The role of language in emotional development

Holly Shablack and Kristen A. Lindquist

University of North Carolina at Chapel Hill

To appear in In V. LoBue, K. Perez-Edgar and K. Buss (Eds). *Handbook of Emotion Development.* New York: Springer.

Address correspondence to:
Kristen A. Lindquist
University of North Carolina
Chapel Hill, NC 27599
Kristen.lindquist@unc.edu

Abstract

Much literature suggests a link between language and emotions. Parents' language use is linked to children's later emotion perception and understanding. Perhaps most compellingly, access to emotion words shapes which emotion someone sees on another's face. In this chapter, we outline a developmental perspective on the role of language in emotion perception, whereby language is a mechanism for acquiring and using emotion concept knowledge to make meaning of others' and perhaps one's own emotional states across the lifespan. We begin by discussing language and emotion understanding in preverbal infants, who without language, perceive emotional facial expressions in terms of the more basic dimension of valence. Next, we discuss how language acquisition throughout toddlerhood and early childhood leads to increased emotion understanding and more nuanced emotion perception. We continue to trace the relationship of language and emotion throughout adolescence and into adulthood, documenting that disorders of aging that impair language also impair emotion perception. We close by speculating on the role of emotion words in the context of emotion experience, emotion regulation and cross-cultural differences in emotions.

Keywords: language, emotion development, emotion concepts, socialization, parental discourse, emotion perception

It is clear that emotions change across development. As evidenced by the other chapters in this volume, what remains in question is which aspects of emotions develop over time, when, and how. In this chapter, we discuss the role of language in emotion development. From some theoretical perspectives on emotion, the role of language in emotion should be trivial. For instance, basic emotion views assume that specific emotion categories are largely biologically endowed; in this view, infants are born with the ability to experience, express, and perceive in others categories such as anger, disgust, fear, etc. The words used to name these categories should thus have no influence on how the categories themselves are experienced or perceived (Ekman, 1992; Ekman & Cordaro, 2011; Izard, 1971, 1994, 2007). As a case in point, Ekman & Cordaro (2011, p. 369) state, "Language and emotion are independent of each other; both can evolve independently without the presence of the other…Language is socially constructed; basic emotions are not."

Yet many other psychological models of emotion assume that there is an effect of language on emotions across development. Some approaches focus on the role of language as parents transmit knowledge about emotion categories to their children through verbal discourse (Dickson, Fogel, & Messinger, 1998; Dunsmore & Halberstadt, 1997; Ereky-Stevens, 2008; Fivush, Brotman, Buckner, & Goodman, 2000; Fivush, Haden, & Reese, 2006; Fogel et al., 1992; Halberstadt, Denham, & Dunsmore, 2001; Halberstadt & Eaton, 2002; Halberstadt & Lozada, 2011; McElwain, Halberstadt, & Volling, 2007; Perlman, Camras, & Pelphrey, 2008; Saarni, Campos, Camras, & Witherington, 2006; Sullivan, Carmody, & Lewis, 2010).

Other work views language as an important mechanism in emotion. Some models focus on how children's general language ability (Pons, Lawson, Harris, & De Rosnay, 2003; Ridgeway, Waters, & Kuczaj, 1985) or culture (Tsai, Louie, Chen, & Uchida, 2007; Vinden, 1999) is a mechanism for emotion perception abilities or emotional understanding (Widen,

2013). Our own work on the psychological and neural basis of emotions hypothesizes that words for emotion categories are a crucial mechanism in both perception of emotions on others' faces and bodies (e.g., Doyle & Lindquist, 2018; Gendron, Lindquist, Barsalou, & Barrett, 2012; Lindquist, MacCormack, & Shablack, 2015; Lindquist, 2013; 2017; Lindquist, Barrett, Bliss-Moreau, & Russell, 2006; Lindquist, Gendron, Barrett, & Dickerson, 2014) and the experiences of emotions in one's own body (e.g., Lee, Lindquist, & Payne, in press; Lindquist & Barrett, 2008a; MacCormack & Lindquist, in press). This theoretical perspective, called psychological constructionism, hypothesizes that the words that name emotion concepts ("anger," "fear," "sadness," etc.) help individuals to acquire knowledge about culturally-relevant emotion categories. Words, and the concepts they name, then in turn help individuals to make meaning of—or "construct"— experiences of emotions in one's own body or perceptions of emotions in others' facial expressions. In this view, language serves as a conceptual cue in emotion, by cohering together the internal cache of knowledge associated with a set of features (facial configurations, body postures, physiological states, situations) for a particular instance of an emotion category (see Lindquist et al. 2015). This view hypothesizes a particular developmental trajectory, in which people learn to disambiguate the meaning of their culture's emotion categories across infancy and early childhood as words naming emotion concepts are acquired; these words then continue to help people to access and use emotion concept knowledge to make meaning of others' and their own states into adolescence and adulthood (see Lindquist et al. 2015). In this chapter, we evaluate whether the existing data is supportive of this developmental trajectory.

We begin our chapter by outlining the psychological constructionist predictions that language is a mechanism of emotion perception and understanding across development. We then turn to evidence documenting a role of language in emotion perception and understanding from

infancy to late adulthood. Specifically, we show that pre-verbal infants do not perceive facial expressions in terms of discrete categories, but rather in terms of more basic affective dimensions of psychological meaning such as valence and arousal. We next discuss evidence documenting the emergence of discrete emotion perception and understanding as young children acquire emotion words. We trace the relationship between language and emotion through adolescence and then focus briefly on the causal evidence in adults showing that when language is well established, impaired access to emotion words via experimental manipulation or disease makes participants revert to the perception of very general affective states. Throughout, we highlight the fact that greater proficiency at perceiving emotions in others, and greater understanding of what different emotion concepts entail is linked to a host of beneficial outcomes, including increased subjective well-being, better emotion regulation (Kashdan, Barrett, & McKnight, 2015; Lindquist & Barrett, 2008b), greater prosocial behavior (Eggum et al., 2011), higher educational attainment, and improved work relationships and productivity (Brackett, Rivers, Reyes, & Salovey, 2012; Hagelskamp, Brackett, Rivers, & Salovey, 2013). It is thus important to understand the role language plays in emotions for both mechanistic and applied reasons.

Definitions and Focus

Before we begin, it is important to clarify the constructs we will be discussing, as these are often used differently across fields and sub-fields. We mostly focus herein on research examining the role of language in emotion perception and emotion understanding. "Emotion perception" refers to the ability to infer the emotional meaning of another's non-verbal behaviors. This research often uses methods that rely on sensory perception (e.g., vision), and we focus exclusively on studies of visual facial perception for two reasons. First, the face has long been considered an important channel of emotion expression and there is a long theoretical

history of examining perception of emotion in the face (Ekman, 1972; Fridlund, 1994; 1991; Izard, 1971). Second, perception of emotion in faces is most frequently examined in infancy and early childhood of normal healthy aging children. As such, we do not review the relatively smaller literature using other singular channels of expression (e.g., body postures, voice; Atkinson, Dittrich, Gemmell, & Young, 2004; Aviezer, Trope, & Todorov, 2012; Grossmann, 2010; Mondloch, 2012; Walker-Andrews, 1997) or multimodal channels of expression (combinations of vocalizations, vocal prosody, body posture, scenarios etc. see Flom & Bahrick, 2007; Grossmann, 2010; Walker-Andrews, 1997). Our interpretations of the studies on facial emotion perception extend to these other modalities, however.

"Emotion understanding" is a broader construct and refers to the ability to understand the causes and consequences of one's own and others' emotions, the ability to identify the emotions of characters in stories, or the ability to predict what emotion someone would feel in a given scenario (see Eggum et al., 2011; Grazzani, Ornaghi, Conte, Pepe, & Caprin, 2018; Lane, Wellman, Olson, LaBounty, & Kerr, 2010; Pons, Harris, & de Rosnay, 2004). Emotion understanding is what we sometimes call "conceptual knowledge" about emotions (Lindquist et al., 2015; Lindquist & Barrett, 2008b) and using this knowledge is a key facet of emotional complexity (Lindquist & Barrett, 2008) and emotional intelligence (Mayer, Salovey, & Caruso, 2008; Mayer, Salovey, Caruso, & Sitarenios, 2001). This research often uses methods that rely on images of facial expressions, verbal scenarios or videos. or images of facial expressions.

In contrast to emotion perception and understanding, "emotional experience" and "emotion expression" are terms used to describe the emotional feelings one has in their own body and how that person expresses those feelings in their face, voice, body posture or behavior. Although our constructionist view hypothesizes that words for emotion categories (e.g., "anger" v. "fear") help people to disambiguate and thus experience as discrete the meaning of their own

internal states (Lindquist et al. 2015; 2016), we do not focus on this work herein for two reasons. First, too little empirical work addresses the role of language in emotional experience or expression across the lifespan. To our knowledge, the only research assessing the role of language in emotion experience does so in adults (Brooks et al., 2017; Kassam & Mendes, 2013; Kirkland & Cunningham, 2012; Lieberman et al., 2007; Lieberman, Inagaki, Tabibnia, & Crockett, 2011; Lindquist & Barrett, 2008a; Niles, Craske, Lieberman, & Hur, 2015; Satpute, Shu, Weber, Roy, & Ochsner, 2013; Satpute et al., 2015). There is thus no way at present to comprehensively review the cross-sectional role of language in emotional experience across development. Second, at present it is empirically challenging to manipulate and measure the role of language in emotional experiences in very young individuals. In the realm of emotion perception, it is possible to objectively measure whether a pre-verbal infant or a child acquiring language perceives two facial expressions as similar; there is no comparable test for whether they experience the same emotion in response to two images or scenarios. There are at present no objective physiological (e.g., anger v. disgust; Barrett, 2006; Mauss & Robinson, 2009; Siegel et al., 2018) nor behavioral (Baumeister, Vohs, DeWall, & Zhang, 2007; Chester et al., 2016) measurements of whether an individual is experiencing one specific emotional state over another. Studies of emotion expression in children do not find clear differentiation between the facial expressions produced in one emotional situation v. another (Camras et al., 2007; Saarni et al., 2006), suggesting that children's outward expressions alone cannot be used as an objective index of their state (this method is also likely problematic in adults; see Bogart & Matsumoto, 2010; Lindquist & Gendron, 2013; Matsumoto, 1987; 1993; Matsumoto & Kupperbusch, 2001) Finally, although research increasingly asks young children to self-report their emotions (e.g., Nook et al. 2018), self-report is either impossible or very limited in very young children, pre-verbal infants, or individuals with verbal impairments due to disorders of aging. Given these

methodological caveats, we focus our attention on studies that convincingly document a role of language in emotion perception and understanding across the lifespan. We review the evidence for the role of language in emotion experience when that evidence is available.

Throughout our review, we focus almost exclusively on normative development and do not focus on how language deficits in developmental disorders (e.g., autism) may impact emotion understanding, although this is certainly an important topic of inquiry. We also focus exclusively on semantics (i.e., word meaning) in verbal or written language, although we recognize that there are many aspects of language that may impact emotion (e.g., syntax; see Majid, 2012 for a review). Finally, we do not review research explicitly examining how children learn to associate specific emotions with specific words (e.g., Shablack, Lindquist, & Becker, under review), although this type of work represents a necessary next step in an understanding of the role of language in emotion perception and understanding.

A Psychologist Constructionist Approach to Emotional Development: The Trajectory from General Affective States to Specific Discrete Emotions

The psychological constructionist approach hypothesizes a particular developmental trajectory, in which people learn to disambiguate the meaning of their culture's emotion categories across infancy and early childhood as words naming emotion concepts are acquired. These words then continue to help people to access and use emotion concept knowledge to make meaning of others' and their own states into adolescence and adulthood. According to the psychological constructionist approach to emotions (Barrett, 2006, 2013; Clore & Ortony, 2008; Cunningham, Dunfield, & Stillman, 2013; Russell, 2003), infants are not born being able to experience and perceive in others a set of discrete emotion categories such as "anger," "disgust," "fear," and so on (Bridges, 1932; Camras & Shutter, 2010; Nelson, 1987; Widen, 2013). Instead, young infants experience and perceive in others very general core affective states. Core affect

refers to the general physiological state of an individual that is constituted of valence (positive or negative) and arousal (level of activation or alertness) (Barrett & Bliss-Moreau, 2009; Russell, 2003). The psychological constructionist view predicts that infants and children develop the ability to further differentiate and refine those states into more specific discrete emotions over the course of development as they acquire the ability to make situated meaning of core affect. Critically, the latter process relies on conceptual knowledge about emotions (Barrett, 2009, 2014; Clore & Ortony, 2013; Cunningham et al., 2013; Lindquist, et al., 2015; Lindquist, 2013). Conceptual knowledge refers to the cache of information (i.e., representations of the facial configurations, body postures, physiological states, situations etc.) an individual has about specific emotion categories (for review, Lindquist et al., 2015). For example, a child's knowledge of perceiving sadness in someone may include crying, a quivering lip, slouched shoulders and a preceding set of events (such as having a toy take away). A child is thought to draw on this knowledge in the moment to differentiate a negative expression (e.g., a quivering lip) as an instance of sadness v. anger (Barrett, 2012).

Importantly, psychological constructionism posits that language plays a mechanistic role in the acquisition and use of this conceptual knowledge, as words serve as a way to cohere together the array of multi-modal information that is associated with each discrete emotion category. In this sense, words are "essence placeholders" for abstract concepts (see Lindquist et al., 2015; Lupyan, 2012; Xu, 2002) and help to access and use conceptual knowledge in an online fashion (Lupyan, 2012) to make meaning of on-going core affective perceptions (Doyle & Lindquist, 2018) and experiences (Lindquist & Barrett, 2008). The psychological constructionist approach thus predicts a specific developmental trajectory, whereby the development of emotion words co-occurs with children's ability to understand general affective states vs. specific discrete emotions. Although causal research for the role of language in emotion is presently limited to

work with adults (Doyle & Lindquist, 2018; Fugate, Gendron, Satoshi, & Barrett, 2017; Gendron, Lindquist, Barsalou, & Barrett, 2012; Lindquist, Barrett, Bliss-Moreau, & Russell, 2006; Roberson & Davidoff, 2000; Roberson, Davidoff, & Braisby, 1999), the correlational evidence documenting a connection between language and emotion across the lifespan (e.g., Labouvie-Vief, DeVoe, & Bulka, 1989; Nook, Sasse, Lambert, McLaughlin, & Somerville, 2017; Widen, 2013) is consistent with this psychological constructionist view. We review this evidence, beginning with evidence showing that in the absence of language, pre-verbal infants perceive emotions in terms of the broad dimensions of valence and arousal, but not discrete emotion categories (for a similar view, see Ruba & Repacholi, forthcoming).

Pre-verbal infants perceive valence and arousal, not discrete emotions

If language is necessary for discrete emotion perception, then it follows that pre-verbal infants should not perceive discrete emotions on faces. Early work on emotion perception in pre-verbal infants was largely interpreted as evidence that emotion categories are innate (Izard, 1971, 1994; Izard & Malatesta, 1987). In this view, language is epiphenomenal to the understanding of emotions (see Ekman & Cordaro, 2011; Izard, 2007). Despite continued interpretation of the data as evidence for discrete emotion perception (e.g., Izard, 2007), others have called into question the idea that infants perceive discrete emotions on faces (Balaban, 1995; Caron, Caron & Myers, 1985; Widen, 2013; Widen & Russell, 2008). It is beyond the scope of this chapter to review the entire literature on emotion perception in infancy and early childhood (see Bullock & Russell, 1986; Camras & Shutter, 2010; Grossmann, 2010; Nelson, 1987; Quinn et al., 2011; Slater, 2002; Tronick, 1989; Widen, 2013; Widen & Russell, 2008b), but we briefly examine this literature with an eye towards whether the findings clearly support perception of discrete emotion or more basic features of emotion categories such as valence and arousal.

Two things are immediately clear when reviewing the literature on perception of facial expressions in neonates and infants. The first is that neonates and young infants respond to, and are interested in emotional facial muscle movements. What remains unclear is whether they understand the discrete emotional meaning of facial expressions. This uncertainty is in part due to a second fact observed in the literature—that most studies do not provide conditions that allow for strong inference about discrete emotion perception. Rather, most studies are designed in a manner that only permits inference about whether infants can differentiate basic perceptual features of faces, or at most, draw a psychological inference about the valenced or aroused meaning of a set of facial muscle movements.

The research on emotion perception with neonates is limited, but what is clear is that neonates and infants mimic mouth movements and tongue protrusions (Field et al., 1983; Field, Woodson, Greenberg, & Cohen, 1982; Haith, Bergman, & Moore, 1977; Meltzoff & Moore, 1977), focus on areas of the face that are diagnostic of social interactions, such as the nose, mouth and eyes (Caron, Caron, & Myers, 1985; Haith et al., 1977; Kestenbaum & Nelson, 1990) and with age begin to predominantly focus on the eyes of faces (Haith et al., 1977; Maurer & Salapatek, 1976). The literature on infants, finds that infants also clearly prefer faces that are smiling (Kuchuk, Vibbert, & Bornstein, 1986), and this preference in turn influences their ability to recognize facial identities (Bornstein & Arterberry, 2003; Turati, Montirosso, Brenna, Ferrara, & Borgatti, 2011). Although these findings are often alluded to as evidence that neonates can perceive “emotions” on faces (Field et al., 1983, 1982; Haith et al., 1977; Maurer & Salapatek, 1976; Meltzoff & Moore, 1977; Slater, 2002) they do not explicitly test the hypothesis that infants differentiate between different discrete emotion categories.

To test the hypothesis that infants can differentiate between different discrete emotion categories, studies typically use behavioral methods. These methods tend to include preferential

looking paradigms, paired comparisons, familiarization and habituation, and social referencing tasks (see, de Haan & Nelson, 1998 for task descriptions). Many of these tasks rely on how long an infant looks at a specific stimulus, which comes with a set of important caveats (Oakes, 2010). Longer looking times are considered evidence that the infant views the stimulus as something novel, and correspondingly, distinct from other stimuli. Using this methodological framework, many studies suggest that infants are able to distinguish between discrete emotional expressions, however a closer look at the data shows that most studies cannot conclude discrete emotion perception is taking place.

A first issue is that many studies examine emotion perception by exclusively comparing two cross-valence emotions that differ in the broad dimension of valence (i.e., a positive valence face such as happiness v. a negative valence face such as anger or fear). The overwhelming evidence suggests that past a certain age, infants can generally differentiate between pleasant and unpleasant facial expressions. The ability to perceive valence on faces is consistent with the psychological constructionist view, but unfortunately cannot speak to whether infants perceive discrete emotions on faces. For instance, in habituation tasks, infants consistently discriminate between happy and other negative faces. By 3-months (Barrera & Maurer, 1981; Young-Browne, Rosenfeld, & Horowitz, 1977) and 5-months (D'Entremont & Muir, 1997), infants can differentiate between happy and sad faces. By 4- to 9- months (Serrano, Iglesias, & Loeches, 1995), infants differentiate between happy and angry expressions. A study looking at blink latencies, wherein larger and faster eye blinks are associated with startle responses to unpleasant and high arousal images, finds that 5-month old infants exhibit larger blinks when an angry face is paired with a loud noise than when happy or neutral faces are paired with loud noises (Balaban, 1995).

In contrast to infants' ability to differentiate happy from angry and sad faces, there is relatively less evidence that infants can easily differentiate happy and fearful faces. What seems clear is that infants are interested in the eyes of faces in general, and posed fearful faces tend to have particularly salient eyes (Adolphs et al., 2005; Gosselin & Schyns, 2001). Infants' attention is particularly drawn to faces with wide eyes, but this does not appear to be a bias towards posed fear because infants attend to wide eyes regardless of whether the rest of the face portrays fearful or neutral affect (Peltola, Leppänen, Mäki, & Hietanen, 2009). Interestingly, the tendency to attend to the eyes of a face might be further moderated by culture. East Asian infants, like East Asian adults (Jack, Blais, Scheepers, Schyns, & Caldara, 2009; Jack, Garrod, Yu, Caldara, & Schyns, 2012) focus significantly more on the eyes of faces than do Western infants (Geangu et al., 2016).

Infants' interest in faces with wide eyes might be driven by novelty or uncertainty. In adults, the amygdala—a brain region associated with uncertainty and salience (Cunningham & Brosch, 2012; Whalen, 2007)—activates strongly to the presence of wide eyes in facial expressions (Whalen et al., 2004) and adults report seeing the types of posed fearful faces used in studies very infrequently in ecologically valid settings (see Somerville & Whalen, 2006 for evidence that fearful faces are very infrequently seen). Habituation studies in infants are consistent with the hypothesis that fearful faces may be particularly novel or unusual to infants. These studies show some evidence for differentiation of happy and fearful faces but are plagued by order effects that suggest that infants might be attending longer to less frequently seen fearful faces. For example, 7- and 8-month old infants show longer looking times to fear faces, but only when habituated with happy faces and not vice versa (Ludemann & Nelson, 1988; Nelson & Dolgin, 1985; Nelson, Morse, & Leavitt, 1979). These findings may show that infants can distinguish between very familiar faces (happy faces) and more unusual faces (fearful faces) but

not that infants necessarily understand the psychological meaning of fearful facial expressions. A separate study found differentiation of fearful and happy faces (Geangu et al., 2016), but is also consistent with the idea that infants are preferentially focusing on highly novel or unusual facial muscle movements. Seven-month old infants across all cultural backgrounds looked at fearful faces longer than happy faces; in this study they discriminated between happy and fearful expressions regardless of which expression was habituated. However, the amount of looking time for fearful faces was significantly reduced when infants viewed their own race fearful faces as opposed to other-race fearful faces (Geangu et al., 2016). If fear is truly serving a group-signaling role, then it would be more adaptive for infants to attend to fearful faces from their social group than an out-group. Instead, these findings are consistent with the idea that infant looking is driven by novelty, not discrete emotion perception.

As these findings suggest, a major critique of familiarization and habituation paradigms concerns whether they give evidence of categorical perception or whether findings are driven by infants' attention to a more basic perceptual or meaning dimension that co-varies with posed stimulus categories. That is, infants may be able to distinguish between perceptual differences in faces (e.g., smiling v. frowning faces), but may not do so in a manner that indicates an understanding of the discrete emotional meaning of those perceptual differences. Categorical perception occurs when an object is classified as the same category as another object. It is a psychological phenomenon in which within-category differences become perceptually minimized and between-category differences become perceptually emphasized (see Fugate, 2013 for a discussion of categorical perception in emotion). A classic study demonstrated that infants' perceptions of facial expressions might be driven more by attention to perceptual differences than the categorical perception of emotion. Caron, Caron, and Meyers (1985) showed that 4-, 6- and 7-month old infants do not perceive angry and happy faces categorically, but that the

appearance of differentiation between emotion categories is driven by infants' attention to the presence of teeth in facial expressions. When stimuli are matched for the presence of teeth (i.e., infants see toothy grins, non-toothy grins and toothy scowls), infants differentiate between different types of happy faces (toothy grins v. non-toothy grins) but not between happy and angry faces that are matched for toothiness (toothy grins v. toothy scowls). This pattern has been since replicated (Kestenbaum & Nelson, 1990).

Thus, a gold standard for demonstrating categorical perception is to demonstrate both within-category equivalence (i.e., seeing both toothy and non-toothy grins as similar) and between-category discrimination (i.e., seeing toothy grins and toothy scowls as different) in perception (see Fugate, 2013; Goldstone, 1994). In adults, categorical perception is established by using two paired studies. A first study is typically conducted to identify the categorical boundary (when a stimulus is no longer perceived to be part of one category and is now perceived to be part of another). Following the categorical boundary identification, individuals complete a discrimination test wherein they are presented with a series of stimuli that are different morphed combinations of the categories of interest. For example, participants may be presented with a morph that is a 40% fearful expression and 60% happy expression and told to indicate if the face matches face A (a 100% fearful expression) or face B (a 100% happy expression). Evidence that a 70% fearful, 30% happy face is perceived to be more similar to a 90% fearful, 10% happy face than a face at the category boundary such as a 50% fearful, 50% happy face is suggestive that participants see stimuli that are equal steps along a perceptual gradient as categorically different from one another.

Very few studies have explicitly examined categorical perception in infants, likely due to the difficulties associated with experimentally documenting it. One study adapted the categorical perception paradigm for infant facial emotion perception using fearful and happy expressions

(Kotsoni, de Haan, & Johnson, 2001). Infants were familiarized to a facial expression (e.g., a 40% fearful-60% happy face), followed by a discrimination phase in which they were presented two times with the familiarized face and: (1) a face on the other side of the category boundary (e.g., an 80% fearful-20% happy face) and (2) a face within the same category boundary (e.g., a 20% fearful – 80% happy face). No significant differences were seen in looking time for faces within the category boundary, however, when looking at the cross-category boundary test trials, infants looked significantly longer at the novel expression when they were familiarized to the happy expressions (i.e., 40% fearful – 60% happy), but not the fearful expressions (e.g., 40% happy- 60% fear). It has been argued that this provides evidence of specific categorical perception of fear v. happy faces, however, similarly to Nelson, Morse and Leavitt (1979) and Nelson and Dolgin (1985), infants only responded to the novel expression when it was fearful, indicating possible order effects. Regardless, the findings at best show evidence that infants can differentiate a positive face (happy) from a negative face (fear).

To truly show evidence for discrete emotion perception, studies would have to demonstrate categorical perception between faces portraying multiple discrete emotion categories, especially those that are matched in terms of the underlying dimensions of valence or arousal. One study found that infants as young as 3-months could discriminate surprise from happy and sad expressions—but only when fear, anger and disgust expressions were not present. Once fear, anger and disgust expressions were included, infants were no longer able to differentiate surprise expressions from the others (Young-Browne et al., 1977). One interpretation is that infants were differentiating surprised and happy/sad faces on the basis of either the presence of wide eyes, or the underlying dimension of arousal, as surprise is a highly aroused emotion and happy and sad are not. To control for the role of wide eyes or the arousal level of a facial expression, studies could assess differentiation of surprise v. fear; yet, those that

have done so, again yield order effects. Infants discriminate between surprise and fear faces, but only when habituated to fear and tested with surprise (Schwartz et al., 1985). An added confound is the fact that adults often see surprised faces as ambivalent, signaling positive valence in some contexts and negative in others (Kim, Somerville, Johnstone, Alexander, & Whalen, 2003; Kim et al., 2004; Neta & Whalen, 2010). Thus, differentiation of surprise and fear may in fact be further evidence of valence differentiation.

A handful of habituation studies that control for confounding factors between emotion categories such as valence and arousal exist (Caron, Caron, & Myers, 1982; Ludemann & Nelson, 1988; Serrano, Iglesias, & Loeches, 1992; Young-Browne et al., 1977). However, these studies do not tend to find consistent and clear evidence for specific discrete emotion perception. For instance, 5-month-old infants were unable to discriminate anger when it was a novel expression in a paired comparison task of fear and sadness (Schwartz, Izard and Ansul, 1985). Montague and Walker-Andrews (2001) found variation in infants fixation times on facial expressions of sad, angry, or fearful expressions in a peek-a-boo task, however, the trends are inconsistent across emotion categories and may indicate that infants were paying attention to differences in facial muscle features but not consistently understanding the psychological meaning of the categories.

Perhaps the clearest evidence for discrete emotion perception in children exists in a recent study that directly compared perception of posed portrayals of anger and disgust (Ruba, Johnson, Harris, & Wilbourn, 2017). This study offers a particularly well-controlled comparison because anger and disgust are thought to be similar in valence and arousal (Russell & Bullock, 1986a, 1986b) and caricatured portrayals of these facial expressions even share similar facial muscle movements (e.g., corrugator activity). The authors found that both 10-month old infants and 18-month old infants showed discrimination for angry and disgusted faces. Although 10-

month olds were unable to discriminate identities, 18-month year olds were able to and familiar identities enhanced their ability to discriminate between angry and disgusted faces. Interestingly, children older than 24 months and adults struggle to categorize these faces using labeling and free-sort tasks, suggesting that younger children may rely more on perceptual statistical regularities to differentiate the faces. It is unclear, however, whether these younger children understand the meaning of the perceptual regularities they are distinguishing, however. Patients who have lost access to the meaning of words as a result of semantic dementia can perceptually match posed facial expressions on the basis of statistical regularities in the posed muscle movements but do not understand the psychological meaning of those facial muscle movements when asked to sort them into meaningful categories (Lindquist et al. 2014).

Language acquisition across childhood accompanies discrete emotion perception

If language is necessary for discrete emotion perception, then it follows that discrete emotion perception should emerge as children begin to learn the meaning of emotion category words. That is, a child who knows the words “anger” and “sadness” should be able to differentiate between these two same-valence emotions. The literature, although correlational, bears out this pattern across early childhood. We also briefly discuss more causal evidence that emotion word acquisition influences adult’s discrete emotion perception.

To test the hypothesis that children can differentiate between different discrete emotions once they know the meaning of specific emotion category words, studies typically use behavioral methods. Like the infant literature, much research focuses on emotion perception using facial stimuli and we focus our attention on this literature. We also briefly touch on work on emotion concept understanding, more generally.

Studies of emotion perception in children over 24 months typically ask children to categorize expressions using one of three types of paradigms. In one type of paradigm, children

perform an emotion perspective taking task, wherein the child is presented with a short story (often by puppets or with a neutral image of a face) and asked to identify what the character is feeling either through free labeling or pointing to facial expression response options (Cutting & Dunn, 1999). Alternatively, the child might be given a facial expression (e.g., a happy face) and is asked to freely label it (Widen & Russell, 2003). In other types of paradigms, the child is given an emotion word (e.g., happy) and is asked to point to facial expression response options that match the word (Denham & Couchoud, 1990). Finally, a child might be asked to sort facial expressions of a certain category into one box while leaving out others (Widen & Russell, 2008b).

Of course, many of these paradigms rely on words, so it is not surprising that children's age and language ability are generally positively correlated with performance in emotion perception tasks (Astington & Jenkins, 1999; Beck, Kumschick, Eid, & Klann-Delius, 2012; Cutting & Dunn, 1999; Harris, De Rosnay, & Pons, 2005; Pons et al., 2004, 2003; Wellman, Harris, Banerjee, & Sinclair, 1995). There is a well-known developmental trajectory in children's use of mental state words. When describing others, very young children (e.g., 2.5 years) primarily discuss external sensory perceptions (i.e., visual perceptions of others; e.g., the girl runs). With time, these descriptions become more internal and more complex, focusing on physiological states (feeling sick, hot), volition (desires), and lastly, emotion, cognition and moral judgments (Bretherton & Beeghly, 1982). Word use related to emotions also follows a developmental trajectory, and as predicted by the psychological constructionist account, this trajectory starts broad, focusing on valence, and gets more specific with development (Widen, 2013). Prior to the age of two children generally rely on "happy" and depending on the child, "sad" or "mad," to describe pleasant v. unpleasant feelings. With age, word use expands to include "happy," "mad," "sad" and eventually, "scared," "surprised" and "disgust" (Bretherton

& Beeghly, 1982; Ridgeway et al., 1985; Widen & Russell, 2003); for review, see Widen, 2013). Notably, disgust is not reliably used until well into childhood (e.g., around age 7) (Widen & Russell, 2008a, 2013).

However, what is particularly interesting about these findings, and consistent with a psychological constructionist account, is that children's linguistic and corresponding conceptual abilities correlate with their perceptual abilities and emotion understanding. For example, preschoolers that are older and have better language ability are better able to correctly identify what a target character is feeling and label facial expressions when prompted (Cutting & Dunn, 1999). Bosacki and Moore (2004) find that 3-year old children's language influences their ability to understand simple (happy or sad) v. more complex (embarrassed or proud) emotion categories. Specifically, when asked to identify what a puppet is feeling, accuracy in identifying the emotion portrayed by the researchers was positively associated with general verbal ability. This suggests that language influences the ability to perceive and identify emotions in others. In addition to the role of language, the authors also found that the more stereotypically female the child's behavior, the more accurate the child was to understand the character's complex emotions. This finding in and of itself is likely related to the acquisition of emotion words, a point we return to later.

Of course, the aforementioned findings could be merely interpreted as evidence that as children age, they become better at emotion perception and understanding. A developmental effect surely exists, but language ability remains a strong predictor for emotion understanding performance among 3- to 6-year old children when controlling for age, parental attachment, and gender (de Rosnay & Harris, 2002). Furthermore, language ability accounts for more variance than age alone, suggesting that language ability has a larger impact on emotion understanding than age per se (Pons et al., 2003). Indeed, language ability is related to improved performance in

false belief tasks and emotion-based attributions (de Rosnay, Pons, Harris, & Morrell, 2004). Here, 3- to 6-year old children who higher language ability and were deemed to be more mentalistic (or introspective) by their mothers were more likely to understand an association between a target character's emotional state and beliefs or knowledge of a situation as compared to children low in language and metalizing abilities.

Taken together, the findings show a relationship between language ability and emotion perception and understanding, but do not speak to the psychological mechanisms underlying this relationship. Our psychological constructionist approach hypothesizes that language ability is important to emotion because language conveys information about the emotion concepts that a child in turn uses to make meaning of the range of pleasant and unpleasant feelings, behaviors, and situations that accompany different discrete emotions. This hypothesis predicts two outcomes: first, that learning specific discrete emotion concept words should drive discrete emotion perception in children, and second, that greater opportunities for learning concepts through language should predict better emotion perception and understanding.

Learning emotion words is associated with emotion perception. Children's use of discrete emotion words (e.g., "anger," "fear," "sadness," "proud," etc.) increases with age, as seen in children's spontaneous word production during discourse (Ridgeway et al., 1985) and in free labeling of facial emotion expressions (Widen & Russell, 2003). Interestingly, children do not learn words for emotion categories all at once and instead follow a trajectory from a narrow valence-based understanding of emotion category words to broader and more nuanced understanding that reflects differences amongst same-valenced emotions. For instance, at 2 years old, children on average use the words "happy," and "sad"[1] when labeling facial expressions and

[1] Some children use "mad" instead of "sad" to indicate negative emotion (see Widen, 2013). The reason for this difference is unknown, but it's possible that this reflects differences in parents' choice of negative emotion words, which could stem from individual differences or even gender norms. There is some evidence that 3-year olds are

often overgeneralize their use of these terms in valence-congruent ways. For example, they tend to label all negative facial emotion expressions as "sad," suggesting that what they understand about "sadness" is that it is a negative emotion. By 5-years, children use a broader range of words (including "surprise," "fear," and sometimes "disgust") and are correspondingly better able to differentiate negative emotions as indicated by a decrease in broadly categorizing all negative faces as "sad" (Widen & Russell, 2008b).

To quasi-experimentally examine the effect of children's emotion word knowledge and perceptual abilities, Widen and Russell (2008b) examined 2- to 5- year old children's ability to produce emotion labels and then examined their behavior in a perceptual sorting task. To understand how many labels children knew, children first freely labeled facial emotion expressions. Children were more likely to use the words "anger," followed by "happy," "sad," "surprise," "fear," and "disgust." Consistent with other literature, older children had the largest range of emotion word knowledge. Next, children performed a face sort task in which they were asked to place certain emotional faces (e.g., sad faces) into a labeled box (e.g., the "sad" box). Consistent with the idea that emotion word knowledge is associated with emotion perception, children's accuracy and pattern of errors was associated with how many emotion words they knew. Across all ages, children were more likely to make same-valence errors (i.e., place a fearful expression in a box labeled "sad"), but the likelihood of the error decreased with greater emotion word knowledge. That is, children who knew the word "fear" were less likely to place a fearful face in the "sad" box.

Other evidence is suggestive that emotion words are particularly important for organizing children's knowledge about emotion concepts and helping them to access this knowledge during online tasks. That is, children show a "label superiority" effect (Russell & Widen, 2002) when it

---

more likely to ascribe "sadness" to girls and "anger" to boys (Haugh et al. 1980), suggesting that children learn gender-based associations with emotion categories even as they are learning about the categories themselves.

comes to emotional understanding and perception, whereby they perform much better when cued by an emotion word v. a face or other information. For instance, Camras and Allison (1985) found that children from preschool to second grade are better able to identify what a character in a story is feeling when given emotion word options ("happy," "angry," "sad," "fear," and "disgust") rather than facial expressions depicting the target emotions. Extending these findings to a younger sample, Russell and Widen (2002) found that words, but not faces, facilitated emotion understanding and emotion perception in 2- to 7- year olds. First to test emotion understanding, children were asked to tell a story about a cued emotion concept and were either shown the relevant emotion word (e.g., "anger" or a facial expression of the target emotion e.g., an angry face). Children were less likely to describe a story reflective of the target emotion when cued with a facial expression, whereas they more clearly described an event eliciting the target emotion when cued with a word. To test emotion perception, children performed the same emotion face categorization task as used in Russell and Widen (2008), but here they were either cued to place faces in a box labeled with a word (an "angry" box), a box labeled with the target facial expression (e.g., a box depicting an angry face), or a box labeled with a label plus facial expression. Children performed most accurately when the boxes were labeled with emotion word labels, and worst when the boxes were denoted with a facial expression. Interestingly, when boxes had both emotion words and facial expressions, performance did not differ from the condition in which boxes only had emotion words, suggesting that facial expressions do not add any additional information above and beyond the label for guiding children's perceptual judgments.

Taken together, these findings suggest that emotion words play an especially important role in cuing children to the meaning of emotion concepts. Interestingly, this same effect persists into adulthood, such that adults are more accurate at matching a face to a label than matching

two facial expressions to one another (Nook, Lindquist, & Zaki, 2015). These findings run counter to the idea that all children are born automatically understanding facial expressions for basic emotions (Izard, 1971, 1994; Izard & Malatesta, 1987) and need to merely learn to apply labels to them during language acquisition. Rather, these findings are consistent with our constructionist view that words act as an "essence placeholder" that unites together perceptual instances (e.g., different instances of angry facial expressions) in concept knowledge and helps humans access that knowledge when making meaning of a new instance of that category. Evidence from cognitive science suggests that words play a special role in representing abstract concepts (Andrews, Vigliocco, & Vinson, 2009; Barsalou & Wiemer-Hastings, 2005) and in turn shape online perception (Lupyan, 2012; see Lindquist et al 2015 for a discussion in the realm of emotion). The linguistic form of a concept helps people acquire category knowledge, above and beyond mere experience with that category (Doyle & Lindquist, 2018; Lupyan, Rakison, & McClelland, 2007). A word helps adult perceivers to acquire categories for novel emotional facial expressions and biases later perceptual memory for similar faces (Doyle & Lindquist, 2018). No studies to our knowledge have explicitly tested this hypothesis in children, but at least one study is suggestive that children are using novel words to acquire novel emotion categories.

Two to 10 year-old children were presented with a series of facial expressions including a novel expression made up by the researchers and were asked which word denoted the expression (Nelson & Russell, 2016). Critically, children were provided with a list of typical English emotion words plus a new word, "pax." After a few trials, children began to use the new label, "pax" to label the novel emotion, suggesting that children use the process of elimination to infer that a novel word corresponds to a novel emotional expression. These findings suggest that even children as young as 2-years begin to cohere novel categories around words when given the opportunity to do so. These findings bring us to the second hypothesis of our psychological

constructionist view, which is that children who have greater opportunity for emotion word learning are more likely to acquire a set of complex emotion concepts, which in turn is associated with greater emotion perception abilities and better emotion understanding.

Parental communication is associated with emotion perception and understanding.

One way in which children begin to learn and associate emotion words with emotion concepts may be through communication and socialization from their caregivers, allowing for increased exposure and experiences of emotional instances. Indeed, a large body of work suggests that the amount of discourse that occurs between caregivers and children predicts children's verbal ability, which in turn leads to improved emotion perception and understanding in others (Brackett et al., 2012; Eggum et al., 2011; Hagelskamp et al., 2013; Rivers et al., 2013; Twenge, Catanese, & Baumeister, 2003). Improved emotion understanding is in turn linked to better peer relationships and popularity in children as young as 5-years old (Dunn, 1995; Dunsmore & Karn, 2004).

The effect of parent discourse on emotion understanding and perception likely occurs because parental discourse offers an avenue for introducing emotion concepts (e.g., "he feels sad!") and helping children understand the properties of those concepts (e.g., "he's crying because he's sad," "taking his toy made him sad," "he'll be less sad if you give it back"). Consistent with this interpretation, amongst 7- to 9- year old children, receptive vocabulary (the ability to understand language from others), literacy (the ability to understand language from written text) and understanding of narrative structure (the ability to understand narratives) particularly predict children's emotion vocabulary (the number of emotion words known), declarative emotion knowledge (the extent to which children can identify what a character feels), awareness and understanding of mixed emotions and performance in a facial emotion recognition task (Beck, Kumschick, Eid & Klann-Delius, 2012). On the other hand, children with low levels

of receptive language are more likely to demonstrate consistent maladaptive behaviors and poor emotion regulation (Cohen & Mendez, 2009). These findings suggest that language may be a vehicle for acquiring emotion concept knowledge because it allows parents to teach children about categories, causal relationships (Dunn, Brown, & Beardsall, 1991) and the specific causes and consequences of emotions (Russell, 1990; Widen, Pochedly, & Russell, 2015).

On the parents' side, a number of factors predict children's acquisition of emotion knowledge (Chaplin, Cole, & Zahn-Waxler, 2005; Dunsmore & Halberstadt, 2009; Eisenberg, Cumberland, & Spinrad, 1998; Halberstadt, 1986; Halberstadt & Eaton, 2002; McClure, 2000; Wong, McElwain, & Halberstadt, 2009). For instance, the extent to which a parent explains emotions, the frequency with which a parent uses emotion language, and how they respond to the child's emotions is a strong predictor of the child's emotion understanding (Adams, Kuebli, Boyle, & Fivush, 1995; Denham, Zoller, & Couchoud, 1994; Denham & Kochanoff, 2002; Kuebli, Butler, & Fivush, 1995). Additionally, parental emotion displays (Castro, Halberstadt, Lozada, & Craig, 2014; Halberstadt, Dennis, & Hess, 2011; McElwain et al., 2007; Perlman et al., 2008) and beliefs about emotions (Castro, Halberstadt, Lozada, & Craig, 2014; Dunsmore, Her, Halberstadt, & Perez-Rivera, 2009; Lozada, Halberstadt, Craig, Dennis, & Dunsmore, 2016) predict children's knowledge about emotions. For example, at 44-months, a child's cognitive-language ability and the extent to which a mother explained emotions, frequently used emotion language, and how they responded to the child's emotion predicts the child's ability to identify facial expressions depicting emotions (Denham et al., 1994). These behaviors also impact a child's own social status among their peers, in that kindergarteners whose mothers believed teaching emotion words was important were more popular with their peers (Dunsmore & Karn, 2004).

Perhaps the most compelling evidence for the role of parental communication in emotion understanding comes from longitudinal research. Mother and sibling discourse with children as young as 36-months predicts children's ability to recognize emotions in others at age 6. In particular, the frequency of conversation, discussions about causality, and having a large variety of discussion topics in general are positively correlated with emotion recognition above and beyond language ability alone (Dunn et al., 1991). Longitudinal evidence further shows that mothers' language about "desire" when their child is 15-months-old influences how children discuss mental states and their performance in identifying the facial expressions associated with vignettes at 24 months (Taumoepeau & Ruffman, 2006). At 33 months, children's mental state language was most influenced by mothers' earlier discussions of other people's thoughts and feelings (Taumoepeau & Ruffman, 2008). Additionally, there is evidence that peer relationships can be a source of emotion word knowledge. Children with more stable friendships demonstrated increases in emotion word knowledge over the course of a year (Denham et al., 2003).

Amidst these findings exists interesting gender differences: finding suggest that girls are superior to boys in emotion understanding (Brown, Craig, & Halberstadt, 2015; Chaplin et al., 2005; Garner, Robertson, & Smith, 1997; McClure, 2000; Montagne, Kessels, Frigerio, De Haan, & Perrett, 2005). Importantly, growing evidence suggests that these differences may be due to language too. Longitudinal evidence suggests that parents adjust how they speak about emotions to children of different gender (Adams et al., 1995; Kuebli et al., 1995). A longitudinal study with children aged 40- to 45-months (Fivush et al., 2000) found that mothers discussed a wider range of emotions and focused on negative emotions more with their daughters than sons. Critically, this gender difference emerged as the child grew older and was longitudinally associated with gender differences in children's discussion of emotions. A separate study of both mothers and fathers found that both parents talk about emotions more with their daughters than

their sons (Fivush et al., 2000), underscoring the fact that parents may be reinforcing gender stereotypes about emotion—and providing girls with a greater repertoire of emotion knowledge—across early childhood.

Of course, the role of language in emotion perception and understanding does not end in early childhood. Changes in emotion concept knowledge and the language that supports this knowledge continues throughout childhood. A study of found that emotion word knowledge roughly doubled every two years until the age of 11 (Baron-Cohen, Golan, Wheelwright, Granader, & Hill, 2010). Changes in emotion knowledge associated with those words continues into adolescence and early adulthood (O'Kearney & Dadds, 2004), and perhaps for the rest of life. For instance, in a sample of individuals aged 10 to 77 years old, language ability correlated with the complexity of participants' descriptions about their personal experiences of anger, fear, sadness and happiness (as, not surprisingly, did age and mental development) (Labouvie-Vief, DeVoe, & Bulka, 1989). We next trace evidence for a link between language and emotion in adolescence through adulthood.

Emotion language during adolescence

Unlike the basic research in infancy and early childhood, the majority of work examining language and emotion in older childhood and adolescents does so in the context of mental health (Conti-Ramsden & Botting, 2008; Toppelberg, Medrano, Morgens, & Nieto-Castañon, 2002; Yew & O'Kearney, 2013; for review, see Salmon, O'Kearney, Reese, & Fortune, 2016) or with regards to emotion regulation (Eisenberg, Sadovsky, & Spinrad, 2005). These findings generally suggest that language abilities are a protective factor against mental health symptoms, behavioral problems, and predict greater emotion regulation in adolescence. For instance, children with language impairments in early childhood (3-8 years) were two times more likely to have internalizing and externalizing symptoms at follow-up (2 to 12 years later) when compared to

children with typical language development (Yew & O'Kearney, 2013). Children with language impairments are also more likely to have higher rates of anxiety and depression in adolescence (Conti-Ramsden & Botting, 2008). These findings echo work in early childhood showing that language is a mechanism for acquiring the complex emotion knowledge used in successful interpersonal communication and intrapersonal emotion regulation (see Hagelskamp et al., 2013; Lindquist et al., 2015 for a discussion).

In contrast to the research in infancy and early childhood, which mainly focus on emotion perceptions in others, the basic science research in typically developing adolescents focuses on adolescent's own self-reported emotional experiences or emotion understanding. This methodological emphasis likely reflects the fact that adolescents are better able to self-report their own emotional experiences than are children. This emphasis is also likely due to the fact that adolescents experience an increase in emotional reactivity (Arnett, 1999; Casey, Jones, & Hare, 2008; Hare et al., 2008; Silvers et al., 2012; Somerville, Jones, & Casey, 2010) and internalizing symptoms leading to an increase in mental health disorders (Garnefski, Kraaij, & van Etten, 2005; Hatzenbuehler, McLaughlin, & Nolen-Hoeksema, 2008; McLaughlin, Hatzenbuehler, & Hilt, 2009) as compared to children.

Very little work specifically examines the relationship between language and emotion understanding in healthy adolescents, but a recent study (Nook et al., 2017) of individuals aged 6 to 25 years is suggestive that increasing verbal knowledge (i.e., vocabulary scores) mediates the development of more nuanced emotion concept knowledge during mid-childhood to early adulthood. Participants were asked to compare how similar emotion words (e.g., "anger" v. "sad," "anger" v. "happy") were to one another. Consistent with the work in young children (e.g., Widen, 2013), with increased age and vocabulary scores (as measured by the WASI-II), people's emotion concept knowledge transitioned from a valence-based understanding (i.e.,

emotion categories are solely differentiated in terms of good v. bad) to a more nuanced multidimensional space (i.e., emotion categories are differentiated in terms of valence and arousal). This effect was mediated by verbal knowledge and was not attributable to fluid reasoning or the general ability to represent categories in a complex manner (Nook et al. 2017). These findings suggest that emotion understanding increases across adolescence and is mediated by language.

Another recent study weighed in on how adolescents use emotion words to describe their own emotional experiences (Nook et al. in press). Individuals aged 5-25 completed a laboratory measure in which they rated how much a series of aversive images made them feel "angry," "disgusted," "sad," "scared," and "upset." The researchers calculated participants' degree of emotion differentiation (i.e., emotional granularity), which is a behavioral measure that assesses whether participants use words in a distinctive manner (i.e., describing an unpleasant experience as exclusively "angry") or in a manner that reflects the underlying valence of the experience (i.e., describing an unpleasant experience as "angry," "disgusted," "sad," "scared," and "upset") (Barrett et al. 2001; Boden, Thompson, Dizén, Berenbaum, & Baker, 2013; Demiralp et al., 2012). Differentiation was quadratically associated with age, such that younger children and young adults were more likely to differentiate amongst their emotions, whereas adolescents were not. Interestingly, these findings were not associated with average emotion intensity, suggesting that endorsing multiple emotions was not merely a product of experiencing strong emotion in adolescence. Rather, it may be that changes in emotion concept knowledge across childhood to early adulthood predict differences in emotion differentiation. Younger children were more likely to report a single emotional experience, perhaps because they have a limited repertoire of emotion concepts to draw on (Widen, 2013) or because their emotion concepts are less differentiated (Nook et al. 2017). In contrast, adults' greater tendency to differentiate amongst

emotion categories was not driven by a tendency to report single categories in a given instance, perhaps because adults recognize that in some cases they can feel multiple emotions and in others they do not. Ultimately, the findings might be best described by changes to the complexity of emotion knowledge across the early age span, which is an interesting question that should be addressed in future research. Findings might also be related to the accessibility of emotion concepts across the age span. Whereas children might be less able to flexibly retrieve different emotion concepts during emotional experiences, adolescents might have difficulty suppressing access to multiple emotion concepts. Adults are likely able to do both well. These findings are consistent with the evidence that emotion word accessibility alters adults' emotional perceptions (Barrett, Lindquist, & Gendron, 2007; Gendron et al., 2012; Lindquist et al., 2006; Lindquist, Gendron, Barrett, & Dickerson, 2014) and experiences (Lindquist & Barrett, 2008), which we turn to next.

Manipulating emotion language shifts perceptions and experiences of emotion in young adults

By adulthood, it is assumed that individuals have a well-established cache of emotion knowledge and stable language ability, although it remains in question to what extent emotion knowledge changes across the adult age-span (a point we consider briefly below). There is growing experimental evidence that language continues to alter young adults' emotion perception and experiences, although we do not review it at length herein since we have done so extensively elsewhere (Lindquist, Gendron, & Satpute, 2016; Lindquist et al., 2015; Lindquist, Satpute, & Gendron, 2015; Lindquist, 2017). Instead, we focus briefly on several studies of healthy younger adults that experimentally manipulate emotion word accessibility and correspondingly alter emotion perception and experience. These findings are suggestive that

once emotion concept knowledge is acquired, manipulating access to this knowledge by manipulating language alters emotional perceptions and experiences.

Perhaps the clearest evidence that emotion words are important in emotion perception come from studies that experimentally impair access to emotion words and correspondingly impact emotion perception. These studies used some form of verbal interference such as verbal overshadowing (Roberson & Davidoff, 2000) or semantic satiation (see Black, 2004) to make emotion word meanings temporarily inaccessible and test the effect on emotion perception in faces. For instance, in semantic satiation, after repeating a relevant emotion word ("anger") 30 times (v. 3 times), participants were less accurate and slower to indicate whether two facial expressions (e.g., two angry faces) matched in emotional content or not (Lindquist et al. 2006). A second study demonstrated that semantic satiation of the discrete emotion words impaired the perceptual processing of emotional faces, not just categorization required in matching tasks (Gendron et al., 2012). Specifically, satiating an emotion word (e.g., "anger") hindered the ability of the subsequent face (e.g., an angry face) to perceptually prime itself (e.g., the same angry face) on a subsequent trial. Perceptual priming is an effect that occurs outside of conscious control and thus suggests that semantic satiation of emotion words is interfering with low-level perceptual processes when making meaning of an emotional facial expression.

Evidence also suggests that increased access to emotion words alters adults' emotional experiences, as measured by self-report, behavior, and physiology. These studies generally manipulate participants' access to emotion concepts during an emotionally evocative scenario. For instance, participants heard a vignette that primed either emotion-neutral knowledge or which mentioned the words "fear" or "anger" before they experienced a negative or neutral mood induction. Finally, participants completed a measure of risk perception as an implicit measure of fear. Participants primed with fear demonstrated the greatest risk perception, but only

if they also experienced the negative affect induction, suggesting that access to the word "fear" altered how they experienced their negative state (Lindquist & Barrett, 2008).

In a more recent study, participants were primed with an emotion concept ("fear" v. "sympathy") after completing an implicit measure that assessed their aversive reactions to racial out-group members (Lee et al., in press). White individuals who were encouraged to make meaning of their highly aversive reactions towards Black individuals as "sympathy" were less likely to self-report feeling fear towards Black individuals and were less likely to see Black faces as threatening. Being primed with "fear" also increased participants' skin conductance responses to Black faces.

Finally, other evidence from our lab shows that words continue to help adults acquire and update emotion categories. A study that asked participants to pair novel "alien" facial expressions with "alien" words v. perform a control task (i.e., judge the color of the alien's skin) found that participants who paired novel facial expressions with words were more likely to use this category information to guide later perceptions of other target alien faces (Doyle & Lindquist, 2018). That is, just as is hypothesized to occur during early childhood, adults were using the verbal form of the word to cohere together properties of the novel emotion category. This concept knowledge was then accessed later when viewing other alien facial expressions and biased perceptions of the target faces towards the concept knowledge stored in memory. This effect even occurs for pre-existing emotion categories; pairing novel instances of non-stereotypical angry facial expressions with the word "anger" biased later perceptions of stereotypical angry facial expressions (Doyle & Lindquist, 2018). Thus, it is likely that associating perceptual properties with emotion words across the age-span allows individuals to continue to update their cache of emotion knowledge.

Older adults with deteriorating language ability perceive valence not discrete emotions

We close by reviewing the small literature focusing on the association between language and emotion in older adulthood. Although research examines alterations to the types of emotion categories that older adults self-report (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Gross et al., 1997) or the use of emotion words (Pennebaker & Stone, 2003) across the adult lifespan, very little research has examined how language and emotion continue to interact into older age. It is likely that emotion words continue to support the acquisition of new emotion knowledge across the adult lifespan. Older adults are known to have more complex emotion understanding (Grossmann et al., 2010) and although little studied, it is possible that language mediates the evolution of emotion concept knowledge across older adulthood. For instance, our preliminary work shows that older adults associate words such as "anger," "disgust," and "fear" with fewer interoceptive properties (e.g., a beating heart) than do younger and middle-aged adults (MacCormack, Henry, Davis, & Lindquist, under review), suggesting that words may continue to serve as a mechanism for learning, updating, and using emotion concept knowledge across the adult age-span. A better understanding of how language and emotion interact across the adult lifespan is an important topic of future study.

The majority of research on language and emotion in older age focuses on unhealthy aging as occurs in stroke and neurodegenerative disease. This work is interesting because it shows that as brain regions associated with language deteriorate due to stroke or disease, so too does emotion perception. In some cases (e.g., Lindquist et al., 2014), the patterns observed are the inverse of those observed in early development; as patients lose access to emotion words, their perceptions become more valence-based and less discrete.

Some of the earliest evidence for deficits in language and emotion come from a stroke patient, LEW. LEW had deficits in lexical retrieval following a stroke in his inferior frontal gyrus, a region associated with semantic retrieval (e.g., Grindrod, Bilenko, Myers, & Blumstein,

2008), and was correspondingly unable to perceive discrete emotions on faces (Roberson et al., 1999). On each of three testing occasions, LEW was asked to sort a set of morphed facial expressions (e.g., happy to angry to fearful) into piles. He created piles of facial expressions that were seemingly disorganized and did not correspond to English categories of facial expressions.

Like stroke, semantic dementia, a form of primary progressive aphasia that occurs in the latter half of the lifespan (Gorno-Tempini et al., 2011), offers an interesting lens for studying the role of language in emotion. Semantic dementia is a progressive neurodegenerative disease that results in impairments in concept availability and use (Hodges & Patterson, 2007). Patients with semantic dementia have pronounced lesions to the left anterior temporal lobe, a region involved in representing abstract concepts (Visser, Jefferies, & Lambon Ralph, 2010). These patients also tend to show difficulties labeling facial expressions of emotion, although the effect is typically interpreted as merely a deficit in naming (Calabria, Miniussi, Bisiacchi, Zanetti, & Cotelli, 2009; Rosen et al., 2004). However, we have demonstrated that patients with semantic dementia show predicted deficits in the perception of discrete emotion on faces, but not perceptions in valence, even in tasks that do not explicitly require labeling (Lindquist et al., 2014). Three patients with semantic dementia were asked to freely sort facial portrayals of happiness, sadness, anger, disgust, fear, and a neutral state into piles. Unlike age-matched controls, who sorted into roughly six piles for the six categories represented, patients sorted into roughly three piles representing pleasant, unpleasant, and neutral valence (Lindquist et al., 2014). Despite manipulating the availability of cues (anchoring piles with numbers 1-6; anchoring piles with prototypical facial expressions; labeling piles with emotion words), patients persisted in perceiving faces in terms of valence. Indeed, other research examining neurodegeneration in areas related to semantic retrieval and use (e.g., inferior frontal gyrus, anterior temporal lobe) also find that patients have impaired emotion perception. Those patients with behavioral variant frontotemporal dementia

(bvFTD) who had lesions in the inferior frontal gyrus and anterior temporal lobe also showed deficits in emotion perception (Jastorff et al., 2016), further confirming the role of these language-related regions in emotion perception.

Conclusion

The evidence reviewed herein suggests that language is an important mechanism in emotion perception and understanding from infancy through older adulthood. These findings are consistent with the psychological constructionist hypothesis that language supports the acquisition of the emotion knowledge that in turn shapes how people make meaning of other's facial expressions, how they understand emotion categories, and perhaps even how they experience their own emotions. Consistent with the psychological constructionist hypothesis, pre-verbal infants do not show clear evidence for discrete emotion perception; discrete emotion perception appears to follow a broad (valenced) to narrow (discrete emotional) developmental trajectory as children learn emotion words such as "anger," "disgust" and "fear." Language ability is a clear predictor of emotional understanding across early childhood and even into adulthood, and parents' use of emotion words in discourse with their children causally predicts emotion understanding and a host of other positive socio-emotional outcomes. Across adolescence, language predicts the development of more nuanced representations of emotion categories. In adulthood, experimentally reducing access to emotion words impairs emotion perception, whereas increasing access to emotion concepts alters how adults make meaning of their own body states as specific discrete emotions. Finally, in disordered aging, loss of function to brain areas associated with the semantic aspects of language produces profound changes to emotion perception that recapitulate the patterns of emotion perception observed in early development. Without access to emotion words, adults with semantic dementia can perceive facial expressions in terms of broad valence, but not discrete emotions.

Limitations and Future Directions

Although we review converging evidence from multiple methods (including both correlational and experimental techniques), the findings we reviewed are not without limitations. Throughout, we noted caveats with the existing evidence as we reviewed it. For instance, it is difficult if not impossible to address some hypotheses in pre-verbal infants and young children. For this reason, much research in infants and young children focuses on emotion perception rather than emotional experience, as it is difficult to assess how an infant is feeling without asking them, and objective physiological measures cannot "diagnose" the experience of a specific emotion (Siegel et al., 2018). The infant literature has, at best, mixed evidence of discrete emotion perception. Most studies are not designed to rule out the role of other factors in perception (e.g., valence) and those studies that do have mixed findings and order effects. Although null or mixed findings do not rule out the possibility that infants can in fact easily perceive and understand discrete emotions, the evidence at present is more consistent with the hypothesis that infants perceive facial expressions in terms of valence and develop the ability to understand them in terms of discrete emotion categories over time. Interestingly, children's ability to perceive discrete emotions on faces co-varies with their understanding of the corresponding emotion word. Although, as noted earlier, there is growing research documenting the role of language in emotion experience throughout adulthood, this literature, and for reasons outlined above, has not been extended across the lifespan. It is important that we continue to innovate and explore new and rigorous methods that may be able to capture the role of language in emotion experiences, even in research subjects who cannot self-report their own subjective states.

The correlational evidence across early childhood suggests that language is involved as infants and young children learn to differentiate the meaning of emotional faces. These studies

are of course limited by their correlational nature. Some studies use longitudinal approaches, but even these are open to third variables. However, evidence from school-based interventions that aim to increase children's emotion knowledge are suggestive that increasing children's emotion word knowledge predicts a host of socio-emotional outcomes and mirror the observational data. Training programs thus far suggest that improved emotion knowledge facilitates both better peer relationships (Denham et al., 2003; Dunn, 1995; Dunsmore & Karn, 2004; Eggum et al., 2011) and academic success. Future research should examine the specific role of language in these school-based interventions. Our work in adults suggests that pairing emotion concepts with emotion words is likely to help people learn novel emotion concepts better than learning those concepts without the aid of language (Doyle & Lindquist, 2018).

Future research should also employ more experiments to examine the precise mechanisms by which language helps children acquire emotion knowledge. We have conducted studies examining how children learn to associate emotional concepts with novel word forms (Shablack et al., under review), but much more research is needed. The evidence showing that impaired language ability and limited emotion knowledge in childhood is associated with worse mental health outcomes in adolescence provides an additional incentive to identify the mechanisms by which language impacts emotional well-being.

As we noted, experimental approaches are used more extensively in adulthood to assess the precise mechanisms by which language impacts emotion understanding, perception and experience, but there is a relative dearth of evidence focused on the role of language in older age. With a rapidly aging world population, it would be important to know how the relationship between language and emotion continues to develop across the adult lifespan.

Finally, although we did not discuss cross-linguistic research, it would be important in future research to examine how speaking different languages differently impact emotions, which

can continue to inform us of both role of culture and language in emotion development. There is on-going research examining the role of bilingualism on emotion (Dewaele & Pavlenko, 2004) and hypotheses suggest that speaking two or more languages may provide a person with a more complex cache of emotion knowledge (Alvarado & Jameson, 2011; Dewaele & Pavlenko, 2002; Ozanska-Ponikwia, 2013; Panayiotou, 2004; Panicacci, 2013; Pavlenko, 2005, 2008; Pavlenko & Driagina, 2007). Indeed a recent review, Koven (2017) discusses differing theoretical views and approaches to the nature and structure of emotions in multilingual individuals, and stresses the importance of continued exploration and importantly, interdisciplinary examination of emotions in multilingual individuals. We look forward to this future research on the role of language and emotion across the lifespan and across the globe.

References

Adams, S., Kuebli, J., Boyle, P. A., & Fivush, R. (1995). Gender differences in parent-child conversations about past emotions: A longitudinal investigation. *Sex Roles*, *33*(5–6), 309–323. https://doi.org/10.1007/BF01954572

Adolphs, R., Gosselin, F., Buchanan, T. W., Tranel, D., Schyns, P., & Damasio, A. R. (2005). A mechanism for impaired fear recognition after amygdala damage. *Nature*, *433*(7021), 68–72. Retrieved from http://dx.doi.org/10.1038/nature03086

Alvarado, N., & Jameson, K. A. (2011). Shared knowledge about emotion among Vietnamese and English bilingual and monolingual speakers. *Journal of Cross-Cultural Psychology*, *42*(6), 963–982. https://doi.org/10.1177/0022022110381125

Andrews, M., Vigliocco, G., & Vinson, D. (2009). Integrating experiential and distributional data to learn semantic representations. *Psychological Review*, *116*(3), 463–498. https://doi.org/10.1037/a0016261

Arnett, J. J. (1999). Adolescent storm and stress, reconsidered. *American Psychologist*, *54*(5), 317–326. https://doi.org/10.1037/0003-066X.54.5.317

Astington, J. W., & Jenkins, J. M. (1999). A longitudinal study of the relation between language and theory-of-mind development. *Developmental Psychology*, *35*(5), 1311–1320. https://doi.org/10.1037//0012-1649.35.5.1311

Atkinson, A. P., Dittrich, W. H., Gemmell, A. J., & Young, A. W. (2004). Emotion perception from dynamic and static body expressions in point-light and full-light displays. *Perception*, *33*(6), 717–746. https://doi.org/10.1068/p5096

Aviezer, Hillel; Trope, Yaacow; Todorov, A. (2012). Body cues, not facial expressions, discrimintae between intense positive and negative emotions. *Science*, *338*(November 2012), 1225–1229. https://doi.org/10.1126/science.1224313

Balaban, M. T. (1995). Affective influences on startle in five-month-old infants: Reactions to facial expressions of emotion. *Child Development*, *66*(1), 28–36. https://doi.org/10.1111/j.1467-8624.1995.tb00853.x

Baron-Cohen, S., Golan, O., Wheelwright, S., Granader, Y., & Hill, J. (2010). Emotion word comprehension from 4 to 16 years old: A developmental survey. *Frontiers in Evolutionary Neuroscience*, *2*(NOV). https://doi.org/10.3389/fnevo.2010.00109

Barrera, M. E., & Maurer, D. (1981). The perception of facial expressions by the three-month-old. *Child Development*, *52*, 203–206.

Barrett, L. F. (2006). Solving the emotion paradox: Categorization and the experience of emotion. *Personality and Social Psychology Review*, *10*(1), 20–46.

Barrett, L. F. (2009). Variety is the spice of life: A psychological construction approach to understanding variability in emotion. *Cognition & Emotion*, *23*(7), 1284–1306. https://doi.org/10.1080/02699930902985894

Barrett, L. F. (2012). Emotions are real. *Emotion*, *12*, 413–429.

Barrett, L. F. (2013). Psychological construction: A Darwinian approach to the science of emotion. *Emotion Review*, *5*, 379–389.

Barrett, L. F. (2014). The conceptual act theory: A precis.

Barrett, L. F., & Bliss-Moreau, E. (2009). Affect as a psychological primitive. *Advances in Experimental Social Psychology*, *41*, 167–218.

Barrett, L. F., Gross, J., Christensen, T. C., & Benvenuto, M. (2001). Knowing what you're feeling and knowing what to do about it: Mapping the relation between emotion differentiation and emotion regulation. *Cognition and Emotion*, *15*(6), 713–724. https://doi.org/10.1080/02699930143000239

Barrett, L. F., Lindquist, K. A., & Gendron, M. (2007). Language as context for the perception of

emotion. *Trends in Cognitive Sciences*, *11*(8), 327–332.

Barsalou, L. W., & Wiemer-Hastings, K. (2005). Situating abstract concepts. In D. Pecher (Ed.), *Grounding cognition: The role of perception and action in memory, language, and thought* (pp. 129–163). New York: Cambridge University Press.

Baumeister, R. F., Vohs, K. D., DeWall, C. N., & Zhang, L. (2007). How Emotion Shapes Behavior: Feedback, Anticipation, and Reflection, Rather Than Direct Causation. *Personality and Social Psychology Review*, *11*(2), 167–203. https://doi.org/10.1177/1088868307301033

Beck, L., Kumschick, I. R., Eid, M., & Klann-Delius, G. (2012). Relationship between language competence and emotional competence in middle childhood. *Emotion*, *12*(3), 503–514. https://doi.org/10.1037/a0026320

Black, S. (2004). Review of semantic satiation. *Advances in Psychology Research*, *26*, 63–74.

Boden, M. T., Thompson, R. J., Dizén, M., Berenbaum, H., & Baker, J. P. (2013). Are emotional clarity and emotion differentiation related? *Cognition and Emotion*, *27*(6), 961–978. https://doi.org/10.1080/02699931.2012.751899

Bogart, K. R., & Matsumoto, D. (2010). Facial mimicry is not necessary to recognize emotion: Facial expression recognition by people with Moebius syndrome. *Social Neuroscience*, *5*(2), 241–251. https://doi.org/10.1080/17470910903395692

Bornstein, M. H., & Arterberry, M. E. (2003). Recognition, discrimination and categorization of smiling by 5-month-old infants. *Developmental Science*, *6*(5), 585–599.

Bosacki, S. L., & Moore, C. (2004). Preschoolers' understanding of simple and complex emotions: Links with gender and language. *Sex Roles*, *50*(9/10), 659–675. https://doi.org/10.1023/B:SERS.0000027568.26966.27

Brackett, M. A., Rivers, S. E., Reyes, M. R., & Salovey, P. (2012). Enhancing academic

performance and social and emotional competence with the RULER feeling words curriculum. *Learning and Individual Differences*, *22*(2), 218–224. https://doi.org/10.1016/j.lindif.2010.10.002

Bretherton, I., & Beeghly, M. (1982). Talking about internal states: The acquisition of an explicit theory of mind. *Developmental Psychology*, *18*(6), 906–921. https://doi.org/10.1037/0012-1649.18.6.906

Bridges, K. M. B. (1932). Emotional development in early infancy. *Child Development*, *3*(4), 324. https://doi.org/10.2307/1125359

Brooks, J. A., Shablack, H., Gendron, M., Satpute, A. B., Parrish, M. H., & Lindquist, K. A. (2017). The role of language in the experience and perception of emotion: a neuroimaging meta-analysis. *Social Cognitive and Affective Neuroscience*, *12*(2). https://doi.org/10.1093/scan/nsw121

Brown, G. L., Craig, A. B., & Halberstadt, A. G. (2015). Parent gender differences in emotion socialization behaviors vary by ethnicity and child gender. *Parenting*, *15*(3), 135–157. https://doi.org/10.1080/15295192.2015.1053312

Bullock, M., & Russell, J. A. (1986). Concepts of emotion in developmental psychology. In C. E. Izard & P. B. Read (Eds.), *Measuring emotions in infants and children* (pp. 203–237). Cambridge: Cambridge University Press.

Calabria, M., Miniussi, C., Bisiacchi, P. S., Zanetti, O., & Cotelli, M. (2009). Face–name repetition priming in semantic dementia: A case report. *Brain and Cognition*, *70*, 231–237.

Camras, L. A., & Allison, K. (1985). Children's understanding of emotional facial expressions and verbal labels. *Journal of Nonverbal Behavior*, *9*(2), 84–94. https://doi.org/10.1007/BF00987140

Camras, L. A., Oster, H., Bakeman, R., Meng, Z., Ujiie, T., & Campos, J. J. (2007). Do Infants

Show Distinct Negative Facial Expressions for Fear and Anger? Emotional Expression in 11-Month-Old European American, Chinese, and Japanese Infants. *Infancy*, *11*(2), 131–155.

Camras, L. A., & Shutter, J. M. (2010). Emotional facial expressions in infancy. *Emotion Review*, *2*(2), 120–129.

Caron, R. F., Caron, A. J., & Myers, R. S. (1982). Abstraction of invariant face expressions in infancy. *Child Development*, *53*, 1008–1015. https://doi.org/10.2307/1129141

Caron, R. F., Caron, A. J., & Myers, R. S. (1985). Do infants see emotional expressions in static faces? *Child Development*, *53*, 1552–1560.

Carstensen, L. L., Pasupathi, M., Mayr, U., & Nesselroade, J. R. (2000). Emotional experience in everyday life across the adult life span. *Journal of Personality and Social Psychology*, *79*(4), 644–655. https://doi.org/10.1037//0022-3514.79.4.644

Casey, B. J., Jones, R. M., & Hare, T. A. (2008). The adolescent brain. *Annals of the New York Academy of Sciences*. https://doi.org/10.1196/annals.1440.010

Castro, V. L., Halberstadt, A. G., Lozada, F. T., & Craig, A. B. (2014). Parents' emotion-related beliefs, behaviours, and skills predict children's recognition of emotion. *Infant and Child Development*, n/a-n/a. https://doi.org/10.1002/icd.1868

Chaplin, T. M., Cole, P. M., & Zahn-Waxler, C. (2005). Parental socialization of emotion expression: Gender differences and relations to child adjustment. *Emotion*, *5*(1), 80–88. https://doi.org/10.1037/1528-3542.5.1.80

Chester, D. S., Lynam, D. R., Milich, R., Powell, D. K., Andersen, A. H., & DeWall, C. N. (2016). How do negative emotions impair self-control? A neural model of negative urgency. *NeuroImage*, *132*, 43–50. https://doi.org/10.1016/j.neuroimage.2016.02.024

Clore, G. L., & Ortony, A. (2008). Appraisal theories: How cognition shapes affect into emotion.

In J. M. Haviland-Jones, M. Lewis, & L. F. Barrett (Eds.), *Handbook of Emotions* (Vol. 3, pp. 628–642). New York: Guilford.

Clore, G. L., & Ortony, A. (2013). Psychological construction in the OCC model of emotion. *Emotion Review*, *5*, 335–343.

Cohen, J. S., & Mendez, J. L. (2009). Emotion regulation, language ability, and the stability of preschool children's peer play behavior. *Early Education & Development*, *20*(6), 1016–1037. https://doi.org/10.1080/10409280903305716

Conti-Ramsden, G., & Botting, N. (2008). Emotional health in adolescents with and without a history of specific language impairment (SLI). *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *49*(5), 516–525. https://doi.org/10.1111/j.1469-7610.2007.01858.x

Cunningham, W. A., & Brosch, T. (2012). Motivational salience: Amygdala tuning from traits, needs, values, and goals. *Current Directions in Psychological Science*, *21*, 54–59.

Cunningham, W. A., Dunfield, K. A., & Stillman, P. E. (2013). Emotional states from affective dynamics. *Emotion Review*, *5*, 344–355.

Cutting, A. L., & Dunn, J. (1999). Theory of mind, emotion understanding, language, and family background: Individual differences and interrelations. *Child Development*, *70*(4), 853–865. https://doi.org/10.1111/1467-8624.00061

D'Entremont, B., & Muir, D. W. (1997). Five-months-olds' attention and affective responses to still-faced emotional expressions. *Infant Behavior and Development*, *20*(4), 563–568. https://doi.org/10.1016/S0163-6383(97)90047-3

de Haan, M., & Nelson, C. A. (1998). Discrimination and categorisation of facial expressions of emotion during infancy. In A. Slater (Ed.), *Perceptual Development: Visual, Auditory, and Speech Perception in Infancy* (pp. 287–309). Psychology Press.

de Rosnay, M., & Harris, P. L. (2002). Individual differences in children's understanding of

emotion: the roles of attachment and language. *Attachment & Human Development*, *4*(February 2015), 39–54. https://doi.org/10.1080/14616730210123139

de Rosnay, M., Pons, F., Harris, P. L., & Morrell, J. M. B. (2004). A lag between understanding false belief and emotion attribution in young children: Relationships with linguistic ability and mothers' mental-state language. *British Journal of Developmental Psychology*, *22*(2), 197–218. https://doi.org/10.1348/026151004323044573

Demiralp, E., Thompson, R. J., Mata, J., Jaeggi, S. M., Buschkuehl, M., Barrett, L. F., … Jonides, J. (2012). Feeling blue or turquoise? Emotional differentiation in major depressive disorder. *Psychological Science*, *23*(11), 1410–1416. https://doi.org/10.1177/0956797612444903

Denham, S. A., Blair, K. A., DeMulder, E., Levitas, J., Sawyer, K., Auerbach-Major, S., & Queenan, P. (2003). Preschool emotional competence: Pathway to social competence? *Child Development*, *74*(1), 238–256. https://doi.org/10.1111/1467-8624.00533

Denham, S. A., & Couchoud, E. A. (1990). Young preschoolers' understanding of emotions. *Child Study Journal*, *20*(3), 171–192.

Denham, S. A., Zoller, D., & Couchoud, E. A. (1994). Socialization of preschoolers' emotion understanding. *Developmental Psychology*, *30*(6), 928–936. https://doi.org/10.1037//0012-1649.30.6.928

Denham, S., & Kochanoff, A. T. (2002). Parental contributions to preschoolers' understanding of emotion. *Marriage & Family Review*, *34*(3–4), 311–343. https://doi.org/10.1300/J002v34n03

Dewaele, J. M., & Pavlenko, A. (2002). Emotion vocabulary in interlanguage. *Language Learning*. https://doi.org/10.1111/0023-8333.00185

Dewaele, J. M., & Pavlenko, A. (2004). Languages and emotions: A crosslinguistic perspective.

Journal of Multilingual and Multicultural Development, *25*(2–3), 93. https://doi.org/10.1080/01434630408666522

Dickson, K. L., Fogel, A., & Messinger, D. (1998). The development of emotion from a social process view. *What Develops in Emotional Development?*, 253.

Doyle, C. M., & Lindquist, K. A. (2018). When a word is worth a thousand pictures: Language shapes perceptual memory for emotion. *Journal of Experimental Psychology: General*, *147*, 62–73.

Dunn, J. (1995). Children as psychologists: The later correlates of individual differences in understanding of emotions and other minds. *Cognition and Emotion*, *9*(2–3), 187–201. https://doi.org/10.1080/02699939508409008

Dunn, J., Brown, J. R., & Beardsall, L. (1991). Family talk about feeling states and children's later understanding of others' emotions. *Developmental Psychology*, *27*(3), 448–455. https://doi.org/10.1037/0012-1649.27.3.448

Dunsmore, J. C., & Halberstadt, A. G. (1997). How does family emotional expressiveness affect children's schemas? In K. C. Barrett (Ed.), *The communication of emotion: Current research from diverse perspectives* (pp. 45–68). San Francisco: Jossey-Bass.

Dunsmore, J. C., & Halberstadt, A. G. (2009). The dynamic cultural context of emotion socialization. In *Pathways of human development: Explorations of change.* (pp. 171–190).

Dunsmore, J. C., Her, P., Halberstadt, A. G., & Perez-Rivera, M. B. (2009). Parents' beliefs about emotions and children's recognition of parents' emotions. *Journal of Nonverbal Behavior*, *33*(2), 121–140. https://doi.org/10.1007/s10919-008-0066-6

Dunsmore, J. C., & Karn, M. A. (2004). The influence of peer relationships and maternal socialization on kindergartners' developing emotion knowledge. *Early Education & Development*, *15*(1), 39–56. https://doi.org/10.1207/s15566935eed1501

Eggum, N. D., Eisenberg, N., Kao, K., Spinrad, T. L., Bolnick, R., Hofer, C., … Fabricius, W. V. (2011). Emotion understanding, theory of mind, and prosocial orientation: Relations over time in early childhood. *Journal of Positive Psychology*, *6*(1), 4–16. https://doi.org/10.1080/17439760.2010.536776

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry*, *9*(4), 241–273. https://doi.org/10.1207/s15327965pli0904_1

Eisenberg, N., Sadovsky, A., & Spinrad, T. L. (2005). Associations of emotion-related regulation with language skills, emotion knowledge, and academic outcomes. *New Directions for Child and Adolescent Development*, (109), 109–118. https://doi.org/10.2964/jsik.kuni0223

Ekman, P. (1972). Universals and cultural differences in facial expressions of emotion. In *Nebraska symposium on emotion and motivation, 1971* (pp. 207–283). Lincoln, Nebraska: University of Nebraska Press.

Ekman, P. (1992). An argument for basic emotions. *Cognition & Emotion*, *6*(3), 169–200. https://doi.org/10.1080/02699939208411068

Ekman, P., & Cordaro, D. (2011). What is meant by calling emotions basic. *Emotion Review*, *3*(4), 364–370. https://doi.org/10.1177/1754073911410740

Ereky-Stevens, K. (2008). Associations between mothers' sensitivity to their infants' internal states and children's later understanding of mind and emotion. *Infant and Child Development*, *17*(5), 527–543. https://doi.org/10.1002/icd.572

Field, T. M., Woodson, R., Cohen, D., Greenberg, R., Garcia, R., & Collins, K. (1983). Discrimination and imitation of facial expressions by term and preterm neonates. *Infant Behavior and Development*, *6*(4), 485–489. https://doi.org/10.1016/S0163-6383(83)90316-8

Field, T. M., Woodson, R., Greenberg, R., & Cohen, D. (1982). Discrimination and imitation of facial expression by neonates. *Science*, *218*(4568), 179–181.

https://doi.org/10.1126/science.7123230

Fivush, R., Brotman, M. A., Buckner, J. P., & Goodman, S. H. (2000). Gender differences in parent–child emotion narratives. *Sex Roles*, *42*, 233–253. https://doi.org/10.1023/A:1007091207068

Fivush, R., Haden, C. A., & Reese, E. (2006). Elaborating on elaborations: Role of maternal reminiscing style in cognitive and socioemotional development. *Child Development*, *77*(6), 1568–1588. https://doi.org/10.1111/j.1467-8624.2006.00960.x

Flom, R., & Bahrick, L. E. (2007). The development of infant discrimination of affect in multimodal and unimodal stimulation: The role of intersensory redundancy. *Developmental Psychology*, *43*(1), 238.

Fogel, A., Nwokah, E., Dedo, J. Y., Messinger, D., Dickson, K. L., Matusov, E., & Holt, S. A. (1992). Social process theory of emotion: A dynamic systems approach. *Social Development*, *1*(2), 122–142. https://doi.org/10.1111/j.1467-9507.1992.tb00116.x

Fridlund, A. J. (1991). Evolution and facial action in reflex, social motive, and paralanguage. *Biological Psychology*. https://doi.org/10.1016/0301-0511(91)90003-Y

Fridlund, A. J. (1994). *Human facial expression: An evolutionary view*. Academic Press.

Fugate, J. M. B. (2013). Categorical perception for emotional faces. *Emotion Review*, *5*(1), 84–89. https://doi.org/10.1177/1754073912451350

Fugate, J. M. B., Gendron, M., Satoshi, F. N., & Barrett, L. F. (2017). Emotion words: Adding face value. *Emotion*.

Garnefski, N., Kraaij, V., & van Etten, M. (2005). Specificity of relations between adolescents' cognitive emotion regulation strategies and Internalizing and Externalizing psychopathology. *Journal of Adolescence*, *28*(5), 619–631. https://doi.org/10.1016/j.adolescence.2004.12.009

Garner, P., Robertson, S., & Smith, G. (1997). Preschool children's emotional expressions with peers: The roles of gender and emotion socialization. *Sex Roles*, *36*, 675–691. https://doi.org/doi:10.1023/A:1025601104859

Geangu, E., Ichikawa, H., Lao, J., Kanazawa, S., Yamaguchi, M. K., Caldara, R., & Turati, C. (2016). Culture shapes 7-month-olds' perceptual strategies in discriminating facial expressions of emotion. *Current Biology*. https://doi.org/10.1016/j.cub.2016.05.072

Gendron, M., Lindquist, K. A., Barsalou, L., & Barrett, L. F. (2012). Emotion words shape emotion percepts. *Emotion*, *12*(2), 314–325. https://doi.org/10.1037/a0026007

Goldstone, R. (1994). Influences of categorization on perceptual discrimination. *Journal of Experimental Psychology: General*, *2*, 178–200.

Gorno-Tempini, M. L., Hillis, A. E., Weintraub, S., Kertesz, A., Mendez, M., Cappa, S. F., … Grossman, M. (2011). Classification of primary progressive aphasia and its variants. *Neurology*, *76*, 1006–1014.

Gosselin, F., & Schyns, P. G. (2001). Bubbles: A technique to reveal the use of information in recognition tasks. *Vision Research*, *41*(17), 2261–2271. https://doi.org/10.1016/S0042-6989(01)00097-9

Grazzani, I., Ornaghi, V., Conte, E., Pepe, A., & Caprin, C. (2018). The relation between emotion understanding and theory of mind in children aged 3 to 8: The key role of language. *Frontiers in Psychology*, *9*(MAY), 1–10. https://doi.org/10.3389/fpsyg.2018.00724

Grindrod, C. M., Bilenko, N. Y., Myers, E. B., & Blumstein, S. E. (2008). The role of the left inferior frontal gyrus in implicit semantic competition and selection: An event-related fMRI study. *Brain Research*, *1229*, 167–178. https://doi.org/10.1016/j.brainres.2008.07.017

Gross, J. J., Carstensen, L. L., Pasupathi, M., Tsai, J., Skorpen, C. G., & Hsu, A. Y. C. (1997).

Emotion and aging: Experience, expression, and control. *Psychology and Aging*, *12*(4), 590–599. https://doi.org/10.1037/0882-7974.12.4.590

Grossmann, I., Na, J., Varnum, M. E. W., Park, D. C., Kitayama, S., & Nisbett, R. E. (2010). Reasoning about social conflicts improves into old age. *Proceedings of the National Academy of Sciences*, *107*(16), 7246–7250. https://doi.org/10.1073/pnas.1001715107

Grossmann, T. (2010). The development of emotion perception in face and voice during infancy. *Restorative Neurology and Neuroscience*. https://doi.org/10.3233/RNN-2010-0499

Hagelskamp, C., Brackett, M. A., Rivers, S. E., & Salovey, P. (2013). Improving classroom quality with the RULER Approach to social and emotional learning: Proximal and distal outcomes. *American Journal of Community Psychology*, *51*(3–4), 530–543. https://doi.org/10.1007/s10464-013-9570-x

Haith, M. M., Bergman, T., & Moore, M. J. (1977). Eye contact and face scanning in early infancy. *Science*, *198*(4319), 853–855. https://doi.org/10.1126/science.918670

Halberstadt, A. G. (1986). Family socialization of emotional expression and nonverbal communication styles and skills. *Journal of Personality and Social Psychology*, *51*(4), 827–836. https://doi.org/10.1037/0022-3514.51.4.827

Halberstadt, A. G., Denham, S. A., & Dunsmore, J. C. (2001). Affective social competence. *Social Development*, *10*(1), 79–119. https://doi.org/10.1111/1467-9507.00150

Halberstadt, A. G., Dennis, P. A., & Hess, U. (2011). The influence of family expressiveness, individuals' own emotionality, and self-expressiveness on perceptions of others' facial expressions. *Journal of Nonverbal Behavior*, *35*(1), 35–50. https://doi.org/10.1007/s10919-010-0099-5

Halberstadt, A. G., & Eaton, K. L. (2002). A meta-analysis of family expressiveness and children's emotion expressiveness and understanding. *Marriage & Family Review*, *34*(1–2),

35–62. https://doi.org/10.1300/J002v34n01_03

Halberstadt, A. G., & Lozada, F. T. (2011). Emotion development in infancy through the lens of culture. *Emotion Review*, *3*(2), 158–168. https://doi.org/10.1177/1754073910387946

Hare, T. A., Tottenham, N., Galvan, A., Voss, H. U., Glover, G. H., & Casey, B. J. (2008). Biological substrates of emotional reactivity and regulation in adolescence during an emotional go-nogo task. *Biological Psychiatry*, *63*(10), 927–934. https://doi.org/10.1016/j.biopsych.2008.03.015

Harris, P. L., De Rosnay, M., & Pons, F. (2005). Language and children's understanding of mental states. *Current Directions in Psychological Science*. https://doi.org/10.1111/j.0963-7214.2005.00337.x

Hatzenbuehler, M. L., McLaughlin, K. A., & Nolen-Hoeksema, S. (2008). Emotion regulation and internalizing symptoms in a longitudinal study of sexual minority and heterosexual adolescents. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *49*(12), 1270–1278. https://doi.org/10.1111/j.1469-7610.2008.01924.x

Hodges, J. R., & Patterson, K. (2007). Semantic dementia: a unique clinicopathological syndrome. *Lancet Neurol*, *6*(11), 1004–1014. Retrieved from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=17945154

Izard, C. E. (1971). *The face of emotion*. Appleton-Century-Crofts New York. https://doi.org/10.1109/IGARSS.1992.578647

Izard, C. E. (1994). Innate and universal facial expressions: Evidence from developmental and cross-cultural research. *Psychological Bulletin*, *115*(2), 288–299. https://doi.org/10.1037/0033-2909.115.2.288

Izard, C. E. (2007). Basic emotions, natural kinds, emotion schemas, and a new paradigm.

Perspectives on Psychological Science, *2*(3), 260–280. https://doi.org/10.1111/j.1745-6916.2007.00044.x

Izard, C. E., & Malatesta, C. Z. (1987). Perspectives on emotional development I: Differential emotions theory of early emotional development. In J. D. Osofsky (Ed.), *Wiley series on personality processes. Handbook of infant development* (pp. 494–554). Oxford, England: John Wiley.

Jack, R. E., Blais, C., Scheepers, C., Schyns, P. G., & Caldara, R. (2009). Cultural confusions show that facial expressions are not universal. *Current Biology*, *19*(18), 1543–1548. https://doi.org/10.1016/j.cub.2009.07.051

Jack, R. E., Garrod, O. G. B., Yu, H., Caldara, R., & Schyns, P. G. (2012). Facial expressions of emotion are not culturally universal. *Proceedings of the National Academy of Sciences*, *109*(19), 7241–7244. https://doi.org/10.1073/pnas.1200155109

Jastorff, J., De Winter, F. L., Van den Stock, J., Vandenberghe, R., Giese, M. A., & Vandenbulcke, M. (2016). Functional dissociation between anterior temporal lobe and inferior frontal gyrus in the processing of dynamic body expressions: Insights from behavioral variant frontotemporal dementia. *Human Brain Mapping*, *37*(12), 4472–4486. https://doi.org/10.1002/hbm.23322

Kashdan, T. B., Barrett, L. F., & McKnight, P. E. (2015). Unpacking emotion differentiation: Transforming unpleasant experience by perceiving distinctions in negativity. *Current Directions in Psychological Science*, *24*(1), 10–16. https://doi.org/10.1177/0963721414550708

Kassam, K. S., & Mendes, W. B. (2013). The effects of measuring emotion: physiological reactions to emotional situations depend on whether someone is asking. *PLOS One*, *8*(7), e64959. https://doi.org/10.1371/journal.pone.0064959PONE-D-12-38157 [pii]

Kestenbaum, R., & Nelson, C. A. (1990). The recognition and categorization of upright and inverted emotional expressions by 7-month-old infants. *Infant Behavior and Development*, *13*(4), 497–511. https://doi.org/10.1016/0163-6383(90)90019-5

Kim, H., Somerville, L. H., Johnstone, T., Alexander, A. L., & Whalen, P. J. (2003). Inverse amygdala and medial prefrontal cortex responses to surprised faces. *Neuroreport*, *14*(18), 2317–2322. https://doi.org/10.1097/01.wnr.0000101520.44335.20

Kim, H., Somerville, L. H., Johnstone, T., Polis, S., Alexander, A. L., Shin, L. M., & Whalen, P. J. (2004). Contextual modulation of amygdala responsivity to surprised faces. *Journal of Cognitive Neuroscience*, *16*(10), 1730–1745. https://doi.org/10.1162/0898929042947865

Kirkland, T., & Cunningham, W. A. (2012). Mapping emotions through time: How affective trajectories inform the language of emotion. *Emotion*, *12*, 268–282.

Kotsoni, E., de Haan, M., & Johnson, M. H. (2001). Categorical perception of facial expressions by 7-month-old infants. *Perception*, *30*(9), 1115–1125. https://doi.org/10.1068/p3155

Koven, M. (2017). Language Awareness and Multilingualism. In *Language Awareness and Multilingualism* (pp. 67–82). https://doi.org/10.1007/978-3-319-02325-0

Kuchuk, A., Vibbert, M., & Bornstein, M. H. (1986). The perception of smiling and its experimental correlates. *Child Development*, *57*, 1054.

Kuebli, J., Butler, S., & Fivush, R. (1995). Mother-child talk about past emotions: Relations of maternal language and child gender over time. *Cognition and Emotion*, *9*(2–3), 265–283. https://doi.org/10.1080/02699939508409011

Labouvie-Vief, G., DeVoe, M., & Bulka, D. (1989). Speaking about feelings: conceptions of emotion across the life span. *Psychology and Aging*, *4*(4), 425–437. https://doi.org/10.1037/0882-7974.4.4.425

Lane, J. D., Wellman, H. M., Olson, S. L., LaBounty, J., & Kerr, D. C. R. (2010). Theory of

mind and emotion understanding predict moral development in early childhood. *British Journal of Developmental Psychology*. https://doi.org/10.1348/026151009X483056

Lee, K., Lindquist, K. A., & Payne, B. K. (in press). Constructing bias: Conceptualization breaks the link between implicit bias and fear of Black Americans. *Emotion*.

Lieberman, M. D., Eisenberger, N. I., Crockett, M. J., Tom, S. M., Pfeifer, J. H., & Way, B. M. (2007). Putting feelings into words. *Psychological Science*, *18*(5), 421.

Lieberman, M. D., Inagaki, T. K., Tabibnia, G., & Crockett, M. J. (2011). Subjective responses to emotional stimuli during labeling, reappraisal, and distraction. *Emotion*, *11*(3), 468–480. https://doi.org/10.1037/a0023503

Lindquist, K. A. (2013). Emotions emerge from more basic psychological ingredients: A modern psychological constructionist model. *Emotion Review*, *5*, 356–368.

Lindquist, K. A. (2017). The role of language in emotion: existing evidence and future directions. *Current Opinion in Psychology*. https://doi.org/10.1016/j.copsyc.2017.07.006

Lindquist, K. A., & Barrett, L. F. (2008a). Constructing emotion: The experience of fear as a conceptual act. *Psychological Science*, *19*(9), 898–903.

Lindquist, K. A., & Barrett, L. F. (2008). Constructing emotion: The experience of fear as a conceptual act. *Psychological Science*, *19*(9), 898–903. https://doi.org/10.1111/j.1467-9280.2008.02174.x

Lindquist, K. A., & Barrett, L. F. (2008b). Emotional complexity. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of Emotions* (3rd ed.). New York: Guilford.

Lindquist, K. A., Barrett, L. F., Bliss-Moreau, E., & Russell, J. A. (2006). Language and the perception of emotion. *Emotion*, *6*(1), 125–138. https://doi.org/10.1037/1528-3542.6.1.125

Lindquist, K. A., & Gendron, M. (2013). What's in a Word? Language Constructs Emotion Perception. *Emotion Review*, *5*(1), 66–71. https://doi.org/10.1177/1754073912451351

Lindquist, K. A., Gendron, M., Barrett, L. F., & Dickerson, B. C. (2014). Emotion perception, but not affect perception, is impaired with semantic memory loss. *Emotion*, *14*(2), 375–387. https://doi.org/10.1037/a0035293

Lindquist, K. A., Gendron, M., & Satpute, A. (2016). Language and emotion: Putting feelings into words and words into feelings. In M. Lewis, J. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of Emotions* (4th ed.). New York: Guildford.

Lindquist, K. A., MacCormack, J. K., & Shablack, H. (2015). The role of language in emotion: Predictions from psychological constructionism. *Frontiers in Psychology*, *6*(MAR). https://doi.org/10.3389/fpsyg.2015.00444

Lindquist, K. A., Satpute, A. B., & Gendron, M. (2015). Does language do more than communicate emotion? *Current Directions in Psychological Science*, *24*(2), 99–108. https://doi.org/10.1177/0963721414553440

Lozada, F. T., Halberstadt, A. G., Craig, A. B., Dennis, P. A., & Dunsmore, J. C. (2016). Parents' beliefs about children's emotions and parents' emotion-related conversations with their children. *Journal of Child and Family Studies*, *25*(5), 1525–1538. https://doi.org/10.1007/s10826-015-0325-1

Ludemann, P. M., & Nelson, C. A. (1988). Categorical representation of facial expressions by 7-month-old infants. *Developmental Psychology*, *24*(4), 492–501. https://doi.org/10.1037/0012-1649.24.4.492

Lupyan, G. (2012). Linguistically modulated perception and cognition: the label-feedback hypothesis. *Front Psychol*, *3*, 54. https://doi.org/10.3389/fpsyg.2012.00054

Lupyan, G., Rakison, D. H., & McClelland, J. L. (2007). Language is not just for talking: Redundant labels facilitate learning of novel categories. *Psychological Science*, *18*(12), 1077–1083.

MacCormack, J. K., Henry, T. R., Davis, B. M., & Lindquist, K. A. (under review). Aging bodies, aging emotions: Interoceptive differences in emotion knowledge and self-report across adulthood.

MacCormack, J. K., & Lindquist, K. A. (in press). Hanger: When hunger is conceptualized as emotion. *Emotion*.

Majid, A. (2012). Current Emotion Research in Language Sciences. *Emotion Review*, *4*(4), 432–443. https://doi.org/10.1177/1754073916665470

Matsumoto, D. (1987). The Role of Facial Response in the Experience of Emotion: More Methodological Problems and a Meta-Analysis. *Journal of Personality and Social Psychology*, *52*(4), 769–774. https://doi.org/10.1037/0022-3514.52.4.769

Matsumoto, D. (1993). Ethnic differences in affect intensity, emotion judgments, display rules, and self-reported emotional expression. . *Motivation and Emotion*, (17), 107–123.

Matsumoto, D., & Kupperbusch, C. (2001). Idiocentric and allocentric differences in emotional expression, experience, and the coherence between expression and experience. *Asian Journal of Social Psychology*, *4*(2), 113–131. https://doi.org/10.1111/j.1467-839X.2001.00080.x

Maurer, D., & Salapatek, P. (1976). Developmental changes in the scanning of faces by young infants. *Child Development*, *47*(2), 523–527. https://doi.org/10.2307/1128813

Mauss, I. B., & Robinson, M. D. (2009). Measures of emotion: A review. *Cognition & Emotion*, *23*, 209–237.

Mayer, J. D., Salovey, P., & Caruso, D. R. (2008). Emotional Intelligence: New Ability or Eclectic Traits? *American Psychologist*, *63*(6), 503–517. https://doi.org/10.1037/0003-066X.63.6.503

Mayer, J. D., Salovey, P., Caruso, D. R., & Sitarenios, G. (2001). Emotional Intelligence as a

Standard Intelligence. *Emotion*. https://doi.org/10.1037/1528-3542.1.3.232

McClure, E. B. (2000). A meta-analytic review of sex differences in facial expression processing and their development in infants, children, and adolescents. *Psychological Bulletin*, *126*(3), 424–453. https://doi.org/10.1037/0033-2909.126.3.424

McElwain, N. L., Halberstadt, A. G., & Volling, B. L. (2007). Mother- and father-reported reactions to children's negative emotions: Relations to young children's emotional understanding and friendship quality. *Child Development*, *78*(5), 1407–1425. https://doi.org/10.1111/j.1467-8624.2007.01074.x

McLaughlin, K. A., Hatzenbuehler, M. L., & Hilt, L. M. (2009). Emotion dysregulation as a mechanism linking peer victimization to internalizing symptoms in adolescents. *Journal of Consulting and Clinical Psychology*, *77*(5), 894–904. https://doi.org/10.1037/a0015760

Meltzoff, A. N., & Moore, M. K. (1977). Imitation of facial and manual gestures by human neonates. *Science*, *198*(4312), 75–78. https://doi.org/10.1126/science.198.4312.75

Mondloch, C. J. (2012). Sad or fearful? The influence of body posture on adults' and children's perception of facial displays of emotion. *Journal of Experimental Child Psychology*, *111*(2), 180–196. https://doi.org/10.1016/j.jecp.2011.08.003

Montagne, B., Kessels, R. P. C., Frigerio, E., De Haan, E. H. F., & Perrett, D. I. (2005). Sex differences in the perception of affective facial expressions: Do men really lack emotional sensitivity? *Cognitive Processing*, *6*(2), 136–141. https://doi.org/10.1007/s10339-005-0050-6

Montague, D. P. F., & Walker-Andrews, A. S. (2001). Peekaboo: A new look at infants' perception of emotion expressions. *Developmental Psychology*, *37*(6), 826–838. https://doi.org/10.1037//0012-1649.37.6.826

Nelson, C. A. (1987). The recognition of facial expressions in the first two years of life:

mechanisms of development. *Child Developmentevelopment*, *58*(4), 889–909. https://doi.org/http://dx.doi.org/10.2307/1130530

Nelson, C. A., & Dolgin, K. G. (1985). The generalized discrimination of facial expressions by seven-month-old infants. *Child Development*, *56*(1983), 58–61. https://doi.org/10.2307/1130173

Nelson, C. A., Morse, P., & Leavitt, L. (1979). Recognition of facial expressions by seven-month-old infants. *Child Development*, *50*(4), 1239–1242. https://doi.org/10.2307/1129358

Nelson, N. L., & Russell, J. A. (2016). A facial expression of pax: Assessing children's "recognition" of emotion from faces. *Journal of Experimental Child Psychology*, *141*, 49–64. https://doi.org/10.1016/j.jecp.2015.07.016

Neta, M., & Whalen, P. J. (2010). The primacy of negative interpretations when resolving the valence of ambiguous facial expressions. *Psychological Science*, *21*(7), 901–907. https://doi.org/10.1177/0956797610373934

Niles, A. N., Craske, M. G., Lieberman, M. D., & Hur, C. (2015). Affect labeling enhances exposure effectiveness for public speaking anxiety. *Behaviour Research and Therapy*, *68*, 27–36. https://doi.org/10.1016/j.brat.2015.03.004

Nook, E. C., Lindquist, K. A., & Zaki, J. (2015). A new look at emotion perception: Concepts speed and shape facial emotion recognition. *Emotion*, *15*(5), 569–578. https://doi.org/10.1037/a0039166

Nook, E. C., Sasse, S. F., Lambert, H. K., McLaughlin, K. A., & Somerville, L. H. (2017). Increasing verbal knowledge mediates development of multidimensional emotion representations. *Nature Human Behavior*, *1*(12), 881.

O'Kearney, R., & Dadds, M. (2004). Developmental and gender differences in the language for emotions across the adolescent years. *Cognition & Emotion*, *18*(7), 913–938.

https://doi.org/10.1080/02699930341000356

Oakes, L. M. (2010). Using habituation of looking time to assess mental processes in infancy. *Journal of Cognition and Development*, *11*(3), 255–268. https://doi.org/10.1080/15248371003699977

Ozanska-Ponikwia, K. (2013). *Emotions from a Bilingual Point of View*. Cambridge Scholars Publishing.

Panayiotou, A. (2004). Switching codes, switching code: Bilinguals' emotional responses in english and Greek. *Journal of Multilingual and Multicultural Development*, *25*(2–3), 124–139. https://doi.org/10.1080/01434630408666525

Panicacci, A. (2013). Emotions from a bilingual point of view: personality and emotional intelligence in relation to perception and expression of emotions in the L1 and L2. *International Journal of Bilingual Education and Bilingualism*, *17*(6), 727–730. https://doi.org/10.1080/13670050.2013.857505

Pavlenko, A. (2005). Bilingualism and Thought. In *Handbook of Bilingualism: Psycholinguistic Approaches* (pp. 433–453). https://doi.org/10.1017/S0272263107210071

Pavlenko, A. (2008). Structural and conceptual equivalence in the acquisition and use of emotion words in a second language. *Mental Lexicon*, *3*, 91–120.

Pavlenko, A., & Driagina, V. (2007). Russian emotion vocabulary in American learners' narratives. *Modern Language Journal*, *91*(2), 213–234. https://doi.org/10.1111/j.1540-4781.2007.00541.x

Peltola, M. J., Leppänen, J. M., Mäki, S., & Hietanen, J. K. (2009). Emergence of enhanced attention to fearful faces between 5 and 7 months of age. *Social Cognitive and Affective Neuroscience*, *4*(2), 134–142. https://doi.org/10.1093/scan/nsn046

Pennebaker, J. W., & Stone, L. D. (2003). Words of wisdom: Language use over the life span.

Journal of Personality and Social Psychology. https://doi.org/10.1037/0022-3514.85.2.291

Perlman, S. B., Camras, L. A., & Pelphrey, K. A. (2008). Physiology and functioning: Parents' vagal tone, emotion socialization, and children's emotion knowledge. *Journal of Experimental Child Psychology*, *100*(4), 308–315. https://doi.org/10.1016/j.jecp.2008.03.007

Pons, F., Harris, P. L., & de Rosnay, M. (2004). Emotion comprehension between 3 and 11 years: Developmental periods and hierarchical organization. *European Journal of Developmental Psychology*, *1*(2), 127–152. https://doi.org/10.1080/17405620344000022

Pons, F., Lawson, J., Harris, P. L., & De Rosnay, M. (2003). Individual differences in children's emotion understanding: Effects of age and language. *Scandinavian Journal of Psychology*, *44*(4), 347–353. https://doi.org/10.1111/1467-9450.00354

Quinn, P. C., Anzures, G., Izard, C. E., Lee, K., Pascalis, O., Slater, A. M., & Tanaka, J. W. (2011). Looking across domains to understand infant representation of emotion. *Emotion Review*, *3*(2), 197–206. https://doi.org/10.1177/1754073910387941

Ridgeway, D., Waters, E., & Kuczaj, S. (1985). Acquisition of emotion-descriptive language: Receptive and productive vocabulary norms for ages 18 months to 6 years. *Developmental Psychology*, *21*(5), 901–908. https://doi.org/10.1037//0012-1649.21.5.901

Rivers, S. E., Brackett, M., Omori, M., Sickler, C., Bertoli, M. C., & Salovey, P. (2013). Emotion skills as a protective factor for risky behaviors among college students. *Journal of College Student Development*, *54*(2), 172–183. https://doi.org/10.1353/csd.2013.0012

Roberson, D., & Davidoff, J. (2000). The categorical perception of colors and facial expressions: The effect of verbal interference. *Memory and Cognition*, *28*(6), 977–986.

Roberson, D., Davidoff, J., & Braisby, N. (1999). Similarity and categorisation: neuropsychological evidence for a dissociation in explicit categorisation tasks. *Cognition*,

71(1), 1–42. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10394708

Rosen, H. J., Pace-Savitsky, K., Perry, R. J., Kramer, J. H., Miller, B. L., & Levenson, R. W. (2004). Recognition of emotion in the frontal and temporal variants of frontotemporal dementia. *Dementia and Geriatric Cognitive Disorders*, *17*(4), 277–281. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15178936

Ruba, A. L., Johnson, K. M., Harris, L. T., & Wilbourn, M. P. (2017). Developmental changes in infants' categorization of anger and disgust facial expressions. *Developmental Psychology*. https://doi.org/10.1037/dev0000381

Ruba, A.L. & Repacholi, B. (forthcoming). Do infants understand discrete emotions? A review of early emotion concept development. *Emotion Review.*

Russell, J. A. (1990). The preschooler's understanding of the causes and consequences of emotion. *Child Development*, *61*(6), 1872–1881. https://doi.org/10.1111/j.1467-8624.1990.tb03571.x

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review*, *110*(1), 145.

Russell, J. A. (2003). Core affect annd the psychological construction of emotion. *Psychological Review*, *110*(1), 145–172. https://doi.org/10.1037/0033-295X.110.1.145

Russell, J. a., & Bullock, M. (1986). Fuzzy Concepts and the Perception of Emotion in Facial Expressions. *Social Cognition*, *4*(3), 309–341. https://doi.org/10.1521/soco.1986.4.3.309

Russell, J. A., & Bullock, M. (1986). On the dimensions preschoolers use to interpret facial expressions of emotion. . *Developmental Psychology*, *22*, 97–102.

Russell, J. A., & Widen, S. C. (2002). Words versus faces in evoking preschool children's knowledge of the causes of emotions. *International Journal of Behavioral Development*, *26*(2), 97–103. https://doi.org/10.1080/01650250042000582

Saarni, C., Campos, J. J., Camras, L. A., & Witherington, D. (2006). Emotional development: Action, communication, and understanding. *Handbook of Child Psychology*.

Salmon, K., O'Kearney, R., Reese, E., & Fortune, C.-A. (2016). The role of language skill in child psychopathology: Implications for intervention in the early years. *Clinical Child and Family Psychology Review*, *19*(4), 352–367. https://doi.org/10.1007/s10567-016-0214-1

Satpute, A. B., Kang, J., Bickart, K. C., Yardley, H., Wager, T. D., & Barrett, L. F. (2015). Involvement of sensory regions in affective experience: A meta-analysis. *Frontiers in Psychology*, *6*(DEC), 1–14. https://doi.org/10.3389/fpsyg.2015.01860

Satpute, A. B., Shu, J., Weber, J., Roy, M., & Ochsner, K. N. (2013). The functional neural architecture of self-reports of affective experience. *Biological Psychiatry*, *73*(7), 631–638. https://doi.org/10.1016/j.biopsych.2012.10.001S0006-3223(12)00855-4 [pii]

Schwartz, G. M., Izard, C. E., & Ansul, S. E. (1985). The 5-month-old's ability to discriminate facial expressions of emotion. *Infant Behavior and Development*, *8*(1), 65–77. https://doi.org/10.1016/S0163-6383(85)80017-5

Serrano, J. M., Iglesias, J., & Loeches, A. (1992). Visual discrimination and recognition of facial expressions of anger, fear, and surprise in 4- to 6-month-old infants. *Developmental Psychobiology*, *25*(6), 411–425. https://doi.org/10.1002/dev.420250603

Serrano, J. M., Iglesias, J., & Loeches, A. (1995). Infants' responses to adult static facial expressions. *Infant Behavior and Development*, *18*(4), 477–482. https://doi.org/10.1016/0163-6383(95)90036-5

Shablack, H., Lindquist, K. A., & Becker, M. (under review). How do children learn novel emotion words? A study of emotion concept acquisition in preschoolers.

Siegel, E. H., Sands, M. K., Van den Noortgate, W., Condon, P., Chang, Y., Dy, J., … Barrett, L. F. (2018). Emotion fingerprints or emotion populations? A meta-analytic investigation of

autonomic features of emotion categories. *Psychological Bulletin*, *144*(4), 343–393. https://doi.org/10.1037/bul0000128

Silvers, J., McRae, K., Gabrieli, J. D. E., Gross, J. J., Remy, K., & Ochsner, K. N. (2012). Age-related differences in emotional reactivity, regulation, and rejection sensitivity in adolescence. *Emotion*, *12*(6), 1235–1247. https://doi.org/10.1037/a0028297

Slater, A. M. (2002). Visual perception in the newborn infant: Issues and debates. *Intellectica*, *34*, 57–76.

Somerville, L. H., Jones, R. M., & Casey, B. J. (2010). A time of change: Behavioral and neural correlates of adolescent sensitivity to appetitive and aversive environmental cues. *Brain and Cognition*. https://doi.org/10.1016/j.bandc.2009.07.003

Somerville, L. H., & Whalen, P. J. (2006). Prior experience as a stimulus category confound: an example using facial expressions of emotion. *Social Cognitive and Affective Neuroscience*, *1*(3), 271–274. https://doi.org/10.1093/scan/nsl040

Sullivan, M. W., Carmody, D. P., & Lewis, M. (2010). How neglect and punitiveness influence emotion knowledge. *Child Psychiatry and Human Development*, *41*(3), 285–298. https://doi.org/10.1007/s10578-009-0168-3

Taumoepeau, M., & Ruffman, T. (2006). Mother and infant talk about mental states relates to desire language and emotion understanding. *Child Development*, *77*(2), 465–481. https://doi.org/10.1111/j.1467-8624.2006.00882.x

Taumoepeau, M., & Ruffman, T. (2008). Stepping stones to others' minds: Maternal talk relates to child mental state language and emotion understanding at 15, 24, and 33 months. *Child Development*, *79*(2), 284–302. https://doi.org/10.1111/j.1467-8624.2007.01126.x

Toppelberg, C. O., Medrano, L., Morgens, L. P., & Nieto-Castañon, A. (2002). Bilingual children referred for psychiatric services: Associations of language disorders, language

skills, and psychopathology. *Journal of the American Academy of Child and Adolescent Psychiatry*, *41*(6), 712–722. https://doi.org/10.1097/00004583-200206000-00011

Tronick, E. Z. (1989). Emotions and emotional communication in infants. *American Psychologist*, *44*(2).

Tsai, J. L., Louie, J. Y., Chen, E. E., & Uchida, Y. (2007). Learning what feelings to desire: Socialization of ideal affect through children's storybooks. *Personality and Social Psychology Bulletin*, *33*(1), 17–30. https://doi.org/10.1177/0146167206292749

Turati, C., Montirosso, R., Brenna, V., Ferrara, V., & Borgatti, R. (2011). A smile enhances 3-month-olds' recognition of an individual face. *Infancy*, *16*(3), 306–317. https://doi.org/10.1111/j.1532-7078.2010.00047.x

Twenge, J. M., Catanese, K. R., & Baumeister, R. F. (2003). Social exclusion and the deconstructed state: time perception, meaninglessness, lethargy, lack of emotion, and self-awareness. *Journal of Personality and Social Psychology*, *85*(3), 409–423. https://doi.org/10.1037/0022-3514.85.3.409

Vinden, P. G. (1999). Children's understanding of mind and emotion: A multi-culture study. *Cognition and Emotion*, *13*(1), 19–48. https://doi.org/10.1080/026999399379357

Visser, M., Jefferies, E., & Lambon Ralph, M. A. (2010). Semantic processing in the anterior temporal lobes: A meta-analysis of the functional neuroimaging literature. *Journal of Cognitive Neuroscience*, *22*(6), 1083–1094. Retrieved from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=19583477

Walker-Andrews, A. S. (1997). Infants' perception of expressive behaviors: Differentiation of multimodal information. *Psychological Bulletin*, *121*(3), 437–456. https://doi.org/10.1037/0033-2909.121.3.437

Wellman, H. M., Harris, P. L., Banerjee, M., & Sinclair, A. (1995). Early understanding of emotion: Evidence from natural language. *Cognition and Emotion*, *9*(2–3), 117–149. https://doi.org/10.1080/02699939508409005

Whalen, P. J. (2007). The uncertainty of it all. *Trends in Cognitive Sciences*, *11*(12), 499–500.

Whalen, P. J., Kagan, J., Cook, R. G., Davis, F. C., Kim, H., Polis, S., … Johnstone, T. (2004). Human amygdala responsivity to masked fearful eye whites. *Science (New York, N.Y.)*, *306*(5704), 2061. Retrieved from http://www.ncbi.nlm.nih.gov.ezp-prod1.hul.harvard.edu/pubmed/15604401

Widen, S. C. (2013). Children's interpretation of facial expressions: The long path from valence-based to specific discrete categories. *Emotion Review*, *5*, 72–77.

Widen, S. C., Pochedly, J. T., & Russell, J. A. (2015). The development of emotion concepts: A story superiority effect in older children and adolescents. *Journal of Experimental Child Psychology*, *131*, 186–192. https://doi.org/10.1016/j.jecp.2014.10.009

Widen, S. C., & Russell, J. A. (2003). A closer look at preschoolers' freely produced labels for facial expressions. *Developmental Psychology*, *39*(1), 114–127.

Widen, S. C., & Russell, J. A. (2008a). Children's and adults' understanding of the "disgust face." *Cognition and Emotion*, *22*(8), 1513–1541. https://doi.org/10.1080/02699930801906744

Widen, S. C., & Russell, J. A. (2008b). Children acquire emotion categories gradually. *Cognitive Development*, *23*(2), 291–312. https://doi.org/10.1016/j.cogdev.2008.01.002

Widen, S. C., & Russell, J. A. (2008). Young children's understanding of others' emotions. In J. M. Haviland-Jones, M. Lewis, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 348–363). New York: Guilford.

Widen, S. C., & Russell, J. A. (2013). Children's recognition of disgust in others. *Psychological*

Bulletin, *139*(2), 271–299. https://doi.org/10.1037/a0031640

Wong, M. S., McElwain, N. L., & Halberstadt, A. G. (2009). Parent, family, and child characteristics: Associations with mother- and father-reported emotion socialization practices. *Journal of Family Psychology*, *23*(4), 452–463. https://doi.org/10.1037/a0015552

Xu, F. (2002). The role of language in acquiring object kind concepts in infancy. *Cognition*, *85*(3), 223–250. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12169410

Yew, S. G. K., & O'Kearney, R. (2013). Emotional and behavioural outcomes later in childhood and adolescence for children with specific language impairments: Meta-analyses of controlled prospective studies. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *54*(5), 516–524. https://doi.org/10.1111/jcpp.12009

Young-Browne, G., Rosenfeld, H. M., & Horowitz, F. D. (1977). Infant Discrimination of Facial Expressions. *Child Development*, *48*(2), 555–562. https://doi.org/10.2307/1128653