CHAPTER

15

Age Differences in the Connection of Mood and Cognition: Evidence from Studies of Mood Congruent Effects

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OUTLINE

Introduction 280

Definition and Theories of Mood-congruent Cognition 280

Emotion Theory and Mood Congruence in Young Adulthood: Associationist and Schema Models 280

Emotion Theory and Aging: The Positivity Effect and Its Limits: SST and SAVI 282

Conceptual and Methodological Issues in the Study of Mood-congruent Cognition 282

Effects of Personality Factors on Emotion and Cognition Interaction 284

Mood-congruent Effects on Cognition: Adulthood 285

Mood-congruence Effects in Depression: Memory and Attentional Bias 285

Mood Congruence Effects in Anxiety: Memory and Attentional Biases 287

Mood-congruent Effects on Cognition: Older Adult Populations 289

Depressed Mood and Congruent Cognition in Older Adults 289

Mood-congruent Attention in Sad and Depressed Mood 292

Anxious Mood and Congruent Cognition in Older Adults 293

Implications for Theory and Research on Age Differences in the Mood–Cognition Linkage 295

Implications for Psychological Interventions with Older Adults 296

References 298

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Handbook of the Psychology of Aging, Eighth edition.

DOI: http://dx.doi.org/10.1016/B978-0-12-411469-2.00015-7

INTRODUCTION

The mood–cognition linkage is a key element of the theories underlying cognitive behavior therapy, one of the most well-established psychological therapies with adults of all ages for depression and anxiety. In this chapter, we review current theories and research on age differences in the effects of mood on cognition, with particular attention to mood congruence effects as a way to explore age differences in the mood–cognition linkage when moods change from usual homeostasis to a more negative tone. First, we review theories of mood-congruent cognition and conceptual and methodological issues in the study of mood-congruent cognition. Next, we present evidence for the mood–congruence phenomenon, comprised of lab-based research primarily conducted with younger populations. We then review the research on age differences in the mood–cognition linkage, and discuss potential implications of this literature for adaptations of theory, assessment, and therapeutic intervention with older adult clients.

DEFINITION AND THEORIES OF MOOD-CONGRUENT COGNITION

The terms *mood*, *emotion*, and *affect* all refer to the same mental states that arise spontaneously and generally involve subjective experience, physiological reactions, and behavioral components (American Heritage Dictionary, 2004/2009). We mainly use *mood* in this chapter because of our primary focus on mood-congruent cognition, in some instances we use *emotion* as a synonym when *mood* would be linguistically awkward. Reference to *clinical disorders* refers to diagnosed mental health disorders with depressed or anxious mood as a key component. *Clinical levels of mood* refer to distinction based on duration and intensity, usually indicated by high scores on a screening test. *Mood congruence* refers to the finding that current mood state biases the processing of environmental stimuli, favoring processing efficiency for similarly toned emotional material relative to neutral or emotionally incongruent information (Blaney, 1986). As examples, individuals who experience sadness, either transiently or at clinical levels, are expected to more readily attend to, store, and retrieve depression-relevant information, happy individuals, positive information, and anxious individuals, threat-related information.

Emotion Theory and Mood Congruence in Young Adulthood: Associationist and Schema Models

Bower (1981) provided an early conceptual model of the mood-congruent effect, describing mood-congruence findings within an associative network theory of emotion and memory. Bower's perspective had its origins in the connectionist frameworks used by many cognitive psychologists during the 1970s to model memory (Bower, 1998). The central premise of Bower's associative network model of emotion is that memory is organized in a network of associative nodes. These nodes are idiographically linked by conceptual and perceptual features based on past experiences and learning (Bower, 1998). Within a network, the activation of any one node (via external stimuli or internal memory) may spread, or propagate, to other connected nodes based on the strength or intensity of the activation (Bower, 1981). Connections that are activated are easier to retrieve; in contrast, information in nodes not activated within a context will not be as readily available (Bower, 1981). Finally, connections that are repeatedly activated are thought to be strengthened, and thereby made more efficient (Bower, 1981, 1998).

Within this model, the presence of a mood state activates the corresponding emotion node (e.g., sad), spreading automatically to related thoughts, physiological responses,

and memories (Bower, 1981; Matt, Vasquez, & Campbell, 1992). Thus, mood-congruent information is expected to receive increased processing at both encoding and retrieval due to its connection to activated emotion nodes, while mood-incongruent information (of dissimilar valence or neutral) would be less accessible or potentially inhibited (Bower, 1981; Matt et al., 1992). The consequence of repeated mood exposures is also evident: those more frequently, intensely, or elaborately experiencing an association between a mood state and other internal representations will have strengthened connections between these nodes and more readily access these internal representations than those who have less experience with the mood state (Matt et al., 1992). In this way, Bower's (1981) application of network theories to emotional memory projects beyond current mood state to assert that those who frequently experience a mood (e.g., sadness in depressed individuals), might undergo even more pronounced effects of a mood-congruence due to strengthened mood-relevant associative networks (Bower, 1981).

Bower's model (1981) of mood-congruent memory and information-processing is similar in many respects to Beck's schema activation theory in clinical disorders (Beck & Clark, 1997; Clark, Beck, & Alford, 1999). Beck's cognitive models of clinical disorders like anxiety and depression also assume that the activation of internal cognitive structures (here called *schemas*) within the context of a mood state leads to biased processing via changes in the accessibility of different types of valenced information (Clark et al., 1999). Schemas may have varying complexity, depending on how detailed and interconnected concepts and experiences are within the representation structure (Clark et al., 1999). In everyday sad mood or in the context of clinical depression, mood-congruent information within the affective schema becomes activated, allowing for facilitated attentional and memory processing, particularly if the information is personally relevant to the individual (Clark et al., 1999). Whether conceptualized as nodes or schemas, the basic assumptions of Bower (1981) and Clark et al. (1999), suggest that moods are internally represented in associative networks that connect them to affectively congruent cognitions. In this way, mood state is expected to initiate the activation of mood-congruent processes and information within the cognitive structure, increasing both access and resources devoted to mood-related information and possibly diminishing the availability of incongruent information.

While network and schema activation models are the most frequently referenced theories explaining mood-congruent effects, others have suggested that emotional information-processing biases can more accurately be explained by the goal relevance of the material, than by simple matching between the stimuli and the mood state (for a discussion, see Levine & Edelstein, 2009). Goal relevance models hold that information related to goal attainment receives more cognitive resources, via increased attention and memory processing, independent of its affective valence. According to evolutionary and biological perspectives, discrete mood states are thought to inherently involve different goal tendencies (e.g., detecting and avoiding threat in fear, coping with loss in sadness; Levine & Edelstein, 2009). From this viewpoint, mood-congruent biases occur not because of a valence match between the stimuli and the mood per se, but because similarly valenced stimuli tend to relate more to the goals of a given mood than do non-valenced or opposite-valenced materials and are therefore more salient (Levine & Edelstein, 2009).

An important implication of this model, and one that follows discrete emotion theories (Levine & Pizarro, 2004), is that information-processing biases should be based on the specific mood states; for example, those in fearful moods should show biases to threat-relevant information more than generally negative stimuli, and those in sad moods would be predicted to show preferential attention to loss more than threats to

safety (Levine & Edelstein, 2009). While a comparison of the literature examining the support for associative network versus goal relevance models of mood-congruent information processing is beyond the goals of this chapter, the possibility that goal relevance may be operating to produce mood-congruent effects is important to consider, particularly as we move into our discussion of research comparing mood-congruent biases across the adult lifespan.

Emotion Theory and Aging: The Positivity Effect and Its Limits: SST and SAVI

There is a theoretical foundation for a greater link between mood and cognition in older adults. While some general cognitive processes have been found to decline with age (e.g., reduced associative memory, slowed processing speed; Naveh-Benjamin, 2000; Salthouse, 1995), it has been recognized for some time that in normal aging mood-related cognition is often relatively preserved. Older adults generally show smaller losses in attention and memory for emotional material than for neutral stimuli. In addition, relative to younger individuals, older adults generally engage less with negatively valenced material and sometimes more with positive material (Mather & Carstensen, 2005).

This change in processing away from negative and towards positive information is a part of Socioemotional Selectivity Theory and constitutes the "positivity effect" in late life (Carstensen, Fung, & Charles, 2003). According to Carstensen and her colleagues, older adults perceive a more limited future due to the increasing salience of their mortality and are motivated by this shortened time perspective to prioritize meaning and well-being goals (Carstensen et al., 2003). This motivational shift acts as the mechanism for the age-related increases in the ratio of positive to negative information attended to, rehearsed, and accessed by older adults (for reviews, see Carstensen et al., 2003; Charles & Carstensen, 2009; Mather & Carstensen, 2005).

From this perspective, older adults' increased motivation for positive mood regulation propels attention and memory biases that produce the positivity effect. The positivity effect literature argues that healthy older adults' bias towards positive information may, in part, be accomplished using proactive management of stressful situations when feasible or by devoting more processing resources to mood regulation, for example, by modulating attention and encoding processes to prioritize positive stimuli (Carstensen et al., 2003).

Though a large literature demonstrates positive information-processing biases in aging individuals, not all older adults demonstrate the positivity effect. The Strength and Vulnerability Integration model (SAVI; Charles, 2010) has suggested limitations to the positivity effect, noting that older adults' positivity bias is nullified both under short-term stress and, to an even greater extent, under the pressure of chronic stressors commonly associated with later life (e.g., chronic illness, grief, caregiving). Thus, when high levels of negative mood are experienced, older adults may perform similarly, or even less successfully, in maintaining well-being than younger adults (Charles, 2010). In this chapter, we review the literature on mood congruence effects first in younger adults and then in older adults in order to explore age differences in the mood congruence effect and thus age differences in reactions to change in mood as contrasted with the positivity effect account of age differences when older adults are maintaining homeostasis via emotion regulation.

CONCEPTUAL AND METHODOLOGICAL ISSUES IN THE STUDY OF MOOD-CONGRUENT COGNITION

A number of different methodological and statistical approaches have been used to study mood-congruent cognition. Before we begin

our discussion of the relevant literature, it is worth clarifying some empirically significant distinctions within the area. Research testing the mood congruence effect can take multiple forms, depending on the mood context in which valenced material is presented and recalled. The most commonly used paradigms in the study of mood congruent effects involve presenting emotionally valenced and neutral stimuli to individuals who have either been induced to feel a mood or are expected to present with the mood due to a clinically significant mood disorder as compared to controls (Fox, Russo, Bowles, & Dutton, 2001; Rinck & Becker, 2005). To assess mood-congruent memory, participants are later asked to recall this information when in a similar mood (Russo, Fox, Bellinger, & Nguyen-Van-Tam, 2001). Based on network and schema models, information that is mood-congruent at both encoding and retrieval should show the most prominent mood-congruent biases due both to more elaborated cognitive connections and to increased activation of these connections at search (Matt et al., 1992). However, in theory, the mood at encoding need not match the mood at retrieval to demonstrate mood-congruence (Watkins, Mathews, Williamson, & Fuller, 1992).

Another important consideration in the study of mood-congruent cognitive processes is what type of evidence constitutes "mood-congruence." That is to say, a number of memory and attention patterns have been used to support the existence of mood-congruent biases across research studies. In studies looking at mood-congruent memory in depressed mood, increases in both recognition and recall for negative stimuli as well as decreased recognition and recall for positive stimuli in sad or clinically depressed participants relative to control participants has been taken to indicate mood-congruent processing (Direnfeld & Roberts, 2006).

Multiple definitions of mood-congruence have arguably been even more problematic in studies of mood-congruent attention. Here, evidence of mood-congruent attentional biases in the context of negative mood states has been defined by researchers in numerous ways, including faster reactions to negative targets (facilitated attention; Bradley, Mogg, Falla, & Hamilton, 1998; MacLeod, Mathews, & Tata, 1986; Mogg & Bradley, 2002; Mogg, Bradley, & Williams, 1995), longer engagement with negative information (impaired disengagement; Amir, Elias, Klumpp, & Przeworski, 2003; Fox, Russo, & Dutton, 2002; Yiend & Mathews, 2001), and reduced attention to positive information (Erickson et al., 2005) relative to controls.

To make matters more complex, the basis of comparison for attentional bias in studies has varied, with some studies using a within-subjects design to assess mood-congruence (in which attention to or retrieval of negative information is compared relative to the positive information responses for participants within a certain group), and others using between-subjects analysis (comparing positive and negative information processing of those in neutral or positive mood states to those in negative moods; for a discussion, see Bar-Haim, Lamy, Bakermans-Kranenburg, Pergamin, & van IJzendoorn, 2007).

Finally, while the majority of studies have compared valenced (negative and/or positive) to neutral stimuli when calculating the magnitude of positive or negative cognitive biases, some studies have compared responses to negative and positive information directly in order to calculate bias scores, obscuring directionality by potentially confounding bias towards one valence with bias away from the other (Mathews & MacLeod, 1985). An in-depth comparison and discussion examining differences in mood-congruent processing bias by operational definition is beyond the purview of this chapter. Instead, we adopt the various definitions in our discussion of the literature, indicating whenever possible the approach taken by researchers in a given protocol.

How to measure mood itself is a fundamental issue in this area. Assessment of mood is

quite challenging because it is considered as a multidimensional construct consisting of cognitive (subjective experience), neurophysiological (bodily symptoms), and behavioral expression (Scherer, 2001). Appropriate measures are needed for each dimension (Edelstein & Segal, 2011). Multifaceted aspects of mood require comprehensive assessment of mood, and the use of multiple methods has been strongly recommended in mood study (Eid & Diener, 2006; Haynes & O'Brien, 2000).

In a typical experiment to explore mood–congruent cognition, a particular mood state is induced (happy, sad, or anxious) and the induced mood state is usually confirmed by a self-report method. The subjective experience of mood is considered an important aspect of mood, and self-report is the most frequently used method of measurement. Questionnaire-based measures of mood (e.g., Beck Depression Inventory, Profile of Mood States) have been widely used as self-report measures of mood.

Mood also involves diverse physiological reactions in response to mood-eliciting stimuli. For example, systolic blood pressure changes when watching happy and sad emotion-eliciting film clips. These physiological changes are controlled by the autonomic nervous system (ANS), and a number of techniques have been developed to assess the physiological component of mood (Edelstein & Segal, 2011). Several studies have employed these methods in measuring physiological reactivity in response to emotional stimuli and emotion events (Langley et al., 2008; Tsai, Levenson, & Carstensen, 2000).

Affective neuroscience has focused on investigating how emotions are represented within the brain to explore the nature of emotion–cognition interactions. Historically, the limbic system (e.g., amygdala, prefrontal cortex, and the anterior cingulate) was known as the most important brain area associated with emotion and mood. Advances in technological developments in the functional imaging of the brain have accelerated neurological mood study, and diverse techniques (e.g., PET, fMRI, EEG, MEG) have been used to measure neural correlates of mood.

Traditionally, there are two major conceptualizations of the structure of mood (emotion). The discrete emotions approach assumed that there are some emotions that are basic or primary and that have distinctive neural structures and physiological response patterns, such as anger, fear, and happiness. The dimensional approach proposed that emotions are better described by their positions in a two-dimensional space formed by the dimensions of valence (positive–negative), and arousal (calm–excited) with others using a two-dimensional space with positive and negative valence as the axes. Edelstein and Segal (2011) found that researchers from the two approaches focus on different aspects of mood, use different methods to assess mood, and may study different species to address questions. As both perspectives have been supported by evidence, it is difficult to determine whether the discrete emotion approach or the dimensional approach provides a more accurate view on the structure of mood, and it is beyond the purpose of this chapter. We have included both perspectives on the structure of mood in our discussion of effects of mood on cognition.

EFFECTS OF PERSONALITY FACTORS ON EMOTION AND COGNITION INTERACTION

A good deal of previous research has suggested that personality traits influence mood and cognition interaction. Fox (2008) suggested three ways in which personality traits might influence cognitive bias. First, personality traits directly affect cognitive bias, second, personality traits modulate mood states that, in turn, influence cognitive processing. Lastly, the interaction between personality traits and mood states affects cognitive bias. For example,

Rusting (1999) found that persons high in extraversion and positive affectivity tended to retrieve positive memories and made positive judgments. Those high in neuroticism and negative affectivity retrieved negative memories and made negative judgments. Interaction between personality traits, mood, and cognition is an important issue in studies of mood-congruent cognition, because personality traits influence mood congruent cognition (Rusting, 2001).

Personality has long been seen as an important influence on emotional well–being, which in turn influences cognition. A classic expectation is the link proposed by Gray (1991) between moods and the behavioral activation system in the brain, typically associated with extraversion and positive emotions and the behavioral inhibition system associated with neuroticism and negative emotional states. However, in a meta-analysis, DeNeve (1999) found that while these correlations held, other personality traits were more influential, including those directly related to emotional tendencies such as stability and tension; those related to relationship enhancement, and those related to the way people explain life events such as control and repressive-defensiveness.

The age effects on the connection between personality and emotions is unclear however. Ready, Åkerstedt, and Mroczek (2012) reported stronger connections between neuroticism and negative mood among middle-aged and older compared to younger adults. Ready and Robinson (2008) found weaker connections among four of the Big 5 personality factors in older adults than in younger adults, excluding openness to experience. Javaris et al. (2012) found conscientiousness associated with recovery from negative emotional stimuli in middle-aged but not in older adults. Pearman, Andreoletti, and Isaacowitz (2010) found agreeableness but not age was related to recovery from physiological reactivity to sad pictures. Thus, while there is evidence for influence of personality on the mood–cognition linkage and certainly on mood itself, age differences with regard to this connection are unclear at present and need further systematic study.

MOOD-CONGRUENT EFFECTS ON COGNITION: ADULTHOOD

Mood-congruence Effects in Depression: Memory and Attentional Bias

The interaction between depressed mood and cognition has been studied extensively over the past 30 years (for a review, see Gotlib & Joormann, 2010). In fact, a number of widely held theories of depression posit that biases in information processing affecting memory, attention, and interpretation, not only are present in depressed mood, but play an active role in sustaining it (Bower, 1981; Barlow, 2000; Clark et al., 1999). Cognitive-behavioral therapy (CBT), is presumed to operate by changing negative biases in cognition in order to break the negative mood–cognition linkage. Weakening of the association between negative mood and negative thoughts through therapy, in turn, is thought to reduce depressive symptoms by minimizing the influence of negative mood-congruent schemas on affect (Beck, Rush, Shaw, & Emery, 1979; Gotlib & Joormann, 2010).

Research on the effects of mood state on cognition reveals two patterns of cognitive correlates with depression. Neuropsychological studies have suggested global deficits in cognitive abilities for those with major depression as compared to control samples (McClintock, Husain, Greer, & Cullum, 2010). The performance of individuals with depression is marked by difficulties with attention and memory tasks that require increased cognitive effort and have less task-inherent structure (e.g., semantically unrelated materials, free recall tasks; Gotlib & Joormann, 2010). A second line of research has looked at the relationship between depressed

mood and emotional cognition, which we focus on below. This work suggests a more variable relationship between depression and emotional attention and memory, pointing to both deficits and enhanced abilities by valence depending on whether the material is mood-congruent or mood-incongruent (Gotlib & Joormann, 2010).

To date, there is significant evidence for mood-congruent memory biases in depressed mood. While not all research has shown the effect (Banos, Medina, & Pascual, 2001), a preponderance of studies have shown that individuals with depression or sad mood exhibit preferential recall for negative relative to neutral or positive material (for reviews, see Gotlib & Joormann, 2010; Mathews & MacLeod, 2005). This is in contrast to individuals without current depressed mood, who tend to demonstrate either a general emotional salience effect in memory, in which positive and negative information is remembered about equally, both better than neutral information (Murphy & Isaacowitz, 2008), or a positivity bias in memory, in which positive information is favored relative to negative information (Matt et al., 1992). While not always the case, mood-congruent memory biases for negative information in depressed mood appear to be most consistently seen in explicit, unsupported memory, such as free recall tasks (Gotlib & Joormann, 2010).

Mood-congruent memory biases for those in depressed moods have also been demonstrated in autobiographical memory retrieval. In addition to reductions in memory specificity (Williams et al., 2007), depressive symptomatology has been linked to the increased accessibility of negative autobiographical memories and decreased retrieval of positive personal memories in dysphoric relative to nondysphoric individuals (Joormann & D'Avanzato, 2010; Lyubomirsky, Caldwell, & Nolen-Hokesema, 1998).

The evidence for mood-congruent biases in implicit (e.g., lexical decision and word fragment completion tasks) and less difficult memory tasks, such as recognition, appears to be more mixed. Some have suggested that mood-congruent memory biases in depression may be conditional upon elaborative processes, which could occur through rumination, a common cognitive component of depression (Watkins, 2002). However, a large-scale meta-analysis of implicit cognitive biases suggests an effect size for memory favoring negative information in depressive mood somewhat larger than that seen in explicit memory tasks with clinical and induced depressed persons in the Matt et al. (1992) study ($r = 0.13$, $P < 0.0001$, approximately equivalent to $d = 0.26$; Phillips, Hines, & Thorsteinsson, 2010).

It is worth noting that negative mood is not only associated with increases in hits for negative information, but also in higher false memory rates for intrusions that match the mood condition. Individuals who have undergone a negative mood induction have been shown to demonstrate false recognition of negative lures more than those in a neutral or positive condition (Ruci, Tomes, & Zelinski, 2009). The same pattern of findings has also been seen in those with major depressive disorder (MDD) relative to controls (Howe & Malone, 2011). Relating these findings back to associative theories on mood-congruent cognition, it appears that the activation of sad mood-congruent information in cognitive networks may lead to an increased readiness to falsely identify negatively valenced non-target stimuli, at the same time as it benefits accurate retrieval of previously encountered mood-congruent negative information.

In addition to effects on memory, there is growing evidence for attentional biases to negative material in depressed mood. Based on initial findings in the field (MacLeod et al., 1986), it had been presumed that depressed mood did not significantly affect attention allocation, as anxiety had been shown to do (Mathews & MacLeod, 1994). However, more recent evidence using measures of divided attention, such as the dot-probe task, suggests that mood-congruent biases in attention may be evident in depressed

mood. It seems that mood-congruent attentional biases towards negative stimuli (vigilance) in depressed mood may be discernible with longer, supraliminal stimulus duration exposures of valenced stimuli (i.e., when individuals are allowed greater time to engage in elaborative processes; Eizenman et al., 2003; Koster, De Raedt, Leyman, & De Lissnyder, 2010).

Eye-tracking studies also point to attentional biases in depression. It seems that dysphoric individuals do not orient to visual stimuli any differently than nondysphoric subjects: when presented with simultaneous images (one valenced and one neutral), both groups have been shown to shift attention toward positive and away from negative information relative to neutral images (Caseras, Garner, Bradley, & Mogg, 2007). However, dysphoric and depressed individuals spend a greater proportion of time maintaining attention to negative visual stimuli than healthy controls (Caseras et al., 2007; Eizenman et al., 2003; Kellough, Beevers, Ellis, & Wells, 2008), and may be slower to disengage attention from depression-related images (Sears, Thomas, LeHuquet, & Johnson, 2010).

Taken together, the majority of research on mood-congruent information-processing biases in clinical depression and sad mood indicates the presence of explicit and implicit retrieval biases favoring negatively valenced target stimuli and autobiographical recall. Though evidence is less extensive for attention, literature supporting the existence of increased processing of negative information in depression has emerged, suggesting that the magnitude of mood-congruent attentional biases may be similar to that of mood-congruent memory effects observed in depressed mood.

Mood Congruence Effects in Anxiety: Memory and Attentional Biases

As in depression, cognitive theories of anxiety disorders link biased attentional, and to a lesser extent memory, processes in the development and perpetuation of anxious mood state (Beck & Clark, 1997; Eysenck, 1992; Mathews & Macleod, 1994). Anxious mood state has been hypothesized to be associated with hypervigilance, in which individuals more readily detect and engage with threat-related information in their environment (Barlow, 2000; Beck & Clark, 1997). Anxious cognitive biases are also thought to involve delayed disengagement from cues and stimuli associated with threat, resulting in a net increase in stimulus-driven attention towards threat (Eysenck, Derakshan, Santos & Calvo 2007; Fox et al., 2002). Moreover, the increased attention allocation to threat-related stimuli in anxiety is thought to come at the expense of goal-directed task completion, particularly when the information to be processed is neutral (Eysenck et al., 2007). It has been suggested that when this threat-focused processing style becomes chronic, it, in part, promotes the development of a feedback loop in which the world is perceived as dangerous, and pathological coping strategies are more likely to be enacted, including avoidance and worry (Barlow, 2000). Mirroring depression, the cognitive biases accompanying clinical anxiety are postulated to drive and perpetuate the disorder.

Of note, studies examining mood congruence in anxiety most commonly have compared those who score high on trait anxiety measures to those who score lower on these assessments. Relative to work done on depressed mood, there appears to be somewhat less research examining the effects of clinical anxiety (e.g., generalized anxiety disorder, GAD) or induced anxiety on memory and attention. The heterogeneity of clinical diagnoses within the anxiety disorders category may also complicate the study of mood-congruent processing. Unlike the spectrum of unipolar depressive disorders, which involve varying levels of sad mood, anxiety disorders vary rather broadly in the content and specificity of perceived threats. In the revision of psychiatric disorders reflected in

the DSM 5, trauma and stress-related disorders have become a separate category as have obsessive compulsive disorders (OCDs; American Psychiatric Association, 2013).

For example, while GAD is characterized by diffuse worry in a variety of contexts, OCD and specific phobias, by definition, are related to fear of clearly defined, specific entities (e.g., fear of contamination or spiders; American Psychiatric Association, 2000). From the standpoint of the schema and network theories of mood-congruent processing presented earlier, what is truly "mood-congruent" stimuli should differ quite markedly from one type of anxiety disorder to another depending on the type of information most strongly linked to the anxious mood state in the network (Radomsky & Rachman, 1999). In our review of the literature, it appears that some anxiety researchers are more attentive to the possible effects of stimuli relevance on mood-congruence than others. Therefore, while we believe examining differences in the type of threat stimuli most salient to individuals should be given more detailed consideration in future research, in the discussion that follows, we focus largely on mood-congruence findings in the context of nonspecific trait and state anxiety and do not distinguish between the specific types of threat-related stimuli used.

Despite the fact that many of the diagnoses subsumed under the category of anxiety disorders present and are classified by heightened memory for threatening events (e.g., flashback memories of trauma events in posttraumatic stress disorder (PTSD), panic attacks in panic disorder (PD); American Psychiatric Association, 2000), the evidence for mood-congruent memory in anxious mood is not as consistent as that demonstrated for memory biases in depression (Coles & Heimberg, 2002). In fact, it had previously been posited that anxiety promotes attentional, but not memory biases (Mathews & MacLeod, 1994; Williams, Watts, MacLeod, & Mathews, 1997).

Findings on whether anxiety leads to mood-congruent memory have been mixed. Some studies find no threat-related or negative explicit memory biases in generalized anxiety (Bradley, Mogg, & Williams, 1995), social phobia (Rinck & Becker, 2005), or induced anxiety (Foa, McNally, & Murdock, 1989). A descriptive review of the literature on mood-congruent memory in anxiety disorders found varying support for explicit memory biases by type of diagnosis, with compelling evidence for explicit biases only in PD, and to a lesser extent PTSD and OCD, but not in GAD or specific phobia (Coles & Heimberg, 2002). Implicit memory biases, however, were more consistent across these anxiety disorders (Coles & Heimberg, 2002). As acknowledged by the authors, the relatively limited number of studies in each diagnostic category, as well as the wide variation in the nature of stimuli used, limits the conclusiveness of these findings (Coles & Heimberg, 2002).

Attentional biases in anxiety have been extensively explored. In 2007, Bar-Haim, Lamy, Bakermans-Kranenburg, Pergamin, and van IJzendoorn (2007) completed a meta-analysis of 172 studies examining threat-related attentional bias in over 2000 anxious individuals as compared to over 1500 nonanxious control participants. Results of this study showed that across a number of experimental paradigms, including emotional Stroop, dot-probe, and spatial cuing tasks using both subliminal and supraliminal stimulus presentations, attentional biases favoring threat-related stimuli were present in anxious individuals with a moderate effect size ($d = 0.45$, $P < 0.01$; Bar-Haim et al., 2007). Despite adequate power, the attentional bias to threat stimuli in nonanxious controls was near zero and non-significant ($d = -0.007$, $P = 0.85$), suggesting similar biases favoring threat-related information do not exist in those without clinical or elevated anxiety levels (Bar-Haim et al., 2007).

In this meta-analysis, attentional threat-related biases appeared to exist for clinically,

trait, and state anxious individuals (Bar-Haim et al., 2007). Within-subject attentional biases favoring threat-relevant information were significant across studies for those experiencing clinical levels of anxiety ($d = -0.45$), high trait anxiety ($d = 0.38$), and those assigned to groups on the basis of state anxiety levels ($d = 0.65$; Bar-Haim et al., 2007).

To understand the temporal dynamics of attention in anxious individuals, the time course of attentional deployment in anxiety for facilitated engagement and impaired disengagement in attention has been studied extensively. A widely held perspective is that highly anxious individuals demonstrate sequential attentional stages, such as orienting rapidly to threat, facilitated engagement with threat once detected, impaired disengagement from threat, and lastly, attentional avoidance by focusing away from the threat (Fox et al., 2001; for a review and model, see Ouimet, Gawronski, & Dozois, 2009). This pattern is consistent with the "vigilance-avoidance" hypothesis, which suggests that anxious individuals first engage more strongly with, and then more reliably avoid, threat-relevant material as compared with nonanxious persons (Mogg, Bradley, Miles, & Dixon, 2004).

Facilitated orientation to and engagement with threat information in anxiety is generally seen at short, or subliminal, stimulus presentations and fades at longer durations, while dot probe tasks have largely found evidence for impaired disengagement at longer, supraliminal presentations (for reviews, see Cisler & Koster, 2010; Ouimet et al., 2009). However, the results of a study by Koster, Crombez, Verschuere, Van Damme, and Roelf Wiersema (2006; Experiment 1) using a modified cuing task indicated that high trait anxious individuals show attentional bias in both facilitated engagement and impaired disengagement in the early stages of image presentation (100 ms) and avoidance at later stages (200–500 ms). Others have found that those induced to feel anxious show delayed disengagement from threat stimuli even at longer durations relative to nonanxious controls (600 ms; Fox et al., 2001). Attentional avoidance of threat stimuli in anxious individuals has been shown to begin at display times of 500 ms (Onnis, Dadds, & Bryant, 2011) or longer (Mogg et al., 2004). While these results generally support the sequential attentional pattern described above, there appears to be some overlap in timeframes, particularly in delayed disengagement and avoidance.

While mood-congruent memory effects are less clear in anxiety than in depression, attentional bias to threat is well-established for anxiety. Persons with clinical anxiety disorders and those with high trait and/or state anxiety orient more readily to potential environmental threats as they first appear, take longer to disengage attention from them, but then are more likely to show avoidance at longer time intervals. While the exact time course of these bias changes is still a matter for debate among researchers, the overall order of these attentional stages in anxiety appears to be consistent across studies, involving facilitated orientation and engagement, delayed disengagement, and ultimately avoidance.

MOOD-CONGRUENT EFFECTS ON COGNITION: OLDER ADULT POPULATIONS

Depressed Mood and Congruent Cognition in Older Adults

The limited research that exists on the relationship between sad mood and emotional cognition indicates that older adults may be as vulnerable as younger individuals, if not more so, to the effects of sad mood-congruent memory and attention. This research has involved older adults selected for depressive symptoms as well as those experiencing transient

depressed mood. As with younger adults, procedures to induce specific mood states (e.g., sadness) have been shown to be effective with older populations, and may serve as a laboratory-based analogue to clinical disorders such as depression (Fox, Knight, & Zelinski, 1998; Levenson, Carstensen, Friesen, & Ekman, 1991).

Ferraro, King, Ronning, Pekarski, and Risan (2003) used mood manipulation to study the effects of age and induced mood on an implicit memory test (a lexical decision task) involving emotional stimuli. Older and younger adults were randomized to one of two mood-induction conditions: sad or happy (Ferraro et al., 2003). Following a music-based induction, participants were shown words presented on a computer screen one at a time (Ferraro et al., 2003). Words were from one of three categories: sad, happy, and pseudowords (i.e., nonwords; Ferraro et al., 2003). Subjects were asked to identify as quickly as possible whether each target was an actual word using response buttons, with both accuracy and response times tracked. While there was no effect of mood state on stimulus identification accuracy, Ferraro et al. (2003) found a mood group by stimulus valence interaction across age groups for response times. Individuals induced to feel happiness responded faster to happy as compared to sad words, while sad-induced participants responded faster to sad, relative to happy, targets. Citing Bower's (1981) network model of emotional processing, the authors interpreted the faster response times to mood-congruent targets to be indicative of mood-congruent lexical processing (Ferraro et al., 2003). The results of this study suggested that mood state influences older adults' information processing in ways comparable to younger adults; however, mood-congruent effects were limited in this experiment to a single measure (a lexical decision task).

Randomizing older and younger adults to either a sad or neutral mood manipulation, Knight, Maines, and Robinson (2002) also found that older and younger adults in the sad condition demonstrated mood-congruent memory effects, but that these effects varied by age group and task type. In this study, older and younger adults randomized to one of the two mood conditions completed a variety of cognitive tasks designed to assess mood-congruent memory and interpretative biases, including word, text, and autobiographical recall tasks with valenced material and a lexical ambiguity task involving spelling ambiguous (sad-neutral) homophones. Across the word list immediate recall and lexical ambiguity tasks, a main effect of age on identification of negatively valenced words was observed, with older adults recalling and spelling fewer negative words overall than younger adults, consistent with a positivity bias (Knight et al., 2002).

However, among those in a sad mood, older and younger individuals in this study demonstrated mood-congruent biases. As evidenced by a main effect of mood induction group, but no significant age by induction group interaction, older and younger groups induced to feel sad prior to learning a word list demonstrated subsequent mood-congruent recall at a delay, recalling a higher proportion of negatively valenced words relative to age-matched peers in the neutral induction condition (Knight et al., 2002). Older and younger adults in a sad mood were also significantly more likely to retrieve a negative autobiographical memory when prompted to recall an event from their past than controls (Knight et al., 2002). This finding suggests that longer-term memory (e.g., for material after delay) may be particularly susceptible to sad mood-congruent biases across age groups, in line with those who have suggested that elaborative processes are an important component of depressed mood-congruent cognitive biases (Watkins, 2002).

Of interest, the effects of mood-congruent memory appeared to be more pervasive in the older participant group in this study. In addition to mood-congruent word recall at a delay, older adults randomized to the sad induction

group demonstrated reduced memory for positive words at immediate recall relative to controls (31% of all words retrieved being positive targets in the sad induction group vs. 46% positive word targets in the neutral induction group), a difference not observed in younger participants (42% positive word hits in both groups; Knight et al., 2002). Older adults also evidenced mood-congruent implicit memory as seen in their performance on a lexical ambiguity task, with those in the sad group generating more negatively valenced homophones than peers in the neutral group; younger adults, however, showed an equivalent frequency of negative meanings attributed to ambiguous homophones across induction groups (Knight et al., 2002).

In a replication and extension of the Knight et al. (2002) study conducted with healthy older and younger adults, older adults in a sad mood induction group demonstrated mood-congruent recall for recent autobiographical memories, more frequently recalling negative memories when prompted to retrieve a personal event from a week ago as compared to older adults in a neutral group (Knight, Kellough, & Poon, 2011). Surprisingly, younger adults in this project demonstrated the opposite effect. Younger individuals in the sad induction group were less likely to recall a sad memory from the prior week as compared to those in the neutral condition, indicative of mood-incongruent memory, possibly to promote mood repair. Again, a main effect of age group suggestive of a positivity effect was seen for distant memories (high school events), such that older individuals recalled fewer sad high school memories than younger adults across induction groups. Taken together the work by Knight and associates suggests that older adults' may show mood-congruent memory biases, explicit and implicit, across more domains than younger adults, suggesting that the effects of mood on emotional cognition in older adults may be more extensive.

The few additional studies of depressed mood-congruent memory with older clinical populations support the results found by mood induction research. Two studies have examined the effects of depressive symptomatology on autobiographical memory in individuals over 60 years old. In the first, individuals were classified as positive for clinically significant depressive symptoms (defined as scoring at or above 16 on the Center for Epidemiologic Studies—Depression; CES-D; Radloff, 1977), or, below this threshold, as controls (non-clinically significant depressive symptoms; Serrano, Latorre, & Gatz, 2007). All participants completed the Autobiographical Memory Test (AMT; Williams & Broadbent, 1986) which prompted individuals to retrieve specific past events based on both valenced (positive, negative) and neutral cue words within a 30-s timeframe (Serrano et al., 2007). Memory responses across prompts were subsequently coded for valence (positive, negative, neutral), specificity (specific or general), and frequency of omissions by prompt type. The effects of group membership on memory valence indicated a pattern of results supporting mood congruence in autobiographical memory retrieval.

While older participants with clinically significant depressive symptoms and those without displayed a positivity preference in memory retrieval, providing more positive memories than negative memories across cue types, the magnitude of this positivity effect was moderated by group membership such that depressed individuals displayed a less pronounced bias for positive information than nondepressed individuals (Serrano et al., 2007). The relationship between depressive symptomatology (CES-D score) and the magnitude of positive bias was linearly related, with increasing depressed mood related to decreasing retrieval of positive relative to negative memories ($r = -0.27$), driven by an increased negative memory retrieval in depressed participants as compared to controls (Serrano et al., 2007). In

addition, depressed individuals recalled significantly more negative memories than those who were not depressed (Serrano et al., 2007). Omissions by cue valence also suggested a memory bias. Non-depressed older participants were more likely to fail to provide a memory for a negative cue word in the allotted timeframe than they were to supply a positive cue, whereas depressed older adults were more likely to demonstrate omissions to positive cues and less likely to have omissions to negative prompts than controls (Serrano et al., 2007).

In a similar study, Ricarte et al. (2011) selected older adults from a primary care outpatient clinic, comparing those meeting diagnostic criteria for MDD to age-matched peers in their performance of valenced cues from the AMT. In contrast to Serrano et al. (2007), this study did not find evidence of an overall positivity effect in either the MDD or control groups (Ricarte et al., 2011). Instead, older MDD participants retrieved more memories for negative than positive cue words, whereas older nondepressed individuals exhibited no bias to either valence, retrieving a statistically equivalent number of memories for both positive and negative cues (Ricarte et al., 2011). The results of this later study supplement those found by Serrano et al. (2007), suggesting that a depressive memory bias favoring negative autobiographical memories may be even more prominent in older individuals meeting clinical criteria for mood disorder than those with elevated symptoms alone.

Mood-congruent Attention in Sad and Depressed Mood

Additional laboratory research has suggested that sad mood also influences emotional attention in normal older adults. Poon and Knight (2009) conducted a 2 × 2 design, experimentally inducing both mood (sad vs. neutral) and old-age schema (activated vs. non-activated) among a sample of community-dwelling older adults. The authors examined the effects of condition assignment (mood and old-age schema) on response times to a computerized Stroop task involving physical-symptom, aging-related, and neutral words. Mood was manipulated using an autobiographical writing exercise with a sad or neutral prompt and maintained with music, while old-age schemas were activated using aging-related questions versus non-aging-related general questions (Poon & Knight, 2009). Results indicated that older adults in the control condition (neutral mood, non-activated old-age schema) displayed an attentional bias away from symptom-related (e.g., pain, fatigue) words compared to those in a sad mood or those whose old-age schema was activated (Poon & Knight, 2009), indicating older adults' avoidance of such negative words under normal (i.e., non-emotional) conditions consistent with the positivity effect (Mather & Carstensen, 2005).

Of interest to our discussion, mood exerted a large effect on attention, such that those randomized to a sad induction group focused more on symptom-related words than those in the neutral mood condition ($\eta^2 = 0.47$; Poon & Knight, 2009). In addition, mood interacted with old–age schema activation to exert a net attentional bias toward symptom-related words, with longer within-subject reaction times to symptom than neutral words. The main effects of mood, as well as the interaction of sad mood state with old-age schema, on increased attention to negatively charged symptom words supports the theoretical assumptions of mood-congruent attention. These findings suggest that the activation of an emotional cognitive network or schema via a given mood state may facilitate attentional processes with similarly valenced targets in older adults (Beck & Clark, 1997).

To our knowledge, only one other study has examined attention to emotional information in younger and older adults after negative mood induction. Isaacowitz Toner, Goren, and

Wilson (2008) randomly assigned healthy older and younger participants to positive, negative, and neutral mood inductions and then monitored participants' visual attention for valence (happy, angry, afraid, sad) with neutral face pairs using eye-tracking. The results of this study indicated that older and younger adults induced to feel positive, negative, and neutral mood states showed divergent attentional patterns by age group (Isaacowitz et al., 2008). While younger adults who were induced to feel positive or neutral mood showed increased fixations towards happy as opposed to neutral faces, older adults who were in the positive or neutral condition did not show evidence of such a preference (Isaacowitz et al., 2008). Older adults induced into a negative mood, however, showed a mood-incongruent attentional bias, with an attentional preference away from sad and angry and towards happy faces, while younger adults in the negative mood group showed mood-congruent biases towards angry and afraid faces (Isaacowitz et al., 2008). The authors interpreted this finding as consistent with a motivational account as in socioemotional selectivity theory, which posits that the positivity effect in older adults represents efforts at emotion regulation. In contrast, younger adults are predicted to be motivated to gain information, particularly as such data might provide information on the antecedents and consequences of their emotions. The results of Isaacowitz et al. (2008) suggest that younger adults show mood congruence in early phases of attention whereas older adults in a sad mood show mood incongruence (possibly due to efforts at mood repair).

Findings regarding the effects of sad mood induction on emotional attention are mixed, with some finding mood-congruent attentional biases in older adults experiencing transient sad mood (Poon & Knight, 2009), and others showing that the effects of sad mood may drive older adults to mood-incongruent biases differing from the mood-congruent effects seen in younger adults (Isaacowitz et al., 2008). The methodological differences in the studies may account for these differences. The Stroop task in the Poon and Knight study measures the mood effects by the slowing of response to the intended task resulting from the implicit attention to the meaning of the words, presumed to be an automatic process. Isaacowitz et al. used ratio of eye fixations over 4-s stimulus exposures as the method. As will be seen in the next section on anxiety, that timeframe would be ample for initial attention to face stimuli to shift from vigilance to avoidance using a dot probe task with facial stimuli (Lee & Knight, 2009). There also were differences in responses to verbal versus facial stimuli in the Lee and Knight study.

Taken together, results of these studies generally confirm positivity effects for older adults not experiencing sad mood, but show that when older adults become sad or depressed, they are frequently susceptible to mood-congruent effects, particularly for memory. In our own laboratory studies, we have repeatedly seen mood-congruent effects in older adults at lower mean levels of depressive symptoms (as measured by the CES-D), as well as evidence suggesting that older adults experience these effects on a wider variety of tasks than younger adults (Knight et al., 2002, 2011). While more research on the topic is needed, the data that exist suggest that older adults experiencing sad mood may be as vulnerable, if not more so, to mood-congruent memory and interpretative processes across contexts, but potentially less susceptible to depressed mood-congruent attention.

Anxious Mood and Congruent Cognition in Older Adults

The effects of anxiety on emotional processing in older adults may be more complex and distinct from younger adults than those of depressed mood for several reasons. For one, when anxious, older adults appear to focus on different types of threat than younger adults.

In terms of the content of worry, older adults tend to focus less on social threats and more on health threats, while younger adults display the opposite pattern (Ladouceur, Freeston, Fournier, Dugas, & Doucet, 2002; Lindesay et al., 2006). Secondly, the prevalence of specific types of anxiety disorder may change with age, with older adults less likely to experience panic disorder and PTSD and relatively more likely to experience GAD (Wolitzky-Taylor, Castriotta, Lenze, Stanley, & Craske, 2010). Finally, while attentional processing for neutral information has generally been found to be reduced in older relative to younger adults, especially with regard to selective attention and inhibition of task-irrelevant stimuli (Gazzaley, Cooney, Rissman, & D'Esposito, 2005; Rogers & Fisk, 2001), selective attention to threat stimuli in anxious older populations has only been studied recently. As in younger adults, the limited research on mood-congruent cognition in anxious older adults has focused largely on the impact of anxiety on attention, and not memory, for emotional material.

Fox and Knight (2005) examined the effects of both state anxious mood (assessed after a neutral or anxious mood induction) and trait anxiety (low or high relative to the median split), each measured using the Spielberger State Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), on selective attention to threat in healthy older adults. Attentional biases to threat were determined by response latencies to neutral versus physical- or social-threat words in computerized versions of an emotional dot-probe and emotional Stroop task (Fox & Knight, 2005). The results of this study suggested that anxious mood state contributed to threat-relevant attentional biases in older adults: a main effect of mood induction group was observed such that older individuals experiencing induced anxiety had an attentional bias toward threat information in the dot probe task, while older adults in the neutral group exhibited a tendency to avoid threat.

Surprisingly, on the emotional Stroop, the anxiety induction only contributed to slowed response latencies for threat-relevant words in older adults with low, but not high, trait anxiety levels (Fox & Knight, 2005). These findings run counter to the increased vulnerability to attentional biases for threat thought to occur in those with high trait anxiety induced to feel anxious (Eysenck, 1992). A speculative explanation offered was the possible effect of experience in high trait anxious older adults: older individuals who are highly reactive to anxiety have had many opportunities to practice functioning while anxious, and, as a result, may more effectively use mood regulation strategies in completing the more complex Stroop task. This would also agree with the time course of attentional biases in anxiety, in which, at longer stimulus durations, highly anxious individuals display a pattern of attentional disengagement (i.e., avoidance) with threat stimuli not seen in those low in anxiety (Derryberry & Reed, 2002).

Lee and Knight (2009) recruited nonclinical samples of younger and older adults who were then stratified as low, moderate, or high in self-reported trait anxiety by scores on the STAI. Attentional bias was measured using a dot probe task with negative-neutral stimulus pairings of faces (sad–neutral, angry–neutral), pictures (high threat–non threat), and words (negative–neutral), all presented either subliminally (20 ms exposure for younger adults; 50 ms for older adults) or supraliminally (1500 ms exposure). The use of both subliminal and supraliminal stimuli presentations in this protocol allowed for an analysis of the time course patterns of attentional bias. Lower attentional bias scores for negative- or threat-related material in a subliminal relative to a supraliminal presentation would be indicative of an avoidant-vigilant response, whereas the

reverse pattern (lower attentional bias scores for supraliminal relative to subliminal) would suggest a vigilant-avoidant attentional pattern.

Results indicated that high-anxiety older adults attended less to subliminally presented negative words and gave more attention to supraliminal negative words (avoidant-vigilant pattern; Lee & Knight, 2009). For faces, a main effect of age was found such that older adults across anxiety levels showed a vigilant-avoidant response to angry faces. Only older adults with moderate anxiety, however, showed the same pattern with sad faces. Surprisingly, younger adults did not display attentional biases for threat across any of the three stimuli types. The broad effects of anxiety on attention in older, but not younger, adults observed in this study again suggest that older adults may be more susceptible to mood-congruent cognitive processes and at lower trait anxiety scores than found in the younger adults.

Taken together, it seems that older participants may be susceptible to anxiety-related attentional biases at both the early and late stages of stimulus engagement, depending on the type of stimuli. The rapid detection of anger in faces has been shown to be preserved with age (Mather & Knight, 2006), and may explain older adults' vigilant-avoidant pattern for this type of stimuli: we speculate that older adults' attention is captured by angry faces, shown by early attentional bias to stimuli, but avoidance at longer presentations may represent a coping strategy to down-regulate negative emotions.

In summary, the laboratory work done so far implies that older adults display attentional bias to threat at least as readily as younger adults. As with the work on depressed mood, there are indications that older adults show mood-congruent attentional bias effects at lower levels of self-reported anxiety than younger adults (Lee & Knight, 2009), though the reasons for these differences are unknown. Research disentangling the time course of attentional bias in older individuals remains scarce.

IMPLICATIONS FOR THEORY AND RESEARCH ON AGE DIFFERENCES IN THE MOOD–COGNITION LINKAGE

On the whole, the mood-congruence literature to date points to the mood–cognition linkage being maintained into later life with mood-congruent memory and attentional bias to threat being present in older adults whose moods have changed in a negative valence direction either in lab manipulation or due to influences in their own lives (e.g., those with clinical disorders or with high trait negative mood). Taken with the positivity effects noted in the control conditions, these findings support the SAVI model's account of positivity effects in older adults, but with those effects disappearing or reversing under stress conditions. There is some indication in the small literature on the mood–cognition linkage in older adults that the effects may be more pervasive in older adults (affecting more cognitive processes and operating when young adults do not experience the effects) and may operate at lower levels of self-reported state distress. These findings need further exploration in research.

The persistence of the mood–cognition linkages themselves into later life suggests the importance of theoretical developments that can integrate the associationist and schema accounts of that linkage with the SAVI model's account of positivity effects and their limits. That integration would be useful for understanding age differences in emotion regulation and also in understanding the psychopathology of late life. While developing such a theoretical integration is beyond the scope of this chapter, there are a number of questions suggested by this line of research that can be addressed in future research and that would help guide theory development. What are the circumstances that break through the positivity effect and the generally better emotion regulation shown by older adults? Why do effects of mood on

cognition appear at lower measured levels of negative mood in older adults? While laboratory research participants and most people in natural settings recover from negative mood states and the associated cognitive effects, why do some people get stuck in the mood–cognition linkage and develop clinical depression or anxiety?

We also note that there are methodological differences among studies that yield important differences in the mood–cognition linkage for both young and old adults. The choice of materials matters with faces and verbal material often leading to different results, for example. Future research should explore these differences more systematically and help develop an understanding of the underlying mechanisms for emotional responding to visual stimuli, especially faces, and to verbal material. There are intriguing hypotheses advanced about the evolutionary priority of recognizing emotion in faces, for example, and for the development of changes in the semantic network of words, as words and moods are repeatedly associated over time. These hypotheses are more often advanced in "Discussion" sections rather than being the focus of theory and systematically tested hypotheses.

The timing of the measurement of the linkage is important. Well established in anxiety, and possibly in depressed mood as well, there are shifts from vigilance to avoidance and vice versa that occur on a timescale of tens of milliseconds to seconds. Systematic investigation of the time course of these shifts and understanding their meaning for emotion regulation may well be key to advancing understanding in this area.

IMPLICATIONS FOR PSYCHOLOGICAL INTERVENTIONS WITH OLDER ADULTS

Older adults appear to show the effects of depressed mood and of anxiety at lower measured levels of these moods than younger adults (Knight et al., 2002; Lee & Knight, 2009). Experts in mental health and aging have argued for years that different criteria may be needed for the assessment of depression in older adults, with lower cut-off scores on screening measures developed with younger populations. For example, Allen-Burge, Storandt, Kinscherf, and Rubin (1994) using more inclusive criteria for commonly used depression scales, reported that 15% of older women and 28% of older men diagnosed with unipolar depression on an inpatient geropsychiatry unit would be miscategorized as non-depressed if they had applied traditional thresholds developed for younger groups. There have also been calls for more attention to the importance and greater prevalence of minor as compared to MDD in older adults (Meeks, Vahia, Lavretsky, Kulkarni, & Jeste, 2011). While certainly not conclusive, we would argue that the finding of similar negative cognitive biases at lower measured levels of depressed mood and anxiety support the assertion that older adults may be experiencing similar degrees of symptomatology at lower self-reported scores on mood measures.

The existence of mood-congruent biases in older adults has both theoretical and practical implications for psychological intervention with older individuals. One of the most effective psychosocial treatment approaches for late-life depression and anxiety is CBT (Ayers, Sorrell, Thorp, & Wetherell, 2007; Scogin, Welsh, Hanson, Stump, & Coates, 2005; Wolitzky-Taylor et al., 2010). As described before, CBT, and other cognitively based therapies, are based on the premise that mood and cognitive patterns are inherently linked, such that negative mood precipitates negative information-processing biases and vice versa. Cognitive therapies are thought to work by "undoing" these links, teaching individuals to attend to and interpret information in a less negatively biased and more emotionally neutral, or realistic, manner (Beck et al., 1979).

Based on the proposed mechanism, cognitive therapies should only be effective in those who demonstrate negative mood-cognition coupling. Given the positive results of outcome studies for CBT with older adults, it is not surprising that research on mood-congruence effects confirms that older adults with depressed mood and those experiencing high levels of anxiety show similar cognitive-emotional patterns to those observed in younger adults. There are, however, potential age differences in mood-congruence effects that could be informative for thinking about psychological assessment and intervention with older adults.

While cognitive-behavioral interventions have long been shown to improve mood in older adults with mood disorders (for a review, see Scogin et al., 2005), recent research suggests that general information-processing training may also be a promising therapeutic intervention for older adults. For example, Mohlman (Mohlman, 2005; Mohlman & Gorman, 2005) has reported that adding cognitive training aimed at improving executive functioning improves response to CBT in older adults. Mohlman has mainly conceptualized this approach as enhancing the ability to perform the cognitive work (e.g., complex reasoning) involved in CBT. We would suggest that the executive functioning training itself may improve depression and anxiety symptoms by enhancing older adults' control over memory retrieval and attentional search processes so that the positivity effect can reassert itself. Mather and colleagues (Kryla-Lighthall & Mather, 2009; Mather & Knight, 2005) have demonstrated that the positivity effect only emerges in those with a certain level of executive functioning and attentional capacity, even in normal (i.e., not depressed or anxious) older adults. Thus, improving the overall cognitive functioning of older individuals may have downstream effects on mood regulation and well-being. Future research should specifically test the effects of general cognitive training on subsequent emotional biases in older populations experiencing depression or anxiety.

In addition, therapeutic interventions directly targeting mood-congruence cognitive biases have been developed. In the last decade, researchers have begun to harness the same tasks used to assess mood-congruent cognitive biases (e.g., visual dot probe tasks) in order to attempt to alter these biases (for a review, see MacLeod & Mathews, 2012). This type of intervention is often referred to as attention training, or more broadly, cognitive bias modification (Hallion & Ruscio, 2011). A number of studies have found that by having participants engage in a modified dot-probe task in which the target always replaces positive stimuli, individuals experiencing high levels of stress and anxiety can develop a positive attentional bias on this task, a change that is associated with symptom improvement (Amir, Beard, Burns, & Bomyea, 2009; Dandeneau, Baldwin, Baccus, Sakellaropoulo, & Pruessner, 2007; Hazen, Vasey, & Schmidt, 2009) which may last months (Schmidt, Richey, Buckner, & Timpano, 2009). Not surprisingly from research reviewed above, cognitive bias modification has to date had more support in modifying anxiety than depression (for a recent meta-analysis, see Hallion & Ruscio, 2011).

There is preliminary evidence to suggest that attention modification training is as effective in changing healthy older adults' visual attention to emotional information as in younger adults, and that such training may have associated effects on older individuals' mood. Training older and younger participants to attend to either positive or negative information via a modified dot-probe task, Isaacowitz and Choi (2011) found that older adults' trained to attend to positive information tended to show reduced visual attention to negative images post-training, as well as stable mood, while older adults' trained to attend to negative images experienced more negative mood over time. Surprisingly, younger adults' later

visual attention for negative information was reduced with negative, and not positive, training, and attentional training of either type did not appear to have an effect on younger adults' moods (Isaacowitz & Choi, 2011). These results suggest not only that older adults' mood-congruent attention may be as malleable as younger adults, but also that altering older adults' attentional processing for emotional information may have even more pronounced effects on mood than in younger individuals. While further research is needed, particularly in clinical populations, preliminary results point to the possibility that direct attentional training of the positivity effect may benefit older adults experiencing negative mood.

An explicit focus in therapy on guiding older adults to recall positive autobiographical memories would also be predicted to be effective by the literature on mood congruence and depression. In support of this, older adults with high levels of depressive symptoms who received life review therapy involving 4 weeks of prompted retrieval of specific positive autobiographical memories, reported reduced depressive symptoms, including hopelessness, as well as improved life satisfaction following intervention as compared to a control group (Serrano, Latorre, Gatz, & Montanes, 2004). This study, and the findings described previously on mood–emotion linkages in older and younger adults, would suggest that "training" emotional memory with older clients may require more effort but also have better and more lasting results once the effects of mood-congruent processing are reversed and the positivity effect is reasserted.

In conclusion, while there has been considerable research on the prevalence, nature, and treatment outcomes of mental disorders in later life, there has been relatively little work applying lifespan developmental psychology or mood–cognition linkage theory and research to understanding the processes underlying these disorders or to guiding adaptations of psychological interventions for older adults. The research summarized here on the mood-congruence phenomena in younger and older adults can be taken as a start, providing insight into when older adults normally better emotional regulation strategies are overwhelmed by negative mood, what cognitive mechanisms might operate to sustain this negative mood, and, finally, what empirically based adaptations in psychological assessment and therapy might benefit depressed and anxious older adults.

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