29 Emotional Intelligence

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The term "emotional intelligence" first appeared in the psychological literature in 1990 and was defined as "the ability to monitor one's own and others' feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions" (Salovey & Mayer, 1990, p. 189). However, it was a trade book published in 1995 called *Emotional Intelligence* that introduced the concept of an emotional intelligence to the general public as well as to researchers more broadly (Goleman, 1995). Subsequent headlines reflected bold claims about emotional intelligence (often referred to as "EQ" for emotional quotient) being more important than analytical intelligence (IQ) (e.g., Gibbs, 1995). The notion of "EQ" became a catchall for a number of interpersonal skills, abilities, and personality traits (Mayer, Salovey, & Caruso, 2008). The influence of the concept is now widespread. Harvard Business School published a bestselling compilation of articles on emotional intelligence (Goleman, Boyatzis, & McKee, 2015), corporate trainings on emotional intelligence abound, and hundreds of trade books have been published on the topic. Universities offer emotional intelligence training for staff and several even mandate it for first-year students – although programs vary from the catchall approach to a narrower view based on the version proposed in 1990.

Since its introduction, the study and practice of emotional intelligence has expanded and, given the range of constructs under what became a very broad umbrella term, some have attempted to categorize the various approaches into "ability" models and "mixed" models (Mayer, Salovey, & Caruso, 2000). Ability models view emotional intelligence as a construct related to other intelligences and consisting of a set of mental abilities. Mixed models view emotional intelligence as a blend of standard personality traits and various abilities. We explore these in depth in the "What Is Emotional Intelligence?" section of this chapter.

The two strains have generated a great deal of research. Some studies demonstrate discrete validity between emotional intelligence and neighboring concepts such as general intelligence and the Big Five personality traits, while other studies suggest that emotional intelligence, or more specifically EQ, is nothing more than a repackaging of the Big Five or other characteristics (Brackett & Mayer, 2003; Tett, Fox, & Wang, 2005). Although some of the initial claims made by the media – such as emotional intelligence being a far better predictor of success than IQ – have since been tempered (in Goleman's introduction to the tenth anniversary edition of

Emotional Intelligence, for example; Goleman, 2005), empirical evidence continues to point to the importance of some conceptions of emotional intelligence for school, work, social, and health outcomes (Brackett, Rivers, & Salovey, 2011).

Humans are spending an increasing amount of time in digital and virtual environments and a large sector of the US and global economy is devoted to designing machine learning and artificial intelligence systems to further revolutionize daily life (Bughin et al., 2017). As virtual worlds increasingly intersect and meld with physical ones, sometimes becoming indistinguishable for working, learning, and social interaction, how will our understanding of emotional intelligence be transformed? Is it an intelligence that will help us design environments that improve the human condition, relieve suffering, and promote equity? Or is emotional intelligence value-neutral – that is, can it be applied to achieve any outcome, whether deemed a social good or not? Examining the extant research on the skills that comprise emotional intelligence, the correlates of those skills, and how the skills develop has the potential to inform the design of emotionally intelligent systems to improve health and well-being, productivity, relationships, and quality of life in profound ways.

In this chapter, we review some of the most popular models of emotional intelligence and the measures associated with each. We then offer an overview of the behavioral and neural correlates of the ability conception of emotional intelligence before discussing how emotional intelligence develops, the degree to which it is malleable in adults, and an existing school-based program designed to promote emotional intelligence skills. We conclude with an exploration of possibilities for the research landscape in the next thirty years.

What Is Emotional Intelligence?

The Ability Model

The seminal model of emotional intelligence, proposed by Salovey and Mayer (1990), represented emotional intelligence as the ability to effectively process and act on affective information gathered about both the self and others. Perceiving and expressing emotions, regulating emotions, and utilizing emotional states to enhance thinking and motivation were posited as the specific mental processes that comprise one's emotional intelligence. The most widespread ability model of emotional intelligence today is based on an update to the original model and specifies four categories of related abilities: (1) perceiving emotions, (2) using emotions to facilitate thought, (3) understanding emotions, and (4) regulating emotions (Mayer & Salovey, 1997) (see Table 29.1). Recent revisions to this model are outlined in Mayer, Caruso, and Salovey (2016).

In this model, each of the four branches is composed of several interrelated skills – ranging from basic to advanced – which are acquired over the course of development. The branches themselves also ascend by degree of complexity: perceiving emotions is thought to involve a simpler set of abilities than the more deliberative, willful regulation of emotions.

The first branch, perceiving emotions, encompasses recognizing and expressing emotions, including skills such as identifying and distinguishing between the emotional states one experiences and accurately detecting the sincerity of another person's emotional expression. The second branch, using emotions to facilitate thought, includes skills for generating and exploiting emotional states, such as knowing which emotional state is best for orienting attention to relevant information and generating a specific emotional state to expedite a judgment or choice. The third branch, understanding emotions, includes comprehending the causes of and relationships between emotions. Skills in this branch include accurately labeling emotions and understanding complex emotions, such as differentiating feelings of envy and jealousy. The fourth branch, managing emotions, refers to effectively managing emotional states in the pursuit of specific goals. This branch includes skills such as remaining open to both positive and negative emotional states and selectively engaging with emotions depending on the value of that emotion to a given goal (Mayer & Salovey, 1997). The branches have remained conceptually intact since their introduction; however, Mayer, Caruso, and Salovey (2016) have divided some of the skills within each branch into two or more specific abilities and added new skills to the using and understanding branches.

Although the ability model may not explicitly endorse a basic emotions approach, it was based on the premise that certain aspects of emotion (e.g., facial expressions, physical sensations) are universal. The question of universality is now under substantial debate in the field, however (e.g., Ekman & Cordaro, 2011; Gendron et al., 2014). If one subscribes to a social-constructivist theory of emotions, an ability model of emotional intelligence may "look" a lot different and, instead, may focus on the knowledge of cultural display rules or differences across cultures in the definition of emotion. In one study of emotional intelligence across five different countries, and in another looking at differences between a sample from the United States and China, it appears that there is close to universality in the way people answer the emotion perception items; however, there is a good deal of difference in how people in the United States and China define an "effective" emotion management strategy (although there was more "sharedness" than specificity even in emotion management) (Shao, Doucet, & Caruso, 2015).

Measuring ability emotional intelligence. The Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) was developed to measure emotional intelligence as represented by the four-branch ability model. This measure, in its current form (MSCEIT v2.0), contains 141 items and is divided into four sections, each corresponding to one of the four branches of the model: perceiving emotions, using emotions to facilitate thought, understanding emotions, and regulating emotions (Mayer et al., 2003). Each of the four sections contains two types of tasks. In the emotion perception section, respondents determine (1) the emotions being expressed on provided pictures of faces and (2) the emotions conveyed in provided pieces of artwork. In the using emotions to facilitate thought section, respondents (1) produce a specific emotion and answer questions about the sensations that accompany this emotional state (e.g., how cold it is) and (2) assess which emotions would best assist

Table 29.1 *The four-branch model of emotional intelligence, with added areas of reasoning (from Mayer et al., 2016).*

The Four Branches	Types of Reasoning[a]
4. Managing emotions	• Effectively manage others' emotions to achieve a desired outcome[b]
	• Effectively manage one's own emotions to achieve a desired outcome[b]
	• Evaluate strategies to maintain, reduce, or intensify an emotional response[b]
	• Monitor emotional reactions to determine their reasonableness
	• Engage with emotions if they are helpful; disengage if not
	• Stay open to pleasant and unpleasant feelings, as needed, and to the information they convey
3. Understanding emotions	• Recognize cultural differences in the evaluation of emotions[c]
	• Understand how a person might feel in the future or under certain conditions (affective forecasting)[c]
	• Recognize likely transitions among emotions such as from anger to satisfaction
	• Understand complex and mixed emotions
	• Differentiate between moods and emotions[c]
	• Appraise the situations that are likely to elicit emotions[c]
	• Determine the antecedents, meanings, and consequences of emotions
	• Label emotions and recognize relations among them
2. Facilitating thought using emotions	• Select problems based on how one's ongoing emotional state might facilitate cognition
	• Leverage mood swings to generate different cognitive perspectives
	• Prioritize thinking by directing attention according to present feeling
	• Generate emotions as a means to relate to experiences of another person[c]
	• Generate emotions as an aid to judgment and memory
1. Perceiving emotion	• Identify deceptive or dishonest emotional expressions[b]
	• Discriminate accurate vs. inaccurate emotional expressions[b]
	• Understand how emotions are displayed depending on context and culture[c]
	• Express emotions accurately when desired
	• Perceive emotional content in the environment, visual arts, and music[b]
	• Perceive emotions in other people through their vocal cues, facial expression, language, and behavior[b]
	• Identify emotions in one's own physical states, feelings, and thoughts

Note.

[a] The bullet points are based on Mayer and Salovey (1997) except as indicated in superscripts b and c. Within a row, the bulleted items are ordered approximately from simplest to most complex, bottom to top. The four-branch model depicts the problem-solving areas of emotional intelligence and is not intended to correspond to the factor structure of the area.

[b] An ability from the original model was divided into two or more separate abilities.

[c] A new ability was added.

[d] Note that the Branch 2 abilities can be further divided into the areas of generating emotions to facilitate thought (the bottom two bulleted items) and tailoring thinking to emotion (the top three bulleted items).

with a given task or behavior. In the understanding emotions section, respondents (1) determine which emotions could combine to form a different given emotion and (2) identify which emotion would most likely stem from an intensification of a given emotion. Finally, in the emotion regulation section, respondents determine (1) which actions a character should take to generate a specific emotional state, based on a provided fictional story, and (2) the best way for someone to manage another person's emotional state (Mayer et al., 2003). A youth version of the MSCEIT (the MSCEIT-YRV) designed for those aged ten to eighteen years is also available (Mayer, Salovey, & Caruso, 2014). Its structure is similar to the adult version of the MSCEIT with distinct tasks for each of the four branches of the model.

Responses to items on the MSCEIT are scored along a continuum of "correctness" based on two scoring methods: consensus and expert. Each response receives a proportion of points based on the extent to which a representative sample (consensus scoring) or sample of emotions scholars (expert scoring) agreed with each response choice. For example, in consensus scoring, if an individual selected a response that 66 percent of general respondents also chose, the individual would receive 0.66 points for that response. Points are aggregated across all the items and respondents are given both a general-consensus score and an expert-consensus score. The general consensus versus expert consensus has been shown to correlate highly ($r = 0.91$), as have respondents' scores measured by these two methods ($r = 0.98$) (Mayer et al., 2003). More recently, the YRV replaces consensus scoring with "veridical" scoring whereby relevant literature on emotions is used to construct the scoring algorithm (Mayer et al., 2014).

In the years following the development of the MSCEIT v2.0, studies have examined whether it parses into four factors in accordance with the theoretical model. Several such analyses found that the MSCEIT v2.0 does not, after all, neatly apportion into four factors. Some argue that the MSCEIT is best represented by a single factor (Legree et al., 2014). Others have argued that the second branch – using emotion to facilitate thought – should be omitted from the model (Fan et al., 2010; MacCann et al., 2014; Maul, 2011; Palmer et al., 2005; Rossen, Kranzler, & Algina, 2008). A three-factor model, proposed by Joseph and Newman (2010), posits that emotion perception is causally antecedent to emotion understanding, which in turn causally precedes emotion regulation. This model integrates cognitive ability and elements of the Big Five and proposes that conscientiousness supports emotion perception, cognitive ability supports emotion understanding, and low neuroticism supports emotion regulation (Joseph & Newman, 2010). In a recent update to their model, Mayer, Caruso, and Salovey (2016) agreed that the accumulated data do not support the second branch (using emotions to facilitate thought) as a distinct factor. They argue, however, that it is indeed a means through which people solve emotion-related problems and should therefore remain a component of the model even if the construction of the MSCEIT fails to capture it as a discrete ability (Mayer et al., 2016). Another concern about the MSCEIT is how well the items that comprise the first branch assess emotion perception skills, as this branch has been shown to have low convergent validity with other ability-based measures of emotion perception, such as the Japanese and Caucasian Brief Affect Recognition Test (JACBART) and the Diagnostic Analysis of Nonverbal Accuracy Scales (DANVA-2) (Mayer, Roberts, & Barsade, 2008; Roberts et al., 2006).

Mixed Models

Several other conceptualizations of emotional intelligence were proposed in the literature following Salovey and Mayer's introduction of the ability model of emotional intelligence. These models broadened the catalogue of emotional intelligence components to include not just mental abilities associated with using emotions to guide thinking and thinking to guide emotions but also traits and attributes. Because these models generally include at least one of the core abilities identified in the four-branch model (e.g., emotion regulation) and nonability qualities (e.g., happiness or optimism), these conceptions of emotional intelligence often are referred to as "mixed" models (Mayer et al., 2000).

One popular model, the Bar-On Model of Emotional-Social Intelligence, explains individual performance as a consequence of a host of intrapersonal and interpersonal competencies (Bar-On, 1997, 2006). These competencies include several of the abilities outlined in Salovey and Mayer's four-branch model but also a range of dispositional features, such as optimism, self-regard, and impulse control. Another well-known model, proposed by Petrides and Furnham (2001, 2003), conceptualized "trait emotional intelligence," which is defined as "a constellation of emotion-related self-perceptions and dispositions, assessed through self-report" (Petrides & Furnham, 2003, p. 40). This construct includes dispositional features such as adaptability, assertiveness, and self-esteem (Petrides & Furnham, 2001).

Mixed-model measures. Bar-On's concept of Emotional-Social Intelligence is measured by the Emotional Quotient Inventory (EQ-i) 2.0. It consists of 133 Likert-style items that assess an individual's self-perceived competencies across five categories: self-perception, self-expression, interpersonal, decision-making, and stress management (Multi-Health Systems, 2011). Another mixed-model approach, the Petrides and Furnham (2003) model of trait emotional intelligence, gave rise to the Trait Emotional Intelligence Questionnaire (TEIQue). The TEIQue asks individuals how much they agree with 144 items that address fifteen categories of abilities and traits, including emotion perception (e.g., "I often find it difficult to recognize what emotion I'm feeling"), happiness (e.g., "Life is beautiful"), and self-esteem (e.g., "I believe I'm full of personal strengths") (Petrides & Furnham, 2003, p. 47). Other well-known measures of mixed or trait emotional intelligence include the Schutte Emotional Intelligence Scale (Schutte et al., 1998), which relies on self-report, and the Emotional Competence Inventory (Boyatzis, Goleman, & Rhee, 2000), which employs self-report and other-report techniques.

Which Emotional Intelligence Model Is Correct?

The debate over the different conceptions of emotional intelligence has at times been framed as a matter of which model – ability or mixed – is "correct"; however, it is not necessarily the case that only one of these constructs is valid (Petrides & Furnham, 2001). It is possible, for example, that the trait-based model described by Petrides and Furnham (2001, 2003) represents a wholly independent (or perhaps slightly

overlapping) construct from the ability-based model described by Mayer and Salovey (1997). The dispute, rather, is in large part over which model should lay claim to the title of "emotional intelligence." Multiple distinct constructs using the same identifier adds confusion to the field (Cherniss, 2010; Mayer, Salovey, et al., 2008) and it is likely that one model does in fact better explain how emotional abilities are harnessed and deployed through a means characteristic of the term "intelligence." Ultimately, an intelligence is an aptitude, not a disposition, and should be comprised of interrelated abilities as assessed by performance measures (Mayer, Caruso, & Salovey, 1999). To assess intelligence, people are not asked to report how smart they believe they are (self-report), nor are their family or peers asked how smart they are (other-report); people are asked to perform tasks to demonstrate their intelligence (performance). Thus, we argue that the four-branch model of emotional intelligence most accurately represents an "emotional intelligence."

Some of the strongest evidence that the ability model of emotional intelligence can be considered an intelligence comes from recent work by MacCann and colleagues. Results from an in-depth study requiring up to eight hours of time from participants revealed that a three-factor model of ability emotional intelligence – as measured by the MSCEIT – meets the criteria for a second-stratum factor of intelligence in the Cattell-Horn-Carroll (CHC) model, alongside factors such as crystallized intelligence and fluid intelligence (MacCann et al., 2014). See Mayer (2018) for an in-depth explanation of emotional intelligence as a "broad intelligence" in the CHC model of intelligence, including how it relates to other people-centered intelligences. (For more information on people-centered intelligences, see Mayer, Panter, & Caruso, 2012 for an overview of personal intelligence; Conzelmann, Weis, & Süß, 2013 for an overview of social intelligence; and Wagner and Sternberg, 1985 for an overview of practical intelligence. See also Chapters 30 and 31 in this volume.)

The remainder of this chapter will only report on research employing ability models, unless otherwise specified. The previous edition of this handbook also provides more information on the debate over the different conceptualizations of emotional intelligence (Mayer et al., 2011). Recent developments on the mixed and trait models of emotional intelligence are available elsewhere (e.g., Petrides et al., 2016).

What Are the Correlates of Emotional Intelligence?

Behavioral Correlates

One of the reasons Daniel Goleman's account of the phenomenon garnered so much attention was its strong claims regarding the importance of emotional intelligence for success. Although there is no empirical evidence for claims such as "for star performance in all jobs, in every field, emotional competence is twice as important as purely cognitive abilities" (Goleman, 1998, p. 34), there is evidence that emotional intelligence impacts many aspects of one's life, including social functioning, educational performance, workplace effectiveness, and health and well-being.

Social functioning. The four-branch model posits that emotional intelligence predicts aspects of social effectiveness, including the abilities to accurately read others' emotional states and generate positive emotions in oneself and others. Thus, we would expect scores on the ability measure of emotional intelligence to correlate significantly with measures of the quality of interpersonal relationships. Controlling for factors such as general intelligence and the Big Five personality traits, scores on the MSCEIT are positively and significantly related to a host of social variables, including relationship quality (Brackett, Warner, & Bosco, 2005; Lopes, Salovey, & Straus, 2003; Lopes et al., 2004, 2005) and interpersonal sensitivity (Lopes et al., 2005), using both self reports and peer reports for outcome measures.

MSCEIT scores in college student samples also are negatively related to levels of maladaptive social tendencies: those scoring higher on the MSCEIT have fewer incidents of aggressive behavior, including indirect aggression (e.g., exclusion, spreading rumors) (García-Sancho, Salguero, & Fernández-Berrocal, 2016) and physical aggression (García-Sancho, Salguero, & Fernández-Berrocal, 2017). Further, those with higher scores on emotion perception abilities as measured by the MSCEIT are less likely to use styles of humor associated with hostility (e.g., teasing, sarcasm) (Yip & Martin, 2006). Additionally, adolescents who score higher on the MSCEIT-YRV tend to be rated by their teachers as having fewer behavioral problems in school, less social stress, and lower levels of clinical maladjustment (Rivers et al., 2012).

It is possible, however, that emotional intelligence is not only used for achieving social good. Emotional intelligence has been found to facilitate interpersonally deviant behavior when the emotionally intelligent individual also possesses Machiavellian traits (Côté et al., 2011). Emotional intelligence may make it easier for those with deviant motives to be deviant and may allow one to emotionally manipulate, exploit, and control others (Mayer, 2001). Others have suggested that, even when deviant motives are not present, it is possible that those who are high on emotional intelligence may use their skills strategically for personal gain, perhaps at the expense of others (Kilduff, Chiaburu, & Menges, 2010).

Academic performance. Emotional intelligence correlates with academic success. In a diverse sample of 273 fifth and sixth graders, scores on the MSCEIT-YRV correlated moderately to strongly with teacher-reported student work habits (r = 0.38) and grades in English language arts ($r = 0.65$) and math ($r = 0.51$) (Rivers et al., 2012). These results were supported by a longitudinal study conducted with 413 students aged eleven to twelve years, which showed that scores on the MSCEIT-YRV predicted academic success five years later (Qualter et al., 2012). This effect also holds for older students; a recent study found that, among a sample of undergraduates, scores on the MSCEIT were correlated significantly with grade point average (GPA), controlling for IQ (scores on Raven's Advanced Progressive Matrices) and personality (scores on the reduced version of the Eysenck Personality Questionnaire) (Lanciano & Curci, 2014). Other studies have found correlations between MSCEIT scores and grades in college students; however, these correlations become nonsignificant once verbal intelligence is controlled for

(Barchard, 2003; Brackett & Mayer, 2003). This is not necessarily surprising given that the MSCEIT is a fully language-based assessment and Barchard (2003) and Brackett and Mayer (2003) report correlations of $r = 0.44$ and $r = 0.32$, respectively, between scores on the MSCEIT and verbal intelligence.

Workplace effectiveness. There also is evidence to suggest that emotional intelligence and workplace success are linked. A meta-analysis of nine studies assessing the relationship between work performance and MSCEIT scores showed that emotional intelligence correlated with work performance ($r = 0.24$), even after controlling for personality and cognitive ability (O'Boyle et al., 2011). Another study, investigating the means through which emotional intelligence might improve job performance, found teamwork effectiveness to be a mediator between emotional intelligence and job performance in managerial positions (Farh, Seo, & Tesluk, 2012). Several other studies report a similar connection between emotional intelligence and job performance, identifying potential mediating mechanisms, including the ability to tolerate stress (Lopes et al., 2006), the experience of positive affect (Brackett et al., 2010), leadership emergence (Côté et al., 2010), and leadership effectiveness (Rosete & Ciarrochi, 2005).

Health and well-being. Empirical evidence suggests a relationship between emotional intelligence and well-being. A meta-analysis of eleven studies assessing the relationship between MSCEIT scores and measures of mental health reported a small but significant relationship between emotional intelligence and mental health ($r = 0.17$) (Martins, Ramalho, & Morin, 2010). More specifically, MSCEIT scores correlate negatively with depression (Davis & Humphrey, 2012; Fernández-Berrocal & Extremera, 2016; Hertel, Schütz, & Lammers, 2009), general and social anxiety (Jacobs et al., 2008; O'Connor & Little, 2003), borderline personality disorder (Gardner & Qualter, 2009; Hertel et al., 2009), anorexia nervosa (Hambrook, Brown, & Tchanturia, 2012), and psychopathy (Ermer et al., 2012).

Psychological health is not simply the absence of mental illness – it also encapsulates the presence of positive qualities of well-being (Seligman & Csikszentmihalyi, 2000). To that end, a recent meta-analysis examining the relationship between emotional intelligence and subjective well-being identified three studies assessing the connection between MSCEIT scores and subjective well-being and reported a modest, yet significant, and positive relationship ($r = 0.22$) (Sánchez-Álvarez, Extremera, & Fernández-Berrocal, 2016).

Neural Correlates

Since the first edition of this handbook (Sternberg & Kaufman, 2011), there has a been a substantial increase in neuroscientific research on emotional intelligence. Two lesion-mapping studies conducted on a large sample of Vietnam War veterans provide insight into the neural mechanisms that might underlie emotional intelligence abilities (Barbey, Colom, & Grafman, 2014; Operskalski et al., 2015). Using a sample of participants who suffered traumatic brain injuries, researchers applied voxel-based lesion-symptom mapping (VLSM) to compare specific brain areas in

patients with damage in that area to those with no damage in that area. VLSM is a technique that allows for high statistical power while controlling for the general effects of having undergone a traumatic brain injury (Barbey et al., 2014). In their first study, Barbey and colleagues administered the MSCEIT to 152 brain-trauma patients and used VLSM to identify which damaged brain areas explained the particular deficits in emotional intelligence displayed by these patients. They found that emotional intelligence is linked to neural processes that fall along a social cognitive network, including the areas that support "the uniquely human ability to reason about the contents of mental states" (i.e., the left temporoparietal junction) and the areas that support "emotional empathy" and "shared attention and collaborative goals" (i.e., the left orbitofrontal cortex) (Barbey et al., 2014, p. 267). Barbey and colleagues also report that emotional intelligence abilities were associated with white matter systems connecting the frontal, temporal, and parietal lobes – in particular, the superior longitudinal/arcuate fasciculus, which provides evidence that emotional intelligence abilities are not fully housed in distinct swathes of the brain but depend on information being shared across cortices via this social cognitive network. Their analysis also suggested that emotional intelligence and general intelligence (as measured by the Wechsler Adult Intelligence Scale – Third Edition) draw on many of the same networks, including the dorsal and ventral perisylvian language systems (Barbey et al., 2014).

Employing similar methods to assess the four branches of emotional intelligence individually, a study by Operalski and colleagues (2015) revealed that emotion perception abilities and emotion regulation partially rely on distinct neural structures, despite engaging many of the same areas of the brain. In this study, emotion perception abilities – but not emotion regulation abilities – were related to activity in the ventral temporal lobe, the area associated with categorical conceptual knowledge and emotional expression processing (e.g., Harry et al., 2013). Emotion regulation abilities were linked to three areas: those associated with decision-making and emotional processing (i.e., right posterior orbitofrontal cortex), relational memory and emotional processing (i.e., posterior hippocampus), and attention, executive control, theory of mind, episodic memory, and language processing (i.e., portions of the parietal cortex) (Operskalski et al., 2015).

The results reported by Barbey and colleagues (2014) and Operskalski and colleagues (2015) need to be interpreted within the context of the VLSM methodology and its shortcomings. In particular, VLSM does not provide information about brain mechanisms that are undamaged in the sample of traumatic brain injury patients, which could explain why the other two branches of emotional intelligence (using emotions to facilitate thought and understanding emotions) did not significantly map onto the sample in the second study (Operskalski et al., 2015). Furthermore, it is important to remember that this is purely correlational data from a relatively homogeneous sample. Nevertheless, these findings represent an important step in our understanding of emotional intelligence and provide some initial holistic glimpses of the networks employed in generating the abilities specified by the four-branch model, supporting the division of emotional intelligence into branches of abilities.

Findings from electroencephalography (EEG) activation studies also suggest that those who score highly on the MSCEIT display lower levels of neural activation when solving emotion-related problems, suggesting higher levels of neural efficiency (Jaušovec & Jaušovec, 2005; Jaušovec, Jaušovec, & Gerlič, 2001). The neural efficiency hypothesis is further supported by functional magnetic resonance imaging (fMRI) data collected from individuals engaged in a social exchange reasoning task, which revealed a negative correlation between MSCEIT scores and brain activity (Reis et al., 2007). More recently, Pisner and colleagues (2017) found correlations between scores on the understanding emotions and regulating emotions sections of the MSCEIT and measures of white matter along several important neural tracts, even controlling for IQ. Their findings suggest that stronger emotional intelligence abilities might be due in part to the speed and efficiency of communication between areas of the brain key to affective perception and processing (Pisner et al., 2017). However, causal relationships cannot be determined from these data.

Summary

This section presented research findings on the behavioral and neural correlates of emotional intelligence, using primarily MSCEIT scores as the ability measure of emotional intelligence. MSCEIT scores predict effectiveness across social, academic, and workplace domains, as well as mental health. In terms of neural correlates, higher MSCEIT scores appear to be associated with greater neural efficiency in brain areas implicated in emotion processing. The studies conducted by Barbey and colleagues bring us closer to understanding which brain areas are involved in the emotional intelligence abilities assessed by the MSCEIT.

More research is needed to understand the causal effects of emotional intelligence to move our understanding beyond its correlates. Toward this end, researchers must develop an effective paradigm for experimentally manipulating emotional intelligence.

Development of Emotional Intelligence

In this section, we review one of the few existing models of emotional intelligence development. We also explore the evidence for the malleability of emotional intelligence and discuss some recent attempts to promote more effective emotional intelligence development in schools.

Developmental Models

One of the only development models of emotional intelligence, proposed by Zeidner and colleagues (2003), outlines three interrelated processes that contribute to the development of emotional intelligence abilities: temperament, rule-based skill acquisition, and self-aware emotion regulation.

First, the temperament – the largely biologically informed differences in the type and intensity of emotions experienced – of an infant is expected to influence or

interact with the coping of emotions early in life. The reinforcement of emotion expression and regulation tendencies by caregivers likely shapes an infant's developing abilities for perceiving, understanding, using, and managing emotions.

Second, rule-based skill acquisition refers to a process whereby individual differences in emotional intelligence abilities stem from aptitudes for emotion expression and management skills. According to Izard (2001), this can be thought of as a capacity for emotional adaptiveness, which is at least partially tied into the development of verbal skills that allow for emotional expression and, eventually, labeling emotions. In other words, children who more accurately perceive and express emotions are then able to learn better regulation strategies – and these early skills likely compound in a cycle of reinforcement. Rule-based skill acquisition is thought to also hinge on the modeling and reinforcement the child receives from his or her social environment (Zeidner et al., 2003). This perspective of abilities resulting from a rule-based acquisition process aligns well with the four-branch model, whose hierarchical structure designates emotion perception as antecedent to higher-order abilities such as understanding and regulating emotions (Mayer & Salovey, 1997).

The third process of development specified by Zeidner and colleagues (2003) is self-aware emotion regulation, which concerns children's ability to reflect on their emotional states and is believed to occur later in the maturation process. Self-aware emotion regulation involves explicit emotional self-evaluation, as opposed to implicit adoption of forms of emotional expression and regulation that caregivers model. This process hinges on caregivers – in particular whether and how caregivers discuss emotion and its expression with children. As children grow older, broader sociocultural influences – peers, institutions, cultural representations, and so on – play a prominent role. Ultimately, the metacognitive component of self-aware emotion regulation allows children to develop a more conscious and deliberate emotional understanding (i.e., skills that fall under the third branch of the ability model), which then paves the road for the development of more sophisticated emotion regulation strategies (Zeidner et al., 2003).[1]

This model links these three processes, positing that temperament influences how children develop rules related to emotional expression, which, as children gain a greater capacity to reflect on their emotional state, graduates to the more self-directed process of self-aware emotion regulation (Zeidner et al., 2003). Temperament and rule-based acquisition are thought, however, to continue to distinctly impact development even after children develop the self-reflective abilities marked by self-aware emotion regulation. The model specifies further that these three identified processes are intertwined with genetic influences, caregivers, peer networks, and culture and together these processes and influences shape the trajectory of a child's emotional development.

This developmental model offers a framework to understand how individual differences in emotional intelligence might arise through environmental and

[1] See Zeidner and colleagues (2003) for a thorough review of the literature relevant to the three processes discussed in this section. Critiques of the model have also been published (e.g., see Arsenio, 2003; Fox, 2003).

socialization processes in childhood. Its emphasis on the interaction between the innate (i.e., temperament) and the learned (i.e., skill acquisition and self-reflection) and the implication of one's sociocultural environment in emotional intelligence development are critical. Although these factors surely come as little surprise to social and developmental psychologists, they are important to emphasize because of their implications for the value of environments that are intentionally designed to teach and support skills associated with emotional intelligence development.

One critical barrier to the research on emotional intelligence development is the absence of a validated scale to measure ability emotional intelligence in young children. The closest the field has seen is the MSCEIT-YRV but it is not designed for children under the age of ten and so it is still not possible to reliably assess the four-branch model of emotional intelligence in young children. Given that the processes discussed in this section manifest much earlier than the age of ten, the lack of valid measurement instruments remains a significant limitation for testing theories of emotional intelligence development and is a major reason for the dearth of empirical work in this area. Developing a measure for this age group is no small feat, however, as it must overcome the obstacle of limited verbal acuity. There is, of course, a wealth of research investigating emotional development – including many components of the four branches – but it is not immediately evident how it all coheres to form a strong theory that can offer straightforward and testable predictions about the development of a holistic emotional intelligence.

How Malleable Is Emotional Intelligence?

It is unknown the extent to which emotional intelligence is malleable in adults. There is a lack of rigorous experimental studies that use ability-based measures to answer this question. That said, the limited evidence we do have suggests that at least some of the four branches of emotional intelligence may be amenable to improvement through intervention.

In one study, participants showed improvements on the understanding emotions and managing emotions sections of the MSCEIT – but not the perceiving emotions and using emotions to facilitate thought sections – after attending eleven classes about emotional intelligence compared to a control group that took classes on career or business topics (Dacre Pool & Qualter, 2012). Another study randomly assigned a group of athletes to either a no-treatment control condition or an emotional intelligence training program that consisted of ten workshop sessions and found that the treatment group experienced significant increases in their total MSCEIT scores as well as their scores for each of the four branches (Crombie, Lombard, & Noakes, 2011). Additionally, Reuben and colleagues found a small increase in MSCEIT scores of MBA students attending a semester-long course on ability emotional intelligence compared to those in a control group (Reuben, Sapienza, & Zingales, 2009). Although promising, the results from these studies should be interpreted cautiously until replicated using random assignment and large sample sizes.

Additional studies have explored the malleability of individual branches of emotional intelligence. For example, mindfulness training (see Teper, Segal, & Inzlicht, 2013 for an overview) and even working memory training (Schweizer et al., 2013) have been shown to increase emotion regulation abilities. There is also evidence that people's abilities to perceive emotions in facial expressions can be increased through training (Kemeny et al., 2012; Matsumoto & Hwang, 2011). Furthermore, aiming to address the shortcomings of previous research assessing the malleability of emotional intelligence, Herpertz, Schütz, and Nezlek (2016) conducted a rigorous randomized controlled trial evaluating the efficacy of an emotion perception training and reported a significant increase in scores on the emotion perception section of the MSCEIT, which held when tested six months later. This finding, however, should be viewed in light of the questionable validity of the first branch of the MSCEIT (Mayer, Roberts, & Barsade, 2008).

There is also preliminary evidence that emotional intelligence may develop up until middle age. A recent study of 12,198 participants aged seventeen to seventy-six found a U-shaped relationship between age and scores on the MSCEIT, suggesting that emotional intelligence may increase through middle age before declining as one gets older (Cabello et al., 2016). Follow-up studies should aim to test how emotional intelligence changes over the course of a lifetime within – rather than between – participants to ensure that this analysis is not picking up any generational differences.

Taken in aggregate, these findings support the possibility that emotional intelligence is malleable, at least to some degree, even in adult populations. However, the lines of research discussed thus far deserve further study and there needs to be much more research investigating the tractability of the using emotions to facilitate thought and understanding emotions branches.

Efforts to Improve Emotional Intelligence

A slew of emotional intelligence training programs and courses have cropped up in the last few decades in light of the demonstrated associations between emotional intelligence and social, educational, workplace, and well-being benefits discussed in this chapter. Many of these programs are steeped in the mixed-model approach and many have not been evaluated rigorously for efficacy (as evidenced by the lack of research on the malleability of emotional intelligence); however, there are a select few rigorously designed programs that address many of the skills of the four-branch model. This section will focus on one such program, RULER, as an exemplar of a program informed by research on ability-based emotional intelligence.

RULER is a curriculum designed to teach five core social-emotional skills to school-aged children: recognizing, understanding, labeling, expressing, and regulating emotions (Torrente, Rivers, & Brackett, 2016). The curriculum is based on the four-branch model and seeks to teach skills aligned with the four core abilities. RULER specifies a range of age-appropriate activities and modules that teachers can use in their classrooms. A quasi-experimental study reported encouraging results from the implementation of RULER at the middle school level, including increases

in student social-emotional competence, good work habits, and English-language arts grades (Brackett et al., 2012).

RULER is designed to promote the development of social-emotional skills not only in students but also in teachers and administrators. At schools that implement RULER, faculty and administrators participate in "train-the-trainer" workshops that educate them about the same social-emotional skills they will be promoting in the classroom (Torrente et al., 2016). A randomized controlled trial of RULER in sixty-two middle schools found teacher and classroom outcomes, including improvements in overall emotional climate of the classroom (as judged by both teachers and outside observers) (Rivers et al., 2013), and subsequent boosts in classroom effectiveness, including instructional support and classroom organization two years after adoption (as judged by outside observers) (Hagelskamp et al., 2013). These studies provide preliminary evidence that adopting the RULER curriculum and attending RULER training workshops may impact teachers' behaviors. To date, there have not been experimental studies testing the extent to which RULER impacts emotional intelligence scores of teachers and students.

Designing Environments to Promote Emotional Intelligence

The empirical evidence we have to date points to emotional intelligence as an important factor in critical components of daily life: social functioning, educational and workplace success, and mental health and well-being. Schools are designed to promote the acquisition of knowledge and the establishment and maintenance of positive social relationships; workplaces are designed to encourage efficiency and collaboration; and handheld "smart" devices are designed to facilitate communication, entertainment, and efficiency – why not also design these environments to foster a suite of emotional intelligence abilities that appear to have such positive and far-ranging effects? Especially as artificial intelligence and machine learning advances continue to expand our potential to "humanize" the virtual environments we increasingly inhabit, we have a ripe opportunity to design these environments to promote emotional intelligence skill building.

Fine-Tuning the Environment

We are shaped by the ecological and cultural strata we inhabit (Bronfenbrenner, 1977; Markus & Kitayama, 2010). Not only do our peers and family members influence our development and behavior but so do the institutions in which we participate, the governmental systems to which we belong, the media we consume, and the larger cultures within which we operate.

Programs founded on emotional intelligence theory and evidence could be adapted for university, corporate, or governmental contexts to successfully teach emotional intelligence skills and encourage emotionally adaptive behavior. But clearly not all environments would be suitable for a full-on educational program. Instead, what if we acknowledged the strengths of the holistic approach of RULER and also took a leaf out of the behavioral economics literature? Nudge theory,

proposed by Thaler and Sunstein (2008), argues that systems will always influence people in *some* direction – whether grocery stores situate sugary cereals at eye level or on the top shelf, this placement necessarily nudges a change in cereal-purchasing behavior. Presumably our environments also have the potential to nudge our emotional learning and virtual environments may provide a means of nudging a large percentage of the population.

For example, what if, every time you open Facebook, above your profile photo the current prompt "What's on your mind?" was replaced with one that suggests deeper reflection of your own or others' emotional states? Could seeing this nuanced prompt a dozen or more times a day help Facebook users practice emotion recognition? The nudge literature documents many powerful effects from small tweaks and, given that, as of March 2018, Facebook boasted 1.45 billion daily active users (Facebook, 2018), emotional nudges in contexts such as social media seem an avenue worth investigating.

Nudges offer an intriguing path toward the intentional design of emotionally intelligent environments. By considering the influence of the subtle cues of our environments, nudges represent a broader approach to emotional intelligence development than traditional, individual-focused methods. Ultimately, however, nudges are passive; they may encourage the practice of emotional intelligence skills but may not effectively educate. So, while considering and testing the effects of nudges, we should simultaneously build explicit education and training into our physical and virtual environments.

Virtual Learning

When people use computers and smart devices, they often behave as if they were interacting directly with a sentient source (Sundar & Nass, 2000). A recent study demonstrated that, when interacting with a virtual character, participants' evaluations (e.g., perceived social presence; perceived rapport) and responses (e.g., number of words used; degree of self-disclosure) were nearly the same regardless of whether they believed the virtual characters were avatars being controlled by real people or embodied conversational agents fully controlled by computer algorithms (Von Der Pütten et al., 2010). Furthermore, research indicates that robots and virtual agents who engage people in social-emotional interactions are deemed more trustworthy and supportive, which could further enhance the influence these systems have on our learning and behavior (Fan et al., 2017; Lohani, Stokes, McCoy, Bailey, Joshi, & Rivers, 2016; Lohani, Stokes, McCoy, Bailey, & Rivers, 2016).

These findings have implications for the design of technologies. If people do indeed treat computer systems as fellow social agents and autonomous sources of information, it seems probable that the behavior of these virtual agents (avatars, teammates, video game characters, digital assistants) could impact human behavior and learning. As our representations of human-like systems become more realistic (think early GPS voice-based navigation compared to Siri or the cartoonish video games from the 1990s compared to the hyperrealistic games that are currently popular), we increasingly may have the opportunity to teach through these systems.

Granic and colleagues (2014) argue that video games may already be promoting adaptive emotion regulation strategies. They posit that, by posing new challenges

and altering rule systems throughout gameplay – which generates stressful situations and require players to adapt quickly to shifting expectations – many video games inherently reward reappraisal and discourage rumination. Although this hypothesis has not been tested directly and there is limited rigorous research looking at the direct effects of popular video games on emotion regulation abilities (Villani et al., 2018), a recent randomized controlled trial of a video game designed to help children regulate their anxiety found that playing the game led to a reduction in anxiety symptoms comparable to a comparison group that received cognitive behavioral therapy (CBT), even at a six-month follow-up (Schoneveld, Lichtwarck-Aschoff, & Granic, 2018). Furthermore, a quasi-experimental study testing the effects of a video game designed to teach players emotional intelligence skills found increased MSCEIT scores in the video game condition compared to a wait-list control group, including increased scores on the emotion regulation section of the test (Cejudo & Latorre, 2015).

Video games represent a particularly exciting opportunity for social-emotional skill integration because they are highly engaging, social, and popular. More than half (65 percent) of US households have someone who plays at least three hours of video games a week (ESA, 2017) and teenagers are playing more than an hour of video games a day, on average (Rideout, 2015).

Research indicates that in-game behavior can inform behavior in nongame contexts. For example, Gentile and colleagues found participants were more likely to help others in a puzzle task after playing a video game with a prosocial bent compared to playing a violent or neutral video game (Gentile et al., 2009). Perhaps games could be designed to promote emotional intelligence skills, too. A game could teach players to read emotions from facial expressions, which could help them detect traitorous characters later on in the game. Or players could progressively "collect" emotion regulation strategies that they would need to apply throughout the game to assist characters struggling to maintain their composure in stressful, frightening, or enraging situations. There are abundant opportunities to weave social and emotional learning into video games and developing emotional intelligence skills might even align with the goals of both players and game creators given that so many of the most popular video games (e.g. *World of Warcraft, Call of Duty, Overwatch*) take place in social environments that hinge on effective communication and cooperation (Rivers, 2018).

Findings from the emotional intelligence literature might also help us create systems that are, in some capacity, emotionally intelligent themselves. One study drew on the emotional regulation literature to test the effects of verbal reappraisal on drivers' negative reactions to frustrating driving conditions (e.g., getting cut off by other drivers; being stuck in heavy traffic) (Harris & Nass, 2011). The researchers found that, by having a driving simulator issue verbal reappraisals of the frustrating driving conditions (e.g., "The driver must not have seen you; otherwise he would not have chosen to change lanes"), participants drove slower and received a better driving score from the simulator, which accounts for actions such as collisions, speeding and traffic light violations, and missed stop signs (Harris & Nass, 2011, pp. 750–751). Subsequent experiments are needed to investigate whether systems like these could increase people's emotion management skills outside of the driving

context and how these systems should be designed such that people would choose to use them in their daily lives.

Toward the Future: Machine Emotional Intelligence?

Smartphone apps and interfaces have the potential to dynamically react to users' emotional states. A study employing emotion recognition technology on a smartphone platform found that the software was able to detect emotions with 96 percent accuracy among a set of facial images expressing six common emotions (Alshamsi, Kepuska, & Meng, 2017). As this technology improves, might it also have the capability to dynamically *educate* people? Perhaps smartphones could help users be more aware and reflective of their current emotional state by unobtrusively signaling to users when they detect a prespecified emotion (e.g., briefly tinting the screen with a warm glow when someone is feeling happy). Given the sharp rise in the number and type of "intelligent" systems that surround us on a daily basis (smartphones, smart pens, smart refrigerators), why not make these systems *emotionally* intelligent, too?

Conclusions

We opened this chapter by referencing some of the bold claims about the predictive value of emotional intelligence that began surfacing in the mid-1990s. We explored a handful of conceptions of emotional intelligence that arose shortly thereafter and narrowed in on the four-branch ability model in order to provide a more detailed portrait of the research on the behavioral and neural correlates of emotional intelligence, the development of emotional intelligence, and the degree to which emotional intelligence is malleable. Finally, we journeyed into various possibilities for tweaking our environments to promote emotional intelligence across the life span.

Numerous areas of research on emotional intelligence need deeper and more rigorous investigation. Our understanding of how emotional intelligence maps onto brain structures is still in its infancy. There is a dearth of discussion around how emotional intelligence develops throughout childhood, despite a wealth of research on narrower facets of emotional development (e.g., emotion regulation). We have only a handful of studies, and no rigorous randomized controlled trials, assessing how much we can move adult emotional intelligence scores through intervention. And yet, there has been enormous progress in the field over the course of three decades, with many exciting contributions coming since the previous edition of this handbook. In particular, we have a much clearer picture of what emotional intelligence predicts across a host of domains important for everyday functioning and well-being; and the clear portrait that these findings paint – that emotional intelligence is associated with better social, educational, occupational, and health outcomes – should alone motivate us to delve deeper into the development and plasticity of emotional intelligence.

So, what might the next thirty years of research on emotional intelligence look like? From a methodological standpoint, it seems critical that we develop a way to assess emotional intelligence in young children. This will help us map out the

developmental trajectory of emotional intelligence and perhaps give us insight into the most effective times and places to intervene. Furthermore, the field would benefit from moving beyond correlational findings; but, to accomplish such a feat, we need methods for experimentally manipulating emotional intelligence in an ethical and timely manner. Advances in assessment, and scoring of such assessments, also is key to enhancing our understanding of emotional intelligence more broadly.

From an intervention standpoint, we need randomized controlled trials designed to enhance emotional intelligence. Would emotional intelligence nudges produce any meaningful effect sizes? Are video games an effective medium for learning and practicing emotional intelligence? Or should we look to other tried-and-true interventions for inspiration? There is an extensive body of work on implicit theories of change – the degree to which one believes a certain feature is malleable – in realms such as cognitive intelligence (e.g., Blackwell, Trzesniewski, & Dweck, 2007) and personality (e.g., Yeager et al., 2013). Does encouraging someone to adopt the mindset that emotional intelligence is malleable make that person more likely to experience emotional intelligence growth? A recent study supports this possibility, finding that those who report stronger endorsement of the belief that emotional intelligence is malleable also score higher on the MSCEIT (Cabello & Fernández-Berrocal, 2015).

From a learning standpoint, an obvious path is to investigate the effects of increasingly popular virtual environments like social media and video games on emotional intelligence development. How has this shift in the way we spend our time affected our abilities to perceive, utilize, understand, and regulate emotions? And also, what are the effects of emotional intelligence on how we interact with technology? Do emotionally intelligent individuals engage in technologies like social media in more adaptive ways, such that they reap the potential benefits of social media (e.g., increased social networks), while buffering themselves against some of the potential harmful effects (e.g., increased loneliness)?

And, finally, from an ethical standpoint, it is important to remember that emotional intelligence is neither inherently prosocial nor sinister – like IQ, it can be harnessed for many purposes, good or bad. Any growth in our knowledge about emotional intelligence over the coming decades should be accompanied by the development of ethical principles that can guide us as we apply the science of emotional intelligence to understanding and managing ourselves and others.

The next thirty years will, of course, witness a host of other major developments not discussed or forecasted in this chapter and we anticipate that there will be a growing emphasis on integrating emotional learning with technology as we increasingly rely on it for our social and emotional experiences.

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