality individuals. Importantly, these differences are invisible in people's conceptual and semantic representations of emotional states: High-emotionality individuals reported experiencing equally high levels of condition mood despite those moods having different influences on cognitive processing. People assume that their feelings are similar to as another's feelings (e.g., theory of mind), but their cognitive-affective reactions suggest a different story.

Affective reactivity does not restrict WMC in individuals with evaluatively compartmentalized self-organization

While inconsistent with hypotheses, findings involving evaluative self-organization do converge with the results of Ditzfeld and Showers (2014) involving typical and preferred affect states, which show that compartmentalized individuals prefer high-arousal positive states (e.g., excitement) whereas integratives prefer low-arousal states (e.g., calm). Accordingly, positive compartmentalized individuals perhaps show higher WMC in excited states because excitement constitutes their most comfortable emotion, and therefore makes available the attentional resources needed to perform well on the WMC task. By contrast, negative integratives may be captivated by calm mood. Negative integratives show particularly strong preferences for low-arousal positive states, likely because this state represents an ideal state that they may find difficult to achieve. Consequently, the calm mood manipulation may provide ideal conditions for negative integratives because the exercise creates a distraction from their worries, similar in some respects to a mindfulness manipulation (e.g., Grossman, Niemann, Schmidt, & Walach, 2004). Movement from calm mood into a challenging high-pace cognitive task threatens to vanquish a valued mood state (e.g., Wegener & Petty, 1994), so negative-integrative individuals perhaps are reluctant to fully commit themselves to the WMC task and risk losing their positive state or possibly are perturbed by the gifting and subsequent ungifting of calm mood.

STUDY 1 BASELINE WMC REVISTED

A final set of analyses were run on the baseline WMC data from Study 1 using the key factors and variables found to predict WMC in Study 3. A negative-positive

emotionality and approach-orientation variable was calculated,[4] and then entered into two separate multiple regression analyses that entered the emotionality factor, post-WMC-task happiness rating, and post-WMC-task arousal rating simultaneously (see Table 9). Baseline WMC was correlated positively (and uniquely) with negative-positive emotionality ($\beta = .24$, $p = .058$; two-tailed) and post-task happiness ($\beta = .37$, $p < .01$; two-tailed).[5] Thus, negative-emotionality was associated with higher baseline WMC, which strengthens support for the *over-controlled cognition* hypothesis posited in Study 1. Moreover, post-task happiness ratings again provided a unique predictor of WMC. The robustness of post-task positive mood to correlate with WMC scores suggests that task enjoyment may play a key role in successful cognitive performance. Importantly, task enjoyment may link WMC measures to other cognitive tasks (e.g., fluid intelligence; J. C. Raven, J. Raven, & Court, 1998) whereby superior performance extends from task engagement instead of cognitive ability alone.

GENERAL DISCUSSION

Across three studies, the WMC of individuals high in emotionality was contingent on emotional context. Study 1 provided evidence of a slight executive functioning advantage in negative-emotionality individuals. Behavioral inhibition sensitivity, and to lesser degree neuroticism, was associated with high WMC in baseline conditions. In Study 2, high trait anxiety was associated with low WMC under conditions of anxiety but not under conditions of calm. In Study 3, negative

[4] Negative-positive emotionality variable included BIS for reasons described in Analytic Phase 2 of Study 3. The self-control measure (SCS) was unavailable for inclusion in the approach orientation measure. See Table 9 for full list of measures included in factor scoring.

[5] Alternatively, in an analysis that excluded 1 participant for a zero AOSPAN score and entered negative-positive emotionality, approach orientation, happiness rating, and arousal rating simultaneously, both negative-positive emotionality ($\beta = .30$, $p = .032$) and happiness rating ($\beta = .30$, $p = .040$) significantly predicted WMC. The more conservative analytical approach reported in text is retained for cross-study consistency.

emotionality again was associated with relatively low WMC in a nervous condition, but relatively high WMC in a sad condition. By contrast, positive emotionality was associated with low WMC in a sad condition, but relatively high WMC in a nervous condition. In addition, positive emotionality was associated with relatively low WMC in an excited condition.

Action-Deliberation Model

Affect states are modeled to enact an action-deliberation tradeoff based on the motivational qualities of the feeling state. Nervousness and excitement were associated with cognitive narrowing (low WMC) in positive- and negative-emotionality individuals, respectively. These motivationally intense states are postulated to prioritize action through goal-focus (i.e., lock people into avoidance or approach goals). By contrast, sadness and nervousness was associated with cognitive broadening (high WMC) in negative- and positive-emotionality individuals, respectively. These presumably low motivationally intense states (viz., low approach) are postulated to promote deliberation (e.g., goal formation, planning, problem solving, etc.). Interestingly, sadness restricted executive functioning (low WMC) in positive-emotionality individuals. Apparently, positive-emotionality individuals do not fret over the possibility of failure or loss (low avoidance-orientation) and actually benefit cognitively from added pressure (e.g., anxiety produces optimal-arousal); however, they take failure and loss hard. Their sadness seemingly restricts and captures attention (e.g., Simon, 1967), although no action likely can undo the outcome (unique from Carver, 2004; Carver & Scheier, 1998). Sadness perhaps forces the self to focus on errors *ad*

hoc in the service of learning from mistakes and engendering motives for improving future actions (cf. functional counterfactual thinking; Epstude, & Roese, 2008).

Regulation and Flexible Cognition

Emotion generation and emotion regulation appear to be concurrent, coterminous processes (Campos et al., 2004), wherein the cognitive faculties deemed necessary for emotion regulation are modulated by emotions themselves. These data support state-based models of WMC (Ilkowska & Engle, 2010) and accord with preexisting cognition-affect models including Pessoa's (2009) neurological emotion-directed executive control framework, the integrated process model of stereotype threat (Schmader, Johns, & Forbes, 2008), and motivational accounts of emotions (e.g., Bradley & Lang, 2000). Importantly, shifts in WMC scores highlight the importance of accounting for context *and* personality in human responding (Person x Situation; Lewin, 1935; Mischel, 2004). Namely, a cognitive-affect system (Mischel & Shoda, 1995) approach was adopted to predict WMC in regard to *if-then* reactions based on emotionality and mood state. For example, *if* someone with negative emotionality is in a sad (anxious) mood, *then* WMC is predicted to be high (low).

The broadening-narrowing of WMC is conceptually consistent with dual-process models of cognition. Fluctuations in executive functioning presumably reflect shifts between *automatic* (System 1) and *controlled* (System 2) processing (Kahneman, 2011; Stanovich, 1999) and therefore can be connected to a large body of research (for a review, Evans 2008). States associated with low and high WMC may promote automatic and controlled processing, respectively, and therefore should predict many of the same outcomes. For example, excitement and anxiety perhaps produces automatic

processing in positive- and negative-emotionality individuals, respectively. Automatic processing is associated with greater use of stereotyping (Macrae, Milne, & Bodenhausen, 1994), correspondence bias (Gilbert, Pelham, & Krull, 1988), peripheral-route attitude formation (Petty & Cacioppo, 1986), conservative ideology (Eidelman, Crandall, Goodman, & Blanchar, 2012), self-affirmation (Swann & Schroeder, 1995), and strong adherence to the cultural worldview (Greenberg, Solomon, & Pyszczynski, 1997). In fact, negative-emotionality individuals' generally high WMC may reflect a particularly strong reliance on controlled processing in their everyday lives (e.g., *need for cognition* Cacioppo, Petty, Feinstein, & Jarvis, 1996). Indeed, research on depressive realism shows that dysphoria is associated with excessive controlled processing, at least in laboratory settings (Pacini, Muir, & Epstein, 1998).

Affective reactions can be (and often are) potentiated by conscious sources through the cognitive up-regulation of emotion and mood (as participants did in the current studies). However, once affect is elicited, it is suspected to modulate some of the same cognitive mechanisms that initiated the feeling state. Affect, in effect, takes control of cognition. Although the data provide only clues to neurological processing, the current theorizing is built on the belief that affect often precedes cognition in the sequences of events (Zajonc; 1980, 1984); affect systems underlying personality differences extend from different motivational origins (e.g., Cacioppo & Gardner, 1999; J. A. Gray & McNaughton, 2000; Lang, Bradley, & Cuthbert, 1990) that lie deep in the primitive, subcortical architecture of the brain (Panksepp, 1998); affective reactions move *upward* through neural pathways to the left-right brain hemispheres associated with global-local processing, approach-avoidance orientation, and emotion regulation

(Davidson, Jackson, & Kalin, 2000; Harmon-Jones, Gable, & Peterson, 2010; Volberg & Hübner, 2004); and, at this point, affect influences executive functioning in brain regions responsible for working memory (viz., prefrontal cortex; Kane & Engle, 2002).

Negative Emotionally: An Instrumental Account

Negative emotionality was associated with relatively superior cognitive-control abilities under baseline and sad-mood conditions. These contexts may increase attentional resources that promote self-evaluation and deliberation over current and future actions, likely with a prevention focus (Higgins, 1996; Idson, Liberman, & Higgins, 2004). Anxiety, on the other hand, was associated with restricted WMC. In regard to a process, the end state of deliberation likely is to shift toward goal-focus wherein the self is called into action through the up-regulation of anxiety (sadness-anxiety cycle), which activates behavioral engagement (approach-orientated behavior) or disengagement (goal abandonment). In the deliberation stage, negative-emotionality individuals appear highly selective when prioritizing goals, and rightfully so because they also tend to expend high levels of cognitive energy when working toward goal achievement (Roskes, Elliot, Nijstad, & De Dreu, 2013). Indeed, neurotic traits are associated with elevated and sustained levels of effort, at least to the degree that their performance exceeds others' expectations (whereas extraverts typically fall short; Bendersky, & Shah, 2013). This may be a positive side effect of self-presentation and social comparison concerns (e.g., Elliot & Thrash, 2001). Cognitive up-regulation of anxiety confers evolutionary advantages (Leary & Baumeister, 2000; Buss, 1990; Nesse, 1999). Mentally summonsing one's own anxieties functionally serves to motivate preparatory actions for future events in the absence of immediate biological

threat and potentiate insecurities that drive normative social behavior, among other benefits. Thus, it is not terribly surprising that negative-emotionality is associated with high cognitive-control ability that, at times, may be *over*-controlled, which increases proneness to chronic stress and its attached side effects (Sapolsky, 2004).

Realistically, the anxiety-sadness cycle gives way to positive emotion from time to time. The primary positive emotion of negative-emotionality individuals is theorized to be relief, which arrives at the resolution of an anxious event (Baas, De Dreu, & Nijstad, 2011; Carver, 2004; Fredrickson, Mancuso, Branigan, & Tugade, 2000; Higgins, Shah, & Friedman, 1997). However, even "neurotic pessimists" (Hamachek, 1978) do show pride following accomplishments (Stoeber, Harris, & Moon, 2007). Nevertheless, positive emotional experiences may be short-lived and replaced quickly by upgraded levels of personal standards and higher self-aspirations (Stoeber, Hutchfield, & Wood, 2008), as articulated by *hedonic treadmill* (Brickman & Campbell, 1971; Kahneman, 1999). On the upside, negative-emotionality individuals seem unlikely to "coast" for long periods before changing goal focus and moving onto another task (cf. Carver, 2003).

Negative-emotionality individuals show self-discrepancies between real-self and ought-self (Manian, Strauman, & Denney, 1998), which suggests that their self-expectations are at times unrealistically high. Therefore goal abandonment sometimes is necessary and even ideal. Interestingly, goal abandonment and even goal failure may produce conflictive feelings, such as a mixture of disappointment and relief (e.g., mixed emotion; Larsen & McGraw, 2011). In fact, this feeling may characterize their sadness because failure and loss are disappointing but also provide a reprieve from their anxiety.

Overall, relief may play important roles in these processes, but its study currently is under represented in the research (cf. Sweeny & Vohs, 2012).

Negative-emotionality individuals are believed to up-regulate anxiety in the service of accomplishing their goals, at times purposely and at other times automatically (Mauss, Bunge, & Gross, 2007). Regulation research largely has undervalued negative emotions, but they serve instrumental functions (Campos, Walle, Dahl, & Main, 2011; Mischel et al., 1989; Tamir, 2009). For example, individuals high in neuroticism choose to worry and experience fear in order to promote successful performance (Tamir & Ford, 2009), and these strategies have the desired effect (Tamir, 2005). If anxiety promotes preparation by kicking an individual into gear (e.g., improves study habits by leading students to study prior to the night before the exam), then it is easy to see the potential functionality of neuroticism. Even the apparent downside of negative emotionality, high anxiety and restricted WMC under pressure, in some circumstances may be beneficial. If preparation and practice improve competency, then anxiety may produce "optimal arousal" and allows anxious individuals to rely on their dominant responses (e.g., puts them in the "zone"), as characterized by social facilitation (Zajonc, 1965). Naturally, when competency is not achieved, these same individuals may "chock under pressure" (e.g., Baumeister & Showers, 1986). Indeed, the difference between success and failure in negative-emotionality individuals appears to extend from preparation factors: Defensive pessimists are successful whereas self-handicappers are not (Elliot & Church, 2003).

Pursuit of successful performance. Anxiety is purported to be part of a regulatory system that alerts the experiencer to concerns regarding progress toward a

goal and potential failure (Carver, 2006). If anxiety promotes action toward the goal, then the likelihood of success ordinarily will increase, which in the long run produces positive emotion (e.g., relief and pride). However, if anxiety is treated as *the problem*, then the focus turns toward emotion regulation and not on the source of anxiety. Consequently, anxiety fails to dissipate because no progress is made toward the goal and the person feels powerless against their emotions because their regulation attempts fail. Overall, a chronic tendency to blame negative mood and coping failures for one's failures may set in motion a self-defeating pattern of self-handicapping and unaccomplished goals (e.g., Baumeister, 1997; Baumgardner, Lake, & Arkin, 1985; Zuckerman, Kieffer, & Knee, 1998).

Cultural beliefs about anxiety may have a third-variable (mediating) effect on unsuccessful outcomes. The glamorization of positive emotions in the positive psychology movement (Csikszentmihalyi, 2000; Fredrickson, 1998; Lyubomirsky, King, & Diener, 2005; Seligman, 2002) may contribute to a stigmatization of neuroticism traits (e.g., views of negative emotionality as a weakness). If science says positive emotions promote success across a number of life domains, then people likely will see them as critical for success. This raises the possibility that beliefs about the detrimental effects of anxiety are playing a role in creating unsuccessful outcomes (self-fulfilling prophecy; Bargh & Chen, 1997). "I am going to fail *because* I'm anxious," presumably sets the stage for failure. Thus, neuroticism salience to some degree elicits a stereotype threat effect (e.g., R. Brown & Pinel, 2003). Without accounting for this third variable, it is difficult to determine the direct effect of anxiety on performance outcomes.

Pursuit of happiness. Humans value happiness (Myers, 2000) and negative emotions seem discordant with this happiness ideal (e.g., Kahneman, 1999). In reality, negative emotions are not at odds with happiness and, in fact, often are instrumental in achieving it. Ironically, people may be happier in the long run if they listen to their negative emotions instead of attempting of down-regulating them. Thus, refocusing people toward the instrumental value of negative emotions may diminish their negative effects on self and behavior (Crum et al., 2013; Park & Helgeson, 2006). For example, negative-emotion acceptance (e.g., Hayes, 2004) is associated with better coping to negative events, heightened pain tolerance, and lowered susceptibility to depression (Braams, Belchert, Boden, & Gross, 2012; Shallcross, Troy, Boland, & Mauss, 2010). Negative-emotionality individuals also appear to use negative emotions to their social advantage, such as up-regulating sadness in order to increase helping in others (Hackenbracht & Tamir, 2010). In addition, negative emotionality is associated with high sensitivity to social acceptance/rejection (e.g., approval contingencies; Crocker, Luhtanen, Cooper, & Bouvrette, 2003; Sargent, Crocker, & Luhtanen, 2005), which may promote emotional responsiveness (e.g., compassionate concern). Responsiveness is associated with long-term well-being benefits by building strong relationships (Canevello & Crocker, 2010). By contrast, denying self-worth contingencies ("I shouldn't care what others think about me") negates the affective advantage. Consequently, important belongingness needs go unmet (cf. Baumeister & Leary, 1995) and no regulation strategy likely provides self-fulfillment in the absence of meaningful interpersonal relationships (Deci & Ryan, 2012; Maslow, 1954).

Lastly, concern over the link between negative emotionality and unhappiness may be overblown. Negative emotionality certainly is associated with less positive emotion and lower satisfaction with life (Elliot, Sheldon, & Church, 1997), however it is unclear whether these individuals personally strive for these traits. Negative-emotionality individuals may not live up the happiness as defined by normative cultural standards (Markus & Kitayama, 1991; Tsai, 2007), but live up to their own personal standards. For example, relief may be perfectly fine for some individuals, despite others' insistence that enthusiasm and joy are prerequisites to being "happy". Indeed, while negative-emotionality traits seem suboptimal in Western cultures, these same traits generally are regarded as ideal in Eastern cultures (Kitayama, Markus, & Kurokawa, 2000). Moreover, satisfaction with life for most people is a moving target (e.g., hedonic adaptation; Frederick & Loewenstein, 1999; Kahneman & Riis, 2005) that is motivated by *growth needs* (Maslow, 1954). Acknowledging that there is room for self-improvement may reflect self-awareness rather than a major personality flaw.

Positive Emotionality: Allowing Positive Emotions To Take Control

Positive-emotionality individuals showed similar cognitive-affective advantages and disadvantages as those with negative emotionality. Excitement narrowed cognition (action focus) whereas nervousness broadened cognition (deliberation focus). Calm failed to show the hypothesized broadening effect, which may be due to some positive-emotionality individuals failing to discriminate among positive states (e.g., valence focus; Barrett, 2006b). In other words, these individuals perhaps struggle to taper their enthusiasm when experiencing positive emotions. In a similar vein, anxiety and nervousness did not appear to represent particularly negative states to positive-

emotionality individuals. Instead of focusing on the potential for failure, these individuals may see opportunities for success optimistically (Scheier, Carver, & Bridges, 1994; Peterson, 2000). These individuals appear to some degree approach orientated because they are motivated by appetitive drives (e.g., rewards or fun; Carver & White, 1994), but they have a broader emotional repertoire than strictly approach-orientated individuals (e.g., extraverts).

Pursuit of successful performance. One major advantage of positive emotionality is that action states (e.g., excitement, enthusiasm) may feel as positive (or more so) than the feelings of reward following accomplishments. Hence, action states lock positive-emotionality individuals into positive states in the fashion of intrinsic motivation or flow (Keller, & Bless, 2008; Nakamura & M. Csikszentmihalyi, 2002; Ryan & Deci, 2000). These individuals "love" what they do while the emotional state minimizes access to self-concerns. Moreover, anxiety appears to have beneficial, broadening cognitive effect. Added stress may drive may improved cognitive performance, especially on intensive executive-functioning and creative tasks. Interestingly, procrastination may pay off for positive-emotionality individuals (e.g., Chu & Choi, 2005), which differentiates them from genuinely approach-orientated extraverts who are prone to procrastination and its undesirable effects (Freeman, Cox-Fuenzalida, & Stoltenberg, 2011; Steel, Brothen, & Wambach, 2001).

The potential downsides to positive-emotionality are twofold. First, the narrowing of cognition during action states is good for motivation but seemingly poor for executive functioning. Excitement had symmetric effects with low WMC shown with anxiety in negative-emotionality individuals. Thus, excitement should hinder

performance on tasks that require intensive executive function, at least when the individual has not developed task competency. It is also possible that feelings of excitement simply decreased motivation on the WMC task (cf. Wegener & Petty, 1994). Second, positive-emotionality individuals may struggle to become motivated toward tasks that are not intrinsically enjoyable, which limits the number of domains in which they will be successful. Essentially, they save their energies for performance domains they "love". Unfortunately, love is fickle. After all, simply adding rewards to a previously intrinsically enjoyable task typically makes the task less enjoyable (Deci, Koestner, & Ryan, 1999). Enthusiasm likely fades over time and is replaced by the desire for a fresh start elsewhere.

Pursuit of happiness. If the definition of happiness is the amount of time spent experiencing positive minus negative emotion (Kahneman, 1999), then positive-emotionality individuals are happy by definition. This happiness likely is sustained by the interpersonal social benefits of their personalities (e.g., Madon, Smith, Jussim, Russell, Eccles, Palumbo, & Walkiewicz, 2001). For example, people signaling high self-esteem are believed to have positive personality characteristics (Zeigler-Hill, Besser, Myers, Southard, & Malkin, 2013) and are viewed as more desirable romantic partner (Zeigler-Hill & Myers, 2011). However, because these positive-emotionality traits generally are valued culturally, they also are more likely shaped to fit cultural norms (e.g., Hogg, 2012; Kurzban, & Aktipis, 2007). Thus, in some cases a positive façade may veil over hidden vulnerabilities (Zeigler-Hill & Showers, 2007). When positive-emotional personalities fail to provide social benefits, then they may be particularly susceptible to sadness and negative self-beliefs (e.g., downward spirals of

negativity; Garland, Fredrickson, Kring, Johnson, Meyer, & Penn, 2010), a process represented by the low WMC scores in the sad-mood condition. This potential for instability (high "highs" but also low "lows") may make these individuals particularly susceptible to depression (Kernis, Whisenhunt, Waschull, Greenier, Berry, Herlocker, & Anderson, 1998) and perhaps more so than with negative emotionality. Whereas negative-emotionality individuals may habituate and learn to deal with to their negative emotions, positive-emotionality individuals may be unaccustomed to negative emotions and cognitive-affectively ill-equipped to cope.

Low Emotionality and Cognitive Stability

Low-emotionality individuals had moderate scores on the negative-positive emotionality measure (i.e., line-midpoints on Figure 3). Low emotionality was associated with moderate and invariant WMC scores across mood conditions. Less emotional people did not experience the condition moods as intensely, which apparently promoted cognitive stability. Accordingly, low emotionality was associated with modest advantages in some circumstances (e.g., higher WMC than negative-emotionality individuals in the anxious condition) and modest disadvantages in others (e.g., lower WMC than negative-emotionality individuals in the sad condition).

Evaluative Self-Organization

Evaluative compartmentalization was not associated with the predicted cognitive-affective reactions outlined by the affective reactivity hypothesis. Incorporating another approach to self-organization, the *multiple self-aspect framework* (McConnell, 2011), may be more effective in predicting WMC by influencing mood through activating people's specific self-aspects. For example, making salient

compartmentalized individuals' specific self-aspects that contain self-attributes that are strictly positive (Tim's scholarly self) or strictly negative (Tim's basketball self) may create the appropriate emotional contexts that narrow cognition and lower WMC. Ultimately, however, working memory restrictions simply may not play a role in compartmentalization process. The affective reactivity hypothesis does not hinge entirely on the WMC component of the model. Valence cues may anchor categorization, which links positive-with-positive and negative-with-negative stimuli (e.g., self-beliefs, concepts, and faces; Ditzfeld & Showers, 2011, 2013b, 2014), but not because of executive functioning restrictions (viz., poor emotion-regulation ability). In fact, additional evidence for the categorization component of affective reactivity hypothesis was found in preliminary analyses (previously not discussed) on the Study 3 affect evaluation task (Robinson et al., 2004). In this task, picture stimuli varying in valence and arousal qualities are categorized as pleasant or unpleasant as quickly as possible. Compartmentalized individuals recorded faster affect-evaluation speeds across all affect picture stimuli than did integratives, with the most pronounced speed differences in high- and low-arousal positive picture sets. Thus, compartmentalized individuals are quick to respond to and categorize valenced stimuli, irrespective of arousal quality, and particularly sensitive to positive affective qualities.

Emotion Conceptualization and Differential Experience

Negative and positive emotionality individuals both reported experiencing mood states more intensely than those with low-emotionality. Taken alone this is not surprising, however when paired with the fact that these individuals displayed dissociable cognitive-affect reactions to mood conditions, this finding becomes

markedly more interesting. This arouses the possibility that people are using the same emotion label for qualitatively distinct experiences. Thus, when two people talk about their sadness they may not be talking about the same phenomenological state. For instance, sadness may be a low-arousal state of disappointment for one person (negative-emotionality), but a high-arousal state of distraught for another (positive-emotionality individuals). For researchers, this puts into question the construct validity of self-reported emotion measures.

If emotion concepts are built on separable core-affect foundations, then variability in people's conceptualizations of emotions seems rather probable. After all, even a cursory inspection of the over emotion literature makes clear that the number of definitions for emotions is roughly equivalent to the number of emotion researchers (cf. Larsen & Fredrickson, 1999). Chief among challengers to between-person homogeneity in emotional experience currently is Barrett (2014) as articulated by conceptual act theory. Namely, Barrett (1) argues that emotions are not natural kinds and therefore are irreducible to specific patterns of neural activation (Barrett, 2006c) and (2) treats emotional experiences as situated constructions that can vary among individuals based on affective behavioral adaptations (e.g., fight/flight), emotion conceptualization, emotion labels, cultural factors, and stochastic processes (Barrett et al., in press). Moreover, people vary in their conceptual representation of affect states (Barrett, 2004; Kashdan, Ferssizeidis, Collins, & Muraven, 2010), which indicates that at least semantically affect states mean different things to different people. Importantly, recognizing and accounting for individual differences may be an important key in

understanding emotion comprehensively and, in fact, failures to do so perhaps imposes a major impediment in advancing emotion research.

Limitations

Focus in present studies was placed on qualities of the methodological design (e.g., AOSPAN as a dependent, rather than moderator, variable); therefore limitations likely extend primarily from sampling issues. First, the sample size of Study 3 (N = 195) puts into question the robustness of the reported four-way interactions. Consequently, the Negative-Positive Emotionality x Condition Mood interaction is considered the top emotionality-variable finding. Second, the Study 3 sample was approximately 80% female.[6] Females appear more capable or willing than males to generate the mood states as instructed, particularly "powerless" emotions (e.g., sadness, fear; cf. Fischer, Mosquera, van Vianen, & Manstead, 2004) and display higher emotional ability in general (Brackett, Rivers, Shiffman, Lerner, & Salovey, 2006); but see Barrett and Bliss-Moreau (2009). Note, sex was not associated with condition mood-level ratings (r = -.04, *ns*) or WMC (r = .04, *ns*), and males were not excluded disproportionately from analysis removing individuals with low mood-level ratings (N = 13; 83% female, 17% male). Moreover, WMC effects still depend on the emotionality level of the female; therefore, participant sex may serve as an important moderator variable, but did not account for the present findings. Third, the mood-induction procedure combined personally relevant emotional experience and mood-setting music to provide a potentially multiplicative emotional punch that, although considered a strength of the present design, does leave unclear whether reliving an emotional event,

[6] Similar disproportional rates of female participants were not uncommon at that time (e.g., Ditzfeld & Showers, 2013b)

music type, or the combination of the two is responsible for the produced moods. This approach allowed emotional idiosyncrasies into the design, which is problematic if the produced moods did not appear non-random. Although it is unclear *how* exactly emotional experiences were differentiated qualitatively at this point, the data suggest negative-emotionality individuals share similar emotional experiences that are distinct from positive-emotionality individuals, who share similar emotional experiences of their own.

Conclusion

The current findings highlight the importance of emotional context in cognitive-affective processing. Specifically, the faculties deemed critical in emotion regulation were modulated by emotions themselves (Campos et al., 2004). Across 3 studies, high emotional people were not limited by their cognitive control abilities (WMC), but rather their WMC shifted as a function of emotional state. Indices of negative emotionality were associated with high WMC in baseline (Study 1) and sad (Study 3) conditions, but with low WMC in anxious and nervous conditions (Studies 2 and 3). By contrast, positive emotionality was associated with low WMC in excited and sad conditions, but with high WMC in a nervous condition (Study 3). High-emotionality individuals' responsiveness to emotional context appears to promote cognitive flexibility (e.g., Harmon-Jones et al., 2012), wherein motivationally intense states narrow cognition (*action focus*) and less motivationally intense states broaden cognition (*deliberation focus*). Thus, the utility of WMC to serve as an indicator of cognitive control is context and state dependent (Ilkowska & Engle, 2010). Consequently, understanding the role of

cognitive executive functioning in regulating emotions is incomplete without taking into account the role of affect in regulating cognition (e.g. Pessoa, 2009).

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Appendix A

Tables and Figures

Table 1

Examples of Compartmentalized and Integrative Self-Organization

Compartmentalized Organization					
On good days	*On bad days*	*General Characteristics*	*Shortcomings*	*Insecurities*	*Securities*
Happy	-Not the "real me"	Capable	-Weary	-Inferior	Organized
Successful	-Lazy	Friendly	-Indecisive	-Isolated	Hardworking
Communicative	-Disorganized	Optimistic	-Isolated	-Immature	Intelligent
Independent	-Indecisive	Interested	-Tense	-Self-Centered	Capable
Optimistic	-Immature	Capable	-Lazy	-Incompetent	Lovable
Outgoing	-Like a failure	Comfortable	-Uncomfortable	-Disorganized	Optimistic
Intelligent	-Tense	Intelligent		-Tense	Interested
Energetic	-Irritable	Mature			Happy
Confident		Fun & Entertaining			Independent

Integrative Organization				
In school	*In my relationship*	*Me most of the time*	*With roommate*	*In my family*
Organized	Energetic	-Indecisive	-Irritable	Needed
Hardworking	Lovable	Happy	-Indecisive	Lovable
Friendly	Fun & Entertaining	Communicative	-Tense	-Indecisive
-Tense	-Insecure	Energetic	Hardworking	Energetic
Successful	-Weary	Friendly	Friendly	
-Not the "real me"	-Self-centered	Optimistic		
	Communicative			
	Needed			
	-Immature			
	-Irritable			
	Happy			
	Comfortable			
	Outgoing			

Note. Examples of actual participants' compartmentalized (*phi* = 1.0; differential importance = .76; proportion of negative self-beliefs = .44) and integrative (*phi* = .27; differential importance = .44; proportion of negative self-beliefs = .35) card sorts. Reprinted from Ditzfeld and Showers (2013).

Table 2

Study 1: Emotionality Variables' Intercorrelations and Descriptive Statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Working Memory Capacity	__															
2. Self-esteem (RSES)	-.13	(.83)														
3. Negative trait affect (AVI)	.02	-.70***	(.80)													
4. Depression (BDI-II)	.08	-.72***	.60***	(.94)												
5. Trait Anxiety (TAI)	.10	-.63***	.77***	.69***	(.88)											
6. Positive Trait Affect (AVI)	.02	.55***	-.46***	-.55***	-.60***	(.81)										
7. Stress (PSS)	.11	-.49***	.53***	.60***	.68***	-.57***	(.85)									
8. Neuroticism (EPI)	.21	-.61***	.61***	.59***	.76***	-.51***	.52***	(.79)								
9. Activation: Fun (BAS)	.13	.24	-.17	-.24	-.24	.21	-.09	-.18	(.72)							
10. Activation: Drive (BAS)	.05	.30*	-.13	-.29*	-.13	.18	-.10	-.24	.57***	(.83)						
11. Extraversion (EPI)	.00	.28*	-.25	-.26*	-.30*	.24	-.12	-.28*	.68***	.27*	(.80)					
12. Activation: Reward (BAS)	.03	.55***	-.24	-.49***	-.27*	.36**	-.30**	-.26*	.33**	.48***	.27*	(.68)				
13. Avoidance (BIS)	.30*	-.41***	.36*	.25	.44***	-.29*	.32*	.49***	-.22	-.11	-.29*	-.01	(.79)			
14. Compartmentalization	.00	.04	-.04	-.14	.00	-.08	.13	.00	.18	.09	.09	.24*	.13	__		
15. Self-concept negativity	.18	-.35**	.33*	.23	.29*	-.26	.29*	.22	.08	-.08	-.08	-.17	.07	.40**	__	
16. Differential importance	-.10	.32*	-.22	-.28*	-.27*	.33*	-.22	-.15	.15	.25	.01	.28*	-.06	.30*	-.25	__
M	44.66	3.32	2.24	.56	20.19	3.75	2.74	9.85	13.16	10.98	14.71	17.84	19.61	.76	.29	.67
SD	16.92	.49	.61	.31	8.98	.54	.66	4.39	2.19	2.44	4.35	1.93	2.57	.23	.15	.32
N	62	62	62	61	62	62	61	62	62	62	62	62	62	58	58	58

Notes. Alphas in parentheses. RSES = Rosenberg Self-Esteem Scale; AVI = Affect Valuation Index; BDI = Beck Depression Inventory; TAI = Trait Anxiety Index; PSS = Perceived Stress Scale; EPI = Eysenck Personality Inventory; BAS = Behavioral Activation System; SCS = Self-Control Scale; BIS = Behavioral Inhibition System; ERS = Emotion Regulation Scale.
$^{*}p \leq .05$; $^{**}p \leq .01$; $^{***}p \leq .001$

Table 3

Study 2: Working Memory Capacity (WMC) Correlations with Emotionality and Mood Variables, along with Intercorrelations, Means, and Standard Deviations

	WMC Correlations By Condition		Correlation Matrix						
Variable	*Anxious*	*Calm*	1	2	3	4	5	6	7
1. Trait Anxiety (TAI)	-.40*	-.04	(.90)						
2. Avoidance (BIS)	.17	.04	.43*	(.68)					
3. Activation: Drive (BAS)	.28	-.08	-.27	-.17	(.76)				
4. Activation: Reward (BAS)	.24	-.02	-.05	.14	.63***	(.58)			
5. Activation: Fun (BAS)	.19	.04	-.27	-.12	.62**	.55***	(.58)		
6. Pos State Affect (AVI)	.43*	.29	-.39**	-.13	.05	.28	.33*	(.76)	
7. Neg State Affect (AVI)	.02	.09	.46***	.24	.00	-.05	-.07	-.48*	(.55)
Anxious									
M			44.83	20.30	11.17	18.22	13.09	2.82	2.55
SD			8.28	1.69	2.69	1.56	1.97	.73	.48
Calm									
M			41.42	19.79	11.58	17.75	13.00	2.74	2.23
SD			10.26	2.25	2.15	1.72	1.79	.62	.48

Notes. N_{Anx} = 24, N_{Calm} = 23. Alphas in parentheses. TAI = Trait Anxiety Index; BIS = Behavioral Inhibition System; BAS = Behavioral Activation System; AVI = Affect Valuation Index.
*$p \leq .05$; **$p \leq .01$; ***$p \leq .001$.

Table 4

Study 3: Emotionality-Variables Intercorrelations and Descriptive Statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Self-esteem (RSES)	(.88)																	
2. Neg trait affect (AVI)	-.61***	(.81)																
3. Depression (BDI-II)	-.61***	.64***	(.89)															
4. Trait Anxiety (TAI)	-.58***	.53***	.58***	(.88)														
5. Pos Trait Affect (AVI)	.60***	-.54***	-.53***	-.58***	(.83)													
6. Stress (PSS)	-.50***	.55***	.67***	.62***	-.52***	(.86)												
7. Neuroticism (EPI)	-.50***	.59***	.58***	.58***	-.47***	.53***	(.77)											
8. Fun (BAS)	.13	-.09	-.02	-.12	.17*	-.03	-.02	(.69)										
9. Drive (BAS)	.19***	-.23***	-.07	-.11	.23***	.03	.00	.47***	(.74)									
10. Extraversion (EPI)	.24***	-.21**	-.17*	-.25***	.27***	-.14	-.15*	.57***	.41***	(.79)								
11. Reward (BAS)	.21**	-.15*	-.07	-.07	.34***	-.01	-.04	.22**	.43***	.22**	(.61)							
12. Self-control (SCS)	.39***	-.48***	-.49***	-.28***	.29***	-.38***	-.41***	-.34***	-.11	-.26***	-.03	(.89)						
13. Avoidance (BIS)	-.25***	.23***	.18*	.45***	-.14	.35***	.37***	-.21**	-.07	-.17	.25***	.07	(.77)					
14. Compartmentalization	-.03	.03	.07	.16*	-.05	.14	.10	.03	.08	.04	.08	.03	.11	—				
15. Self-concept negativity	-.46***	.36***	.23**	.30***	-.35***	.27**	.21**	-.10	-.12	-.16*	-.15*	-.17*	.14	.39***	—			
16. Differential importance	.22**	-.12	-.10	-.10	.06	.01	-.12	.08	.18*	.10	.11	.01	.00	.18*	-.02	—		
17. Emotion Suppression (ERQ)	-.05	.05	-.03	.01	.05	-.07	-.03	-.02	-.11	-.20**	-.15*	.04	-.17*	-.02	.09	-.10	(.80)	
18. Emotion Reappraisal (ERQ)	.28***	-.27***	-.27***	-.20**	.35***	-.23***	-.20***	.13	.18**	.19***	.25***	.14	-.13	-.07	-.21**	-.01	.11	(.81)
M	4.19	2.46	1.26	44.81	3.53	3.04	0.52	12.22	10.83	0.54	17.94	3.20	22.09	0.77	0.32	0.48	2.78	3.61
SD	0.63	0.64	0.16	9.71	0.65	0.69	0.19	2.25	2.35	0.19	1.76	0.55	3.87	0.21	0.13	0.45	0.99	0.79
N	195	195	195	195	195	195	195	195	195	195	195	195	195	182	182	182	195	195

Notes. Alphas in parentheses. RSES = Rosenberg Self-Esteem Scale; AVI = Affect Valuation Index; BDI = Beck Depression Inventory; TAI = Trait Anxiety Index; PSS = Perceived Stress Scale; EPI = Eysenck Personality Inventory; BAS = Behavioral Activation System; SCS = Self-Control Scale; BIS = Behavioral Inhibition System; ERQ = Emotion Regulation Questionnaire.

*$p \leq .05$; **$p \leq .01$; ***$p \leq .001$.

Table 5

Study 3: Factor Loadings for Emotionality Variables

	Factor 1	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
	Negative-Positive Emotionality	**Approach Orientation**	**Avoidance Orientation**	**Self-Structure**	**Regulatory Styles**
Self-esteem (RSES)	**-.817**	-.012	.138	-.006	-.066
Negative trait affect (AVI)	**.806**	.061	-.162	-.044	.079
Depression (BDI-II)	**.783**	.221	-.140	-.096	.010
Trait Anxiety (TAI)	**.780**	.073	.219	-.090	.102
Positive Trait Affect (AVI)	**-.768**	.095	.106	-.082	.244
Stress (PSS)	**.742**	.268	.137	-.056	.010
Neuroticism (EPI)	**.728**	.225	.045	-.178	.114
Activation: Fun (BAS)	-.227	**.717**	-.307	.119	.030
Activation: Drive (BAS)	-.299	**.699**	.108	.045	.112
Extraversion (EPI)	-.351	**.668**	-.205	.071	-.189
Activation: Reward (BAS)	-.237	**.562**	.439	-.254	.256
Self-control (SCS)	-.448	**-.557**	.452	-.006	.075
Avoidance (BIS)	.398	.048	**.697**	-.303	.071
Compartmentalization	.134	.162	.422	**.700**	.150
Self-concept negativity	.486	-.037	.097	**.614**	.154
Differential importance	-.153	.214	.318	**.375**	-.351
Emotion Suppression (ERQ)	.018	-.262	-.340	.233	**.688**
Emotion Reappraisal (ERQ)	-.431	.173	-.002	-.157	**.529**

Note. RSES = Rosenberg Self-Esteem Scale; AVI = Affect Valuation Index; BDI = Beck Depression Inventory; TAI = Trait Anxiety Index; PSS = Perceived Stress Scale; EPI = Eysenck Personality Inventory; BAS = Behavioral Activation System; SCS = Self-Control Scale; BIS = Behavioral Inhibition System; ERQ = Emotion Regulation Questionnaire.

Table 6

Study 3: Correlations between Emotionality Variables and Working Memory Capacity by Mood Condition

Variable	WMC Correlations by Condition			
	Nervous	*Sad*	*Excited*	*Calm*
Negative-positive emotionality				
Self-esteem (RSES)	**.28***	-.06	.11	.11
Negative trait affect (AVI)	**-.32***	**.28***	.13	-.11
Depression (BDI-II)	**-.25**†	.16	.07	-.05
Trait anxiety (TAI)	**-.24**†	.11	-.08	-.09
Positive trait affect (AVI)	.23	-.02	-.14	-.11
Stress (PSS)	-.16	**.36****	-.01	.09
Neuroticism (EPI)	**-.29***	**.24**†	-.11	-.06
Approach orientation				
Activation: Fun (BAS)	-.01	-.21	**-.28***	.06
Activation: Drive (BAS)	.03	-.09	-.22	.10
Extraversion (EPI)	.01	-.13	-.15	**-.24**†
Activation: Reward (BAS)	.07	-.04	-.03	.14
Self-control (SCS)	.23	-.20	.08	-.03
Avoidance orientation				
BIS	-.14	.15	.08	.03
Regulatory styles				
Emotion suppression (ERQ)	-.07	-.22	-.16	-.02
Emotion reappraisal (ERQ)	.12	.05	.15	.02
M_{AOSPAN}	48.57	46.41	44.70	46.35
SD_{AOSPAN}	17.70	17.66	17.57	16.21
N	49	47	51	48

Notes. RSES = Rosenberg Self-Esteem Scale; AVI = Affect Valuation Index; BDI = Beck Depression Inventory; TAI = Trait Anxiety Index; PSS = Perceived Stress Scale; EPI = Eysenck Personality Inventory; BAS = Behavioral Activation System; SCS = Self-Control Scale; BIS = Behavioral Inhibition System; ERQ = Emotion Regulation Questionnaire.
$^{\dagger}p \leq .10$; $^{*}p \leq .05$; $^{**}p \leq .001$

Table 7

Study 3. Hierarchical Regression Analyses: Mood x Emotionality (Negative-Positive Emotionality; Approach Orientation; Avoidance Orientation) Predicting Working Memory Capacity

		R^2	sr^2	*sr*		R^2	sr^2	*sr*		R^2	sr^2	*sr*
Step 1		.01				.02				.01		
	Neg-pos emot (NegPos)		.00	.00	***Approach (App)***		.01	-.11	***Avoidance (BIS)***		.00	.03
	Emot reappraisal (ER)		.01	.08	Emot reappraisal (ER)		.01	.10	Emot reappraisal (ER)		.01	.09
	Cond valence (Val)		.00	-.07	Cond valence (Val)		.00	-.06	Cond valence (Val)		.00	-.07
	Cond arousal (Aro)		.00	.01	Cond arousal (Aro)		.00	.02	Cond arousal (Aro)		.00	.01
Step 2		.04				.03				.03		
	NegPos x ER		.01	-.08	App x ER		.00	.05	BIS x ER		.01	.09
	NegPos x Val		.00	.02	App x Val		.00	-.01	BIS x Val		.00	-.01
	NegPos x Aro		.01	-.12	App x Aro		.00	-.05	BIS x Aro		.00	-.05
	ER x Val		.00	-.01	ER x Val		.00	.01	ER x Val		.00	-.01
	ER x Aro		.00	.02	ER x Aro		.00	.05	ER x Aro		.00	.04
	Val x Aro		.00	-.07	Val x Aro		.00	-.07	Val x Aro		.00	-.06
Step 3		.09				.05				.04		
	NegPos x ER x Val		.00	.00	App x ER x Val		.01	.08	BIS x ER x Val		.00	-.01
	NegPos x ER x Aro		**.02***	**-.15***	App x ER x Aro		.00	-.04	BIS x ER x Aro		.00	.06
	NegPos x Val x Aro		**.03***	**.18***	App x Val x Aro		.00	-.06	BIS x Val x Aro		.00	.06
	ER x Val x Aro		.00	.04	ER x Vale x Aro		.00	.04	ER x Vale x Aro		.00	.00
Step 4		.09				.07				.05		
	NegPos x ER x Val x Aro		.00	.01	**App x ER x Val x Aro**		**.02***	**.15***	BIS x ER x Val x Aro		.01	-.08

Note. sr^2 is the proportion of unique variance of each predictor, beyond the variance of all other variables on that step. The sign of *sr* signifies the direction of the association between the predictor and criterion. Reported R^2 are cumulative.
*$p \leq .05$; **$p \leq .01$; ***$p \leq .001$

Table 8

Study 3. Hierarchical Regression Analyses: Mood x Self-Concept Organization Predicting Working Memory Capacity

		R^2	sr^2	*sr*
Step 1		.02		
	Compartmentalization (Phi)		.00	.06
	Differential importance (DI)		.00	-.05
	Negative self-beliefs (Neg)		.01	-.12
	Condition valence		.01	-.09
	Condition arousal		.00	.01
Step 2		.04		
	Phi x DI		.00	-.02
	Phi x Neg		.00	.05
	Phi x Valence		.00	.06
	Phi x Arousal		.00	.06
	DI x Neg		.00	.02
	DI x Valence		.00	-.07
	DI x Arousal		.00	-.06
	Neg x Valence		.00	-.03
	Neg x Arousal		.00	-.07
	Val x Arousal		.00	-.03
Step 3		.08		
	Phi x DI x Neg		.01	.08
	Phi x DI x Valence		.00	-.03
	Phi x DI x Arousal		.02	-.13
	Phi x Neg x Valence		.00	-.04
	Phi x Neg x Arousal		.01	.11
	Phi x Valence x Arousal		.01	-.09
	DI x Neg x Valence		.00	.07
	DI x Neg x Arousal		.00	.02
	DI x Valence x Arousal		.00	.06
	Neg x Valence x Arousal		.00	.06
Step 4		.13		
	Phi x DI x Neg x Valence		.02	.13
	Phi x DI x Neg x Arousal		.00	.00
	Phi x DI x Valence x Arousal		.02	-.13
	Phi x Neg x Valence x Arousal		**.03***	**-.17***
	DI x Neg x Valence x Arousal		.01	.12

Note. sr^2 is the proportion of unique variance of each predictor, beyond the variance of all other variables on that step. The sign of *sr* signifies the direction of the association between the predictor and criterion. Reported R^2 are cumulative.
$^{*}p \leq .05$; $^{**}p \leq .01$; $^{***}p \leq .001$

Table 9

Study 1. Multiple Regressions Predicting Baseline WMC Using Negative-Positive Emotionality and Approach Orientation Measures

	R^2	β	sr^2	sr
	.14*			
Neg-Pos Emotionality		**.24**†	**.06**†	**.24**†
Happy Rating		**.37****	**.12****	**.34****
Arousal Rating		-.15	.02	-.14
	.09			
Approach Orientation		-.05	.00	-.04
Happy Rating		**.32***	**.08***	**.29***
Arousal Rating		-.14	.02	-.13

Note. N = 62. Negative-positive emotionality is a composite measure of AVI negative trait affect, EPI neuroticism, BDI, BIS, PSS, RSES, TAI, AVI positive trait affect, and RSES. Approach orientation is a composite measure of BAS fun, reward, and drive subscales and EPI extraversion. Happy and Arousal ratings are post-AOSPAN levels of state affect.

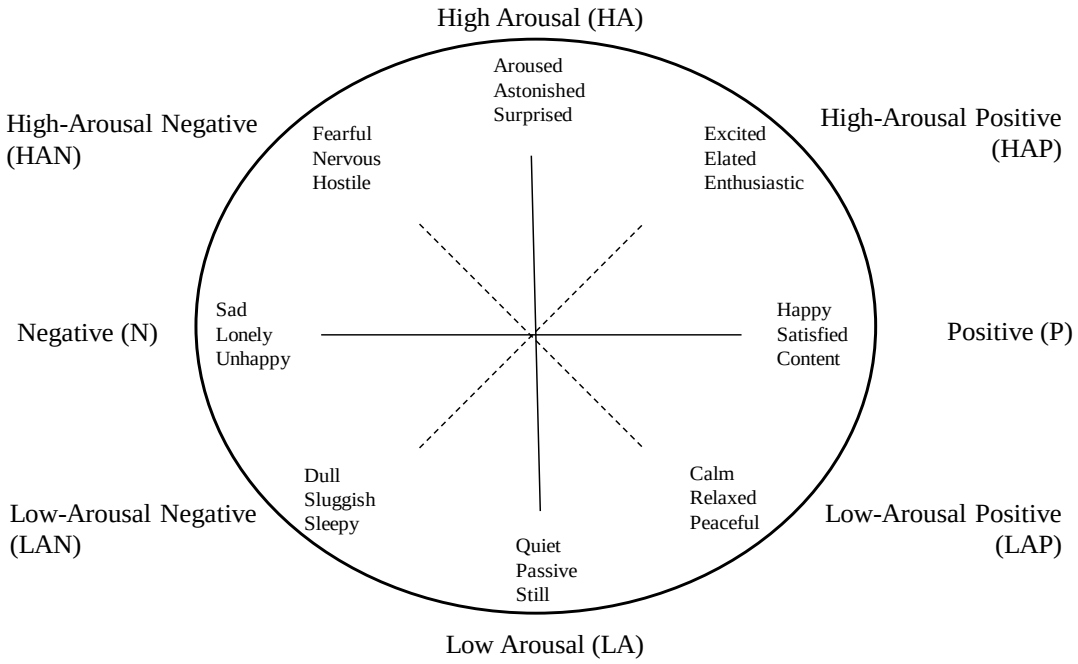

Figure 1. Affect valuation items (Tsai, 2007) displayed within an affect circumplex (Ditzfeld & Showers, 2013; Russell & Barrett, 1999).

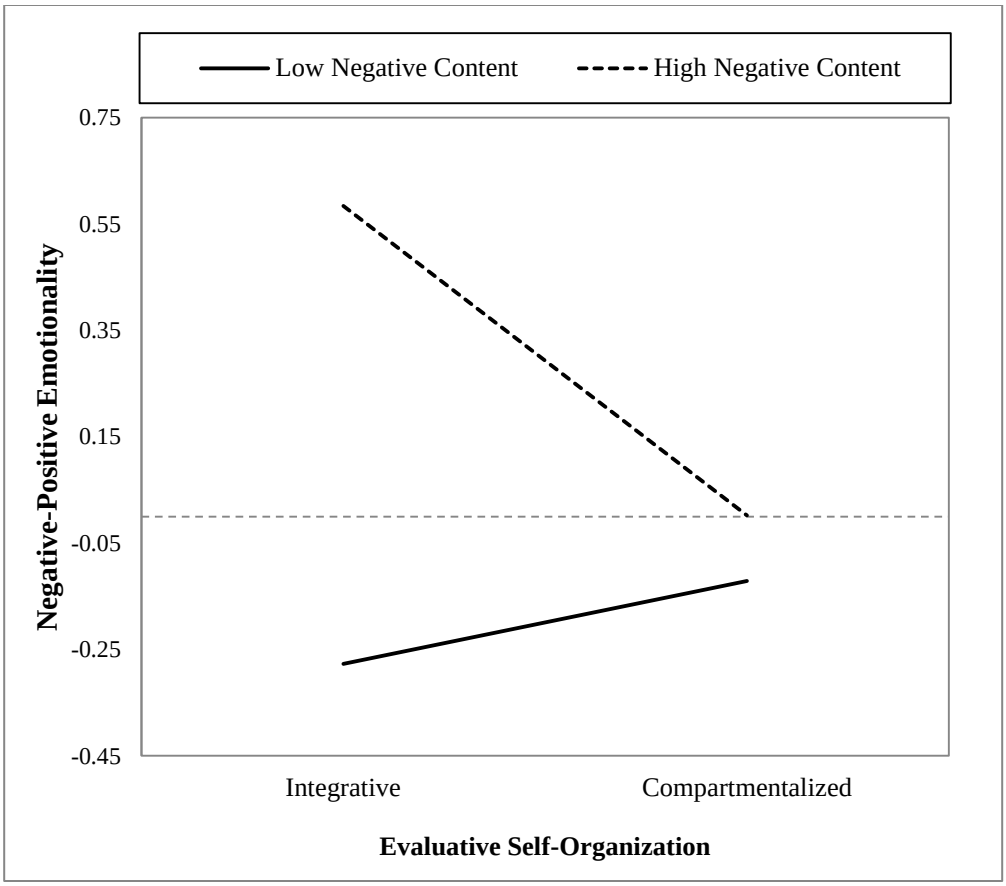

Figure 2. Predicted values for the interaction between evaluative self-structure (phi) and self-concept negativity (neg) in association with positive-negative emotionality at values 1 *SD* above and below the sample means. High values indicate greater negative emotionality and low values indicate greater positive emotionality.

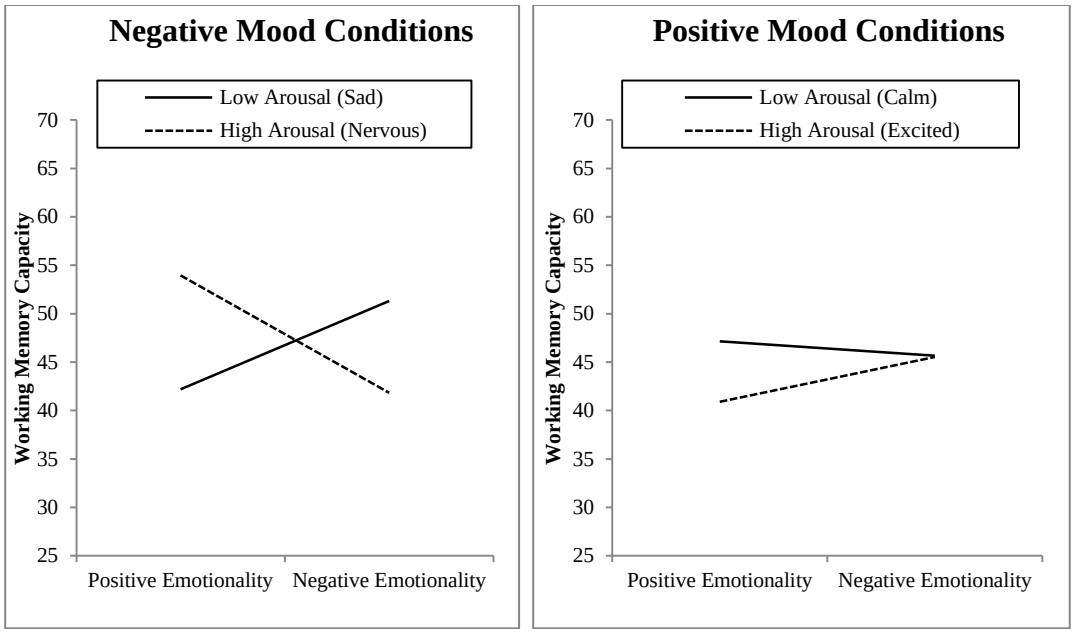

Figure 3. Predicted values displaying working memory capacity as a function of mood condition and negative-positive emotionality. Negative and positive emotionally represent values1 *SD* above and below the sample negative-positive emotionality variable mean, respectively.

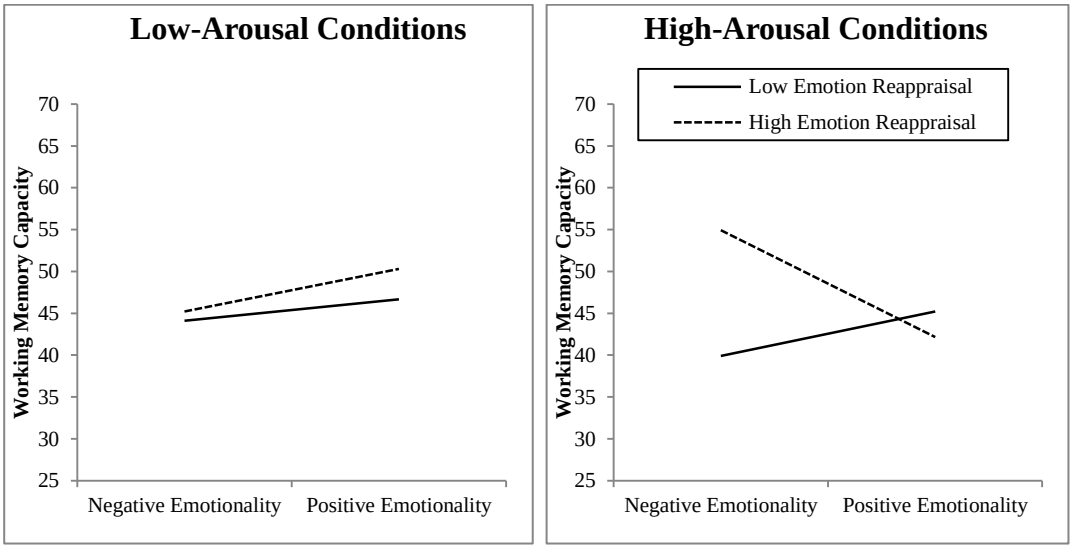

Figure 4. Predicted values displaying working memory capacity as a function of mood-condition arousal, negative-positive emotionality, and emotion-reappraisal. Negative and positive emotionally represent values at 1 *SD* above and below the sample negative-positive emotionality variable mean, respectively. High and low emotional reappraisal ability represent values 1 *SD* above and below the sample mean on the reappraisal subscale of the Emotion Regulation Questionnaire, respectively.

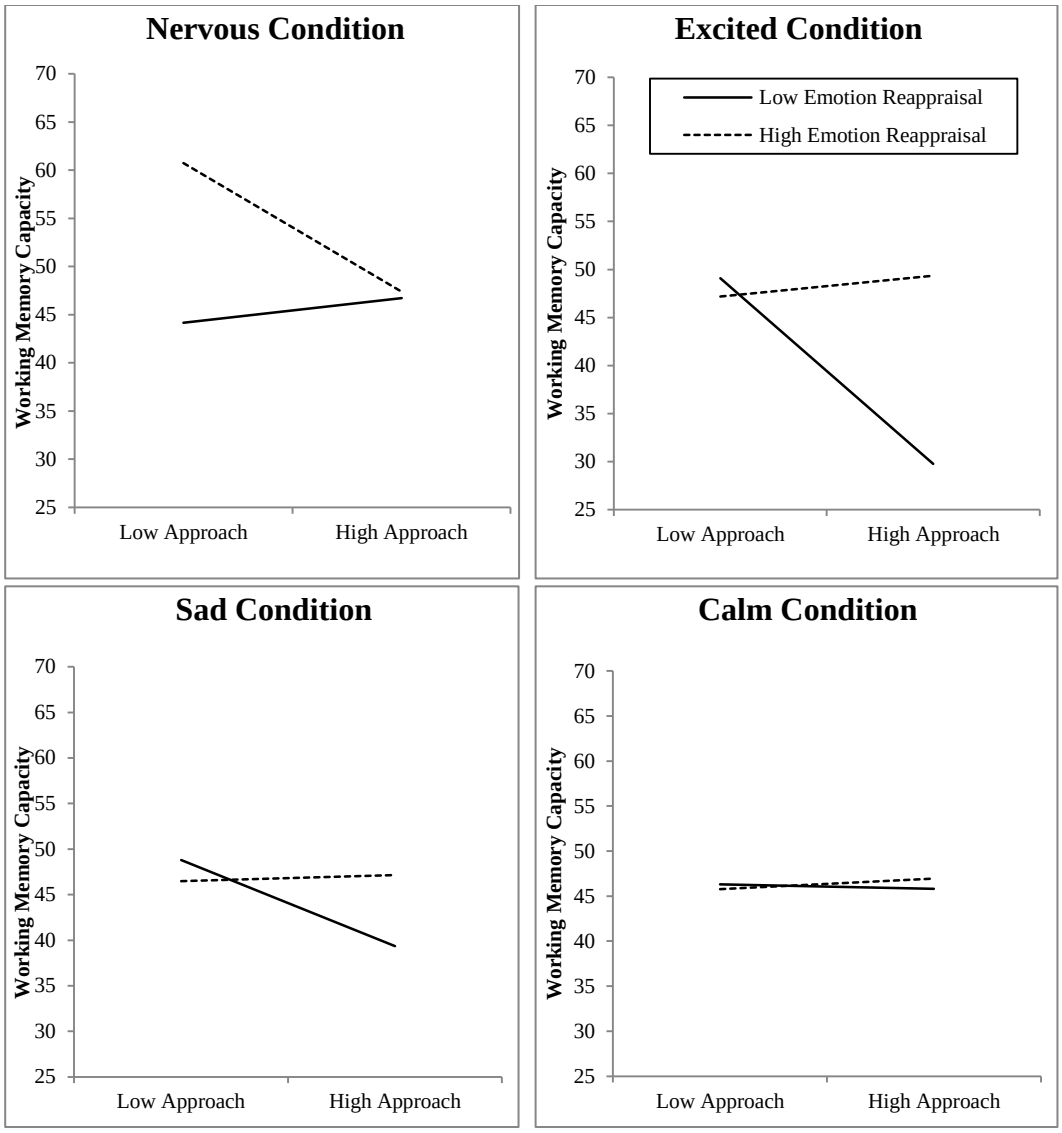

Figure 5. Predicted values displaying working memory capacity as a function of mood condition, approach orientation, and emotion-reappraisal. High and low approach orientation represent values 1 *SD* above and below the sample mean on the avoidance orientation factor variable, respectively. High and low emotional reappraisal ability represent values 1 *SD* above and below the sample mean on the reappraisal subscale of the Emotion Regulation Questionnaire, respectively.

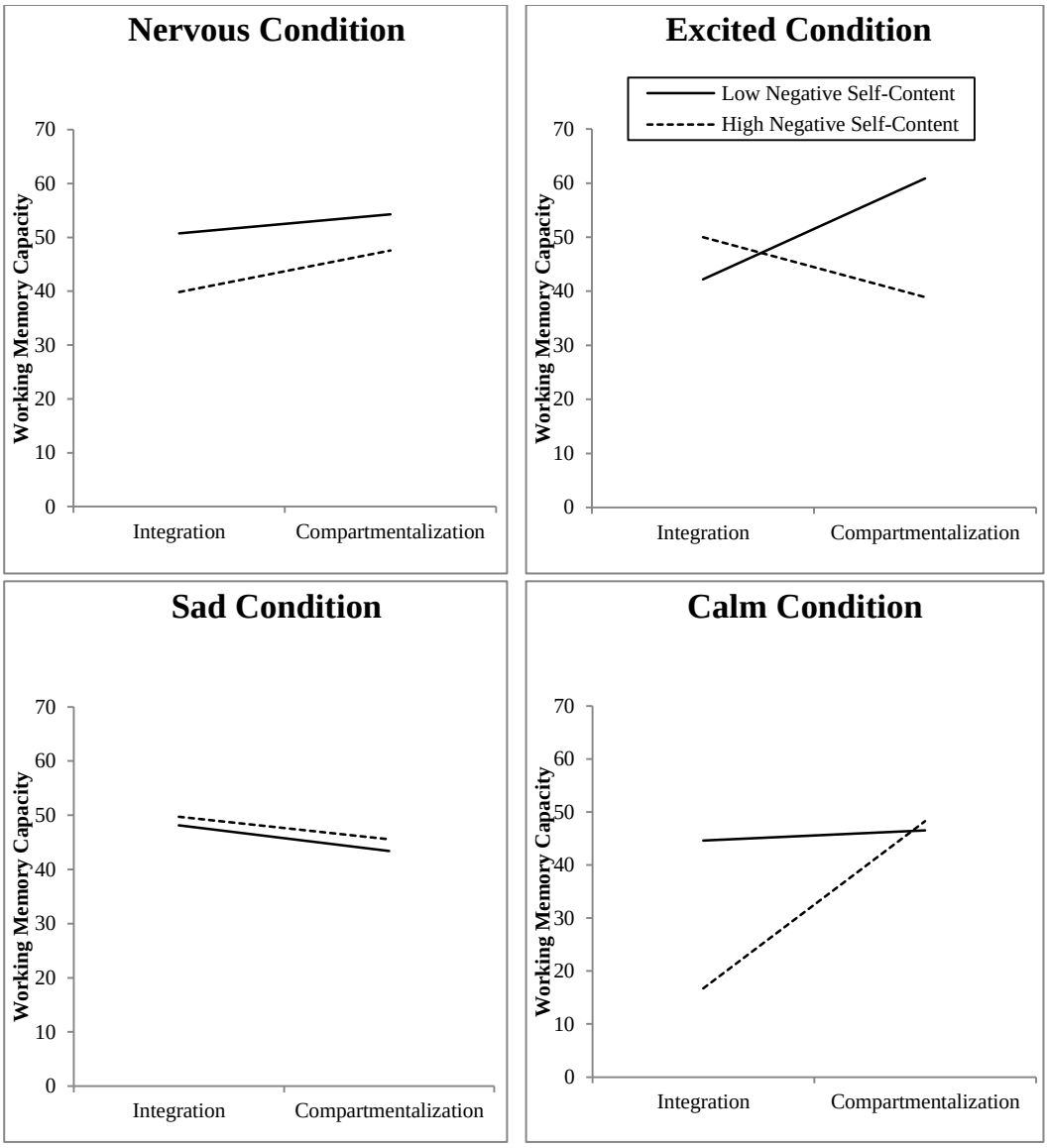

Figure 6. Predicted values displaying working memory capacity as a function of evaluative self-organization, self-concept negativity, and mood condition. Compartmentalization and integration represent values 1 *SD* above and below the sample mean on the evaluative self-structure variable (phi), respectively. High and low self-concept negativity values 1 *SD* above and below the sample mean on the proportion of negative self-content.