

## Happiness and Joy

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### Abstract

Happiness and joy involve feelings of positive engagement which are prototypically expressed through the face, voice, and body. Joyful smiles tend to be strong and involve both eye-constriction (the Duchenne marker) and mouth opening. Through approximately two months of age, joyful expressions are primarily rooted in physiological arousal. Positive emotional expressions then quickly become more social, occurring in face-to-face interactions with caregivers as infants increasingly derive psychological meaning from individuals and events. Beginning in the second half of the first year of life, infants' expressions of positive emotion are increasingly incorporated into patterns of intentional communication. Between one and two years of age, positive expressivity is increasingly responsive to parental affective cues during pretense play. Preschoolers' between two to five years of age, utilize specific forms of positive emotion expressions to foster affiliation with their peers. By 8 years of age, children voluntarily control their expressions of positive emotion depending on the interpersonal context. These early expressions of joy are associated with later social competence, including reduced behavioral inhibition and reticence in reaction to novelty, compliance with parental requests, tolerance of new experiences, and attachment security. Further, positive expressivity is also linked to later life outcomes, primarily life satisfaction and overall well-being in adulthood. Positive emotion expression varies as a function of gender as well as cultural differences in the emotional significance and perceptions of positive expressions. Finally, the development of joyful expressivity is differentially sensitive to a variety of risk conditions, including maternal depression, prematurity, infant blindness, Down Syndrome, and Autism Spectrum Disorder.

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*Overview.* Happiness, and its more intense and short-lived companion joy, refer to positive subjective states ranging from contentment to elation (Ruch, 1993). In infancy, happiness and joy appear to be inextricably associated with characteristic expressive actions such as smiling and laughter which communicate a readiness for positive engagement (Sauter, McDonald, Gangi, & Messinger, 2014). Happiness and joy can be expressed by facial expressions such as smiling, positive vocalizations such as laughter, and ebullient body movement, as well as by self- and other report. Smiling and laughter are perhaps the most specific indices of happiness and joy, and the bulk of the chapter is devoted to these expressions. An initial overview of theoretical perspectives on the development of happiness and joy sets the stage for a review of behavioral expressions of happiness and joy.

### Theoretical perspectives on the development of positive emotion

*Cognitive differentiation theory.* Cognitive differentiation theory holds that joy involves awareness of the pleasure afforded by active engagement with the environment (Sroufe, 1995; Tomkins, 1962). Infants' active cognitive engagement with environmental events, and maybe even early awareness of their own pleasure, is thought to be necessary for the emergence of joy (Barrett, 2006; Bridges, 1932; Sroufe, 1995). Cognitive differentiation theory holds that joy develops out of more diffuse states of pleasurable positive valence prevalent through approximately six months of age. Joy itself is held to develop around nine months of age and is characterized by pronounced drops in cognitively mediated arousal which might occur, for example, during pretend play and is accompanied by intense smiling and laughing (Sroufe, 1995).

*Discrete emotion theory.* In contrast to a cognitive differentiation perspective discrete emotion theory posits a brain-based affect program of joy/happiness which organizes the output

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of multiple expressive systems. Smiles and laughter are thought to express a core joyful feeling state from infancy through childhood, adolescence, and the remainder of the the lifespan (Ackerman, Abe, & Izard, 1998; Izard & Ackerman, 2000; Lewis, 2000). Discrete emotion theory, like the functionalist approach described next, holds that joy motivates social approach and interaction, and facilitates social cohesion.

*Functionalist theory.* While discrete theories hold that joy resides within the individual, functionalist and dynamic theories argue that joy and other emotions exist in the relationship of the child to the social surround (Barrett, 1993; Campos, Mumme, Kermoian, & Campos, 1994; Witherington, Campos, & Hertenstein, 2001). Functionalist perspectives emphasize the adaptive role of happiness and joy in creating and maintaining relationships with social partners throughout development. Ethological research, guided by a functionalist perspective, has illustrated the communicative functions of smiles and other expressions in monkeys and apes, as well as human beings ((Bard, 1992; Burrows, Waller, Parr, & Bonar, 2006; Mizuno, Takeshita, & Matsuzawa, 2006; Redican, 1975; van Hooff, 1972). From one functionalist perspective, for example, early smiles are attachment behaviors whose function is to maintain caregivers in proximity to the infant (Bowlby, 1982).

*Dynamic systems theory.* This chapter uses a dynamic systems perspective as a superordinate orientation with which to integrate insights from other theoretical perspectives (Camras, 2000; Fogel et al., 1992; Messinger, Fogel, & Dickson, 1997; Thelen & Smith, 1994; Thelen & Ulrich, 1991; Witherington et al., 2001). A dynamic systems approach holds that positive emotion expressions are part and parcel of emotional processes. That is, smiling is both a constituent of the experience of joy, and a component of emotional communication with others.

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*Summary.* These theoretical approaches provide contrasting definitions of positive emotion, and insights into the empirical literature on the development of happiness and joy. Each approach also speaks to the clarity of behavioral evidence needed to infer happiness and joy. Below, we review evidence for the behavioral expressions of happiness and joy, which guide the presentation of empirical results in this chapter, and then consider the neurophysiology and genetics of happiness.

### Behavioral expressions of happiness and joy

*Smiles.* Infants express positive emotions such as happiness and joy through facial expressions, vocalizations, touch, and physical movement. Early smiles are often perceived as direct expressions of joyful feelings (see Figure 1). The apparent association between positive emotion and its expressions has motivated research on the emotional significance, causes, behavioral correlates and developmental consequences of early smiling. Piaget (1952) argued that a mastery smile indexed feelings of pleasurable accomplishment, while Darwin (1872/1998) concluded that the early waking smiles of his own infants were expressions of joy.

*Laughter.* Positive vocalizations that index happiness and joy include laughter and non-laughter vocalizations. Laughter is a rhythmic vocalization which occurs during open-mouthed smiles, and indexes intense positive emotion such as joy (Sroufe & Waters, 1976). Tickling and other physically stimulating games, are frequent elicitors of laughter in nonhuman as well as human primate infants (Davila-Ross, Jesus, Osborne, & Bard, 2015; Owren & Amoss, 2014). Laughter emerges between 2 and 5 months, and becomes more frequent through 24 months of age (Nwokah, Hsu, Dobrowolska, & Fogel, 1994; Washburn, 1929). Initial laughs sound much like early vowel-like vocalizations, but mothers recognize and comment on them (Nwokah & Fogel, 1993). Between 6 and 12 months of age, infants become more active participants in social

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games such as peekaboo, and are more likely to laugh during these games (Sroufe & Waters, 1976). From one and two years of age, infant and mother laugh onsets and offsets occur increasingly close in time, suggesting increasing coordination of joyful exchanges (Nwokah et al., 1994).

*Positive non-laughter vocalizations.* Non-laughter vocalizations include gurgling, positively toned babbling, and cooing, which are used to index positive affect in observational research on infant temperament (Fox, Henderson, Rubin, Calkins, & Schmidt, 2001; Goldsmith & Rothbart, 1999; Hane, Fox, Henderson, & Marshall, 2008). However, validation of the emotional specificity of these vocalizations is limited to their face validity and the longitudinal associations of the broader temperament dimensions they help index. In the context of smiling, many infant vocalizations seem to convey happiness and joy. Judges exhibit only moderate agreement when rating the affective tone of infant vocalizations from audio alone (Oller et al., 2013), although agreement increases when observers watch the infant as they listen to their vocalization (Franklin, Oller, Ramsdell, & Jhang, 2011). Yale (2003) found that infants tended to smile, and then vocalize during the course of the smile, finishing the vocalization before ending the smile. When infant nonlaughter vocalizations are temporally embedded in smiles, they appear to emphasize or accentuate the communication of positive emotion (Hsu, Fogel, & Messinger, 2001; Yale, Messinger, & Cobo-Lewis, 2003).

*Body movement and positive touch.* Darwin observed that children may tremble with joy, clap their hands with joy, and jump for joy (Darwin, 1872/1998). In the Lab-TAB measure of infant and child temperament, clapping, excited arm waving, and banging one's hands on a table are identified as positive motor activities (Goldsmith & Rothbart, 1999) because they occur during joy/pleasure episodes designed to elicit positive emotion. Although there has been little

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research on the degree to which body movement indexes positive emotion, touch may be a preferred mode of communicating prosocial emotions. Between 7 and 11 months, infants increasingly display affectionate touch dynamically by patting, hugging, and kissing the caregiver (Landau, 1989). More generally, warm, comfortable touch between infants and caregivers bolsters infants' regulation of arousal (Feldman, Singer, & Zagoory, 2010), and is associated with positive developmental outcomes such as secure attachment (Anisfeld, Casper, Nozyce, & Cunningham, 1990; Weiss, Wilson, Hertenstein, & Campos, 2000). In older children (5- and 6-year-olds), smile intensity is associated with warm family touch (Oveis, Gruber, Keltner, Stamper, & Boyce, 2009), suggesting positive emotional interaction between child and parents.

### The neurophysiology and genetics of happiness.

*The neurophysiology of smiling.* Heart rate is more rapid during infant smiling than during neutral expressions (Emde, Campos, Reich, & Gaensbauer, 1978), a pattern also seen in adults (Cacioppo, Berntson, Larsen, Poehlmann, & Ito, 2000). Anatomically, zygomaticus major contraction creates a smile by pulling the corners of the lips upward and to the side (see Figure 1). The zygomaticus major is innervated by the facial nerve (Elliot, 1969), which emanates from the facial motor nucleus located in the brainstem (Williams, Warick, Dyson, & Bannister, 1989). The facial motor nucleus receives inputs from one neural pathway involved in deliberate smiling and another involved in spontaneous smiling (Rinn, 1984). Spontaneous smiling, which is associated with happiness and joy, involves an extrapyramidal pathway stemming from the basal ganglia.

*The neurophysiology of happiness and joy.* Unexpectedly, meta-analyses of neuro-imaging studies of adults have not unambiguously identified regions of interest activated by positive

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emotions (Barrett & Wager, 2006), although the ventromedial prefrontal cortex (Lindquist, Satpute, Wager, Weber, & Barrett, 2016), the anterior cingulate cortex (Murphy, Nimmo-Smith, & Lawrence, 2003), and the basal ganglia (Phan, Wager, Taylor, & Liberzon, 2004) are candidate structures. More robust evidence suggests an association of joy and other approach related emotions with laterality differences in cerebral activation (Barrett & Wager, 2006). Emotions involving approach motivation, particularly joy, are associated with greater left than right frontal cerebral activation (Murphy et al., 2003). Laterality differences, combined with an absence of robust structural candidates, suggests a distributed cerebral basis for positive emotions, one which may involve distributed activation networks.

*Environmental variability overshadows inherited variability.* Parent reports of infant temperament involving expressions of happiness and joy (indexed by questions about smiling and laughter) have revealed both genetic and environmental effects (Goldsmith, Buss, & Lemery, 1997; Goldsmith, Lemery, Buss, & Campos, 1999). These results contrast with questions about infants' expression of negative emotions, which show higher genetic and lower environmental effects. A recent report suggested an even more striking contrast (Planalp, Van Hulle, Lemery-Chalfant, & Goldsmith, 2017). Observed and parent-reported positive affect was assessed at six and twelve months in a large sample of mono- and dizygotic twins. Genetic (inherited) variability was not detectable in either measure at either age. By contrast, shared environmental variance was associated with both observed and reported positive affect at both ages. The findings underscore the role of family socialization processes in the development of individual differences in happiness and joy. In fact, by twelve months, observed positive affect was positively associated with mothers' reports of their own positive affect and of family positive affect. These findings underline the role of emotional socialization and interpersonal positivity in

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the development of happiness and joy. Below we consider evidence for different expressions of happiness and joy, before reviewing the development of these expressions.

### Joyful positive emotion: The heterogeneity of smiling and positive vocalizations

Smiles are prototypical expressions of happiness but vary in strength and form. All types of smiles, at least in infancy, appear to express happiness, although stronger smiles and smiles involving eye constriction and mouth opening are more joyful than smiles without these characteristics (Messinger, Fogel, & Dickson, 2001). Smiles and laughter are part and parcel of positive emotional engagement with the social environment. Below, we review findings suggesting that different types of smiling express different degrees, and perhaps forms, of happiness and joy.

*Variation in expressions of happiness and joy.* Smiles vary in strength and form and these features are associated with variations in the expression of happiness and joy. Smiles can be stronger or weaker, and they can involve eye constriction (the Duchenne marker) and mouth opening to varying degrees. Smiles are often classified as to whether they do (Duchenne smiles) or do not (non-Duchenne smiles) involve eye constriction and mouth opening. However, all features of smiles vary continuously. Smiles can involve more or less eye constriction (the Duchenne marker) and mouth opening.

*Simple smiles.* The strength of a smile varies with the contraction of the zygomaticus major. Smiles which do not involve Duchenne eye constriction or mouth opening, particularly when they are characterized by weaker smiling action, may be referred to as simple smiles. Simple smiles are more likely to occur during situations thought to elicit happiness (Messinger et al., 2001) and are perceived as more happy than neutral expressions (Messinger, 2002). However, simple smiles appear to share functional similarities with the bared teeth display of

chimpanzees (*pan troglodyte*), which appear to signal affiliation (Burrows et al., 2006; Plooij, 1979; Redican, 1975). Likewise, simple smiles may communicate a readiness for positive affiliation which may lead to more positive engagement. In infants, simple smiles tend to occur, for example, when infants are approached by an impassive stranger (Fox & Davidson, 1988).

*Mouth open smiles.* Smiles involving mouth opening are caused by jaw dropping and are sometimes referred to as play smiles. In infancy, they are typically elicited by social engagement and may reflect excited states. Open mouth smiles are most likely to occur while infants look at their mothers' faces and are perceived as indexing more positive emotion and more arousal than closed mouth smiles (Messinger, Mattson, Mahoor, & Cohn, 2012). The human open mouth smile is morphologically similar to the relaxed open mouth display of non-human primates (Davila-Ross et al., 2015; Waller & Dunbar, 2005). Among infant chimpanzees, these displays are thought to develop during mock biting play with mothers (Plooij, 1979) and, later in life, are most likely to occur during rough play that involves physical contact with a conspecific (Davila-Ross et al., 2015). As in human infants, open mouth smiles communicate aroused, playful engagement, and are a frequent context for laughter (Davila-Ross et al., 2015; Nwokah, Hsu, Davies, & Fogel, 1999; Nwokah et al., 1994; Sroufe & Waters, 1976).

*Duchenne smiles.* The Duchenne marker is the best recognized index of positive emotional intensity from infancy through adulthood. In Duchenne smiles, eye constriction caused by orbicularis oculi, pars lateralis, raises the cheeks toward the eyes and, in adults, produces crow's feet wrinkles (Duchenne, 1990/1862). Infants produce Duchenne smiles when approached by their smiling mothers and, during face-to-face interaction, when their mothers are smiling (Fox & Davidson, 1988). Although not apparent in a high-risk sample (Mattson et al., 2013b), infant smiling in a mid-SES sample was more likely to involve the Duchenne marker in face-to-face

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interaction than when parents hold a still-face, which reduces infant positive affect (Mattson, Cohn, Mahoor, Gangi, & Messinger, 2013a). Duchenne smiling is also associated with greater left than right frontal cerebral activation, a pattern indexing higher levels of approach orientation and joy (Fox & Davidson, 1988). Infants produce more syllabic vocalizations during Duchenne smiling, which may index positive emotional intensity. Duchenne smiles are often regarded as the only veridical index of joyful emotion in adults (Ekman, 1990). However, this distinction does not appear to be absolute. In infants, Duchenne smiling is likely to follow non-Duchenne smiling, suggesting that infant Duchenne smiles are more joyful than non-Duchenne smiles (Messinger, Fogel, & Dickson, 1999).

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*Strong Smiles.* Smiles are continuous processes. The extent of zygomaticus major contraction determines the degree of lip corner movement involved in a smile and determines its strength. Stronger smiles index more intense happiness and joy, and the infant's positive engagement with ongoing play. The climax phase of games for example, is associated with stronger smiling than the preparatory phase of games (Fogel, Hsu, Shapiro, Nelson-Goens, & Secrist, 2006). Parental tickling elicits stronger smiling than getting ready or pretending to tickle. Stronger smiles are perceived as more joyful than weaker smiles. Stronger smiles involving greater zygomaticus major contraction tend to also involve eye constriction and, at least in infancy, mouth opening (Messinger et al., 1999). Smiles without eye constriction and mouth opening tend to involve the weakest zygomatic contraction while the strongest smiles tend to involve both eye constriction mouth opening (see Figure 2). These intensity parameters vary together dynamically during the course of an infant smile. In infancy, as a smiles becomes stronger and weaker, the strength of eye constriction and degree of mouth opening involved in the smile increase and decrease as well.

*Combined strong, open-mouth Duchenne smiles.* In infancy, smiles involving the Duchenne marker tend to involve mouth opening as well (see Figure 1) (Messinger et al., 1999). These combined smiles tend to occur during especially positive periods of interaction such as when infants gaze at their smiling mothers (Messinger, Fogel, & Dickson, 2001). Strong infant smiles involving both eye constriction and mouth opening are perceived as the most joyful (Messinger et al., 2012). They are most likely to occur in contexts—during tickling (Fogel et al., 2006) and during physical play with parents (Dickson, Walker, & Fogel, 1997)—which are likely to elicit the highest degree of arousal and joy.

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*Happiness, joy, and the heterogeneity of smiling.* Inferences of happiness and joy depend not only on smiles and other expressive behaviors but the emotional context in which the expressions occur, as well as simultaneous patterns of central and peripheral nervous system activity. Drawing on these sources of evidence it is possible to provide a preliminary overview of the relationship of different types of smiling and laughter to different positive emotions. Stronger smiles and smiles that involve both eye constriction (the Duchenne marker) and mouth opening are most likely to index joy while weaker smiles and smiles without eye constriction and mouth opening are more likely to index lower intensities of happiness.

### The development of happiness and joy expressions

*Developmental overview.* The development of happiness and joy reflects the emerging cognitive, emotional and social competencies of infants and young children. Smiles quickly become a centerpiece of face-to-face social interactions in the first six months of life where their morphology and context, increasingly supports the view that they index happiness and joy. In the second half of their first year, infants come to understand and use smiles as communications of positive affect. They communicate happiness and joy more intentionally outside of the dyad with their direct communicative partners. Between one and 4 years, children become more aware of the social meanings of their parents' smiles. Between four and eight years, children increasingly engage in peer play and use different types of smiles for different functions with peers and with adults. Finally, early expressions of joy show associations with social competence while later self-presentation of joyful expressions in photographs are associated with positive life outcomes.

### *Neonatal and early smiling: Zero to two months.*

Neonatal smiles occur most frequently in sleeping/drowsy states of rapid eye movement (REM) but also occur in states of alertness suggesting a possible association with positive

emotion (Dondi et al., 2007). Although typically prompted by internal stimuli, the form of neonatal smiles suggests an association with positive emotion. Neonatal smiles occur in the context of other lip and mouthing movements, but one third of neonatal smiles are recognized as smiles by untrained observers (Dondi et al., 2007). Neonatal smiles can have a relatively mature form that involves strong muscular contractions and the Duchenne marker (Dondi et al., 2007; Messinger et al., 2002). However, the neonatal smile emerges before it is integrated into patterns of environmental engagement and social interaction which would provide stronger evidence for joyful emotion.

### *Early smiling and the transition to social smiling: One to two months.*

Toward one month of age, smiles during sleep decrease in frequency, while stronger smiles during alert states increase (Harmon & Emde, 1972; Wolff, 1987). A similar pattern has been observed in infant chimpanzees, who show a decline in neonatal smiling during REM sleep and an increase in social smiling when awake (Mizuno et al., 2006). In the second month of life, social smiling emerges as infants spend more time in awake alert states that enable gazing at a caregiver's face and facilitate interaction (Lavelli & Fogel, 2005). Early social smiles are typically preceded by a 3-20 second period of brow knitting and gazing at the mother's face, followed by relaxation of the brows (Anisfeld, 1982; Lavelli & Fogel, 2005; Oster, 1978). This suggests that the first expressions of happiness are preceded by a period of concentrated effort, which may be linked to visual recognition of the parent. While neonatal smiles appear to be driven by physiological arousal, early social smiles appear to be more cognitively driven, occurring when infants recognize external stimuli as psychologically meaningful. Parents, in turn, feel recognized and rewarded by these first social smiles, setting the stage for the development of social smiling in face-to-face interactions.

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### *The development of social smiling in face-to-face interaction: Two to six months*

*Overview of joyful interaction.* Infant expressions of joy and happiness develop during interaction. In the period between two and six months infants become both increasingly likely to initiate smiles and increasingly likely to respond to their partners' smiles (Cohn & Tronick, 1987). Approximately one fifth of the duration of face-to-face interaction involves infant smiling (Malatesta, Culver, Tesman, & Shepard, 1989; Messinger et al., 2001), and smiles are most likely when infants are gazing at the caregiver's face (Figure 3). Parents often aim to amplify their infants' joyful experiences during interaction (Cohn & Tronick, 1987; Feldman, 2003; Feldman & Greenbaum, 1997; Feldman, Greenbaum, & Yirmiya, 1999; Feldman, Greenbaum, Yirmiya, & Mayes, 1996; Fogel, 1988; Fogel, 1993). Parents smile and laugh, touch the infant, and use high-pitched infant-directed speech to elicit infant smiles and laughter. Parents' multimodal displays increase and decrease in intensity together with and in reaction to their infants' joyful expressions.

*Mothers and fathers.* Infant expressions of happiness are peak moments of play with both mothers and fathers. However, differences in mothers' and fathers' play may influence the temporal patterning of infants' positive displays. Fathers tend to engage in more physical play with infants (e.g., bouncing games) whereas mothers engage in a more visually and vocally expressive style of play (Dickson et al., 1997). Perhaps as a consequence, infants' positive emotional expressions build more gradually during interactions with mothers and appear more suddenly during interactions with fathers (Feldman, 2003).

*Infant and mother responsivity to smiling.* Expressions of happiness and joy during infancy are often assessed during interaction with a parent and in the face-to-face/still-face protocol (FFSF). In the FFSF, an episode of face-to-face play is followed by an episode in which

the parent is asked to not interact with the infant (to hold a still-face), which is followed by a final reunion episode in which the parent is asked to play again with the infant (Adamson & Frick, 2003; Mesman, van IJzendoorn, & Bakermans-Kranenburg, 2009). Smiling declines logarithmically during the course of the still-face (Ekas, Haltigan, & Messinger, 2013) and rises in the reunion episode, though not quite to initial face-to-face levels.

*Contingent responsiveness.* Parental contingent responses during face-to-face interactions provide a framework from which infants develop an understanding of themselves as effective agents in instigating positive interactions with others. Mothers with higher rates of vocal contingent responsiveness to their 2- 3-month-old infants, have infants who display more smiles in the still-face than infants whose mothers have lower rates of vocal contingent responsiveness (Bigelow & Power, 2016). Additionally, infants who have higher durations of smiling during face-to-face interactions with their mother at 2 and 3 months of age produce more smiles and non-distress vocalizations when their mother becomes non-responsive in the still-face, likely in an attempt to reengage their mother in positive social interaction (Bigelow & Power, 2016).

*Interaction.* Interaction suggests that each partner responds to and is responsive to the other. In infancy, this responsiveness is asymmetrical. Infant smiles are reliable elicitors of mother smiles, typically within a 2 second time window (Malatesta & Haviland, 1982; Van Egeren, Barratt, & Roach, 2001). However, mother smiles are less reliable elicitors of infant smiles (Cohn & Tronick, 1987; Kaye & Fogel, 1980; Messinger, Ruvolo, Ekas, & Fogel, 2010), and mothers frequently initiate smiles when infants are not smiling (Messinger et al., 2010). Mothers appear most likely to elicit infant smiles when they combine their own smiling with other behaviors from multiple communicative modalities, such as vocalizing, leaning toward the infant, kissing, and tickling (Beebe & Gerstman, 1984; Mendes & Seidl-de-Moura, 2014;

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Messinger, Mahoor, Chow, & Cohn, 2009). Although parents contingently respond to infant smiles, infants may experience these contingent parent smiles in the midst of many non-contingent smiles and other parental expressive behaviors (Symons & Moran, 1994).

*Primary intersubjectivity.* In addition to exchanges of discrete smiles, infant and mother appear to continuously affect one another's joyful expressions (Messinger et al., 2009). Stronger infant smiling is typically mirrored by stronger mother smiling. While stronger smiling on the mother's part may be mirrored by the infant, the infant may also gaze away from the mother and decrease or terminate smiling to regulate their levels of arousal (Chow, Haltigan, & Messinger, 2010; Stifter & Moyer, 1991). The dyadic smiling states that occur between infants and mothers represent a nonverbal dialogue in which the topic is the shared experience of joy and the regulation of intense experiences of positive emotion. When caregivers mirror their infants' smiles in an intensified form, infants internalize the increase in positive emotion reflected in their parent's smile while simultaneously perceiving an increase in their own positive emotion. Neurophysiological processes implicated in producing feelings of sympathetic joy, including mirror neurons, may be responsible for infants' contingent positive responsiveness to their parent's positive expressivity. Early interactions in which infants are able to observe the impact of their own behaviors on their parents lay the foundation for infants to develop an awareness of changes in their own experiences of joy. The dynamic interplay that results in which the infant is simultaneously aware of their own as well as their social partner's feelings suggests that one path to the development of joy involves experiencing the joy of another, a process known as primary intersubjectivity.

*Perceptions of joy.* Infants' perception of others' smiles indexes the positive emotional content of their own smiles. By 3 months, infants associate their mothers' smiles with their

mothers' positive vocal expressions in viewing tasks. That is, they gazed longer (two thirds of the time) and expressed more positive affect (over 4 on a 5-point scale) while gazing at the mother's smile expression when it occurred with a positive vocalization (Kahana-Kalman & Walker-Andrews, 2001). At four months, infants showed evidence for perceiving the same facial-vocal correspondence to an unfamiliar adult—specifically, increasing looking time when positive (facial-vocal) expressions were followed by (facial-vocal) negative expressions—during several cycles of a peekaboo game (Montague & Walker-Andrews, 2002). Finally, by 7 months infants show a greater propensity to gaze toward a static smiling expression after being habituated to a static sad expression (and vice-versa) (Leppänen, Richmond, Vogel-Farley, Moulson, & Nelson, 2009). The results point to the importance of person familiarity and shared routines in understanding affective expressions (Kahana-Kalman & Walker-Andrews, 2001). More generally, they suggest that infants' understanding of other's expressions emerges in the same period in which infants come to more flexibly utilize their own expressions of joy.

*Why infants smile.* Infants' and mothers' goals during dyadic interactions can be inferred from the patterns of consequences of their smiling (and not smiling) using an inverse optimal modeling framework (Ruvolo, Messinger, & Movellan, 2015). This framework indicated that mothers' actions were most consonant with the goal of increasing time in mutual smiling. Infants' actions—including smiling briefly until mother smiled and then not smiling—were most consonant with the goal of increasing time when mother was smiling but the infant was not. The findings are disconcerting in part because they suggest that infants are not simply acting to increase time in expressions of happiness. Rather their smiling actions involve creating moments of mutual positive emotion expression and then disengaging, a cycle that itself might be regarded as the goal of much early interaction.

### *Developments in interactive smiling between two and six months*

As infant levels of smiling-indexed joyful expressions begin to increase around two months of age, there is a related increase in maternal positive expressions (Lavelli & Fogel, 2002). Infants and mothers appear to become more responsive to one another and smiling interactions become faster-paced. For example, infant-mother smile turn-taking (in which partners alternate initiating and terminating their smiles) increases with age (Messinger et al., 2010). Nevertheless, individual infants exhibit stable levels of smiling in face-to-face interactions between 2 and 6 months (Malatesta et al., 1989). Moreover, the timing of dyadic smiling states (the overall distribution, as well as the mean and variance, of periods of mother and infant smiling and non-smiling) over a given interaction became more similar with age (Messinger et al., 2010). In fact, infants appear to become accustomed to specific levels of positive responsivity in their partners such that two-month-olds smile less at a stranger who is either less or more responsive to the infant's smiles than the infant's mother (Bigelow & Rochat, 2006).

*Temporal patterning of smiles.* Infant patterns of joyful expressivity develop together with changes in the patterning of infant attention to the parent's face. Although infants spend less time gazing at their mothers' faces between two and six months of age, they become more likely to smile when they are gazing at the mother's face (Kaye & Fogel, 1980). As infant smiles become more likely to occur while gazing at mother's face, the temporal patterning of infant smiles and gazes at mother's face changes (Yale et al., 2003). Three-month-olds tend to begin and end smiles within a gaze at the parent's face so that early joyful expressions are dependent on visual engagement with the parent. Six-month-olds also begin smiles while gazing at the parent's face. However, they then tend to gaze away, perhaps to regulate joyful arousal, and then

end the smile. In fact, during peek-a-boo, five-month-old infants tend to avert their gaze from the mother's face more often and for longer periods of time during more intense and longer lasting smiles (Stifter & Moyer, 1991). This suggests that these stronger and longer lasting smiles involve intense positive arousal that the infants regulate by gazing away from the interaction. Thus by 6 months of age, infants are able to utilize intensely joyful smiles in order to participate in highly arousing social exchanges. At the same time, they become increasingly capable of exercising control over the direction in which they smile allowing for infants to become more effective in regulating their own involvement in interchanges that lead to the experience of positive emotion.

*Coy smiles.* Infants may also engage in “coy smiles”, in which they avert their gaze and/or turn their head immediately before or at the apex of the smile in order to regulate their emotional response. Naive observers perceive these coy smiles as communicating shyness in the infant (Draghi-Lorenz, Reddy, & Morris, 2005; Reddy, 2000). Colonessi et al. (Colonessi, Bögels, de Vente, & Majdandžić, 2012) had four-month-olds interact sequentially with a stranger and with each parent either with or without access to a mirror showing the infant their own face. Approximately 70% of infants engaged in coy smiles, and were more likely to do so when they could see their own image during the interaction than when they could not. Infants were also more likely produce coy smiles in interactions with strangers than when they interacted with their parents, which lends support to the theory that coy smiles may serve a tension-release function that allows infants to simultaneously engage with novel stimuli and regulate their emotional response. These patterns of looking at and away from the interactive partner form the context for the development of smiling in face-to-face interactions;

*The development of different types of smiling*

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Although the broader category of infant smiling increases between two and six months during face-to-face interaction, different types of smiling show different developmental trajectories (Mendes & Seidl-de-Moura, 2014; Messinger et al., 2001). Between one and five months, Mendes and Seidl-de-Mour (2014) indicate an increasing number of associations between specific types of smiles and specific mother behaviors during naturalistic mother-infant interactions at home. For example, 5-month-olds respond to mothers' smiles and vocalizations with simple smiles, open-mouth smiles, and combined open-mouth Duchenne smiles (Mendes & Seidl-de-Moura, 2014). However, the relative likelihood of specific types of smiles occurring in specific contexts varies (Messinger et al., 2001). Simple smiles that do not involve eye constriction or mouth opening increase in all interactive periods, irrespective of whether the mother is smiling or the infant is gazing at the mother (see Figure 4). By contrast, the more joyful open-mouth Duchenne showed a developmentally specific rise between two and six months. Infants open-mouth Duchenne smiling increases only when infants are gazing at their smiling mothers. These especially joyful smiles decline in periods when infants are gazing away from the mother's face and mothers are not smiling. That is, highly joyful smiles become increasingly associated with periods of interaction that are more likely to elicit positive engagement. The increase in infants' apparent propensity to engage their smiling mothers with open-mouth Duchenne smiling speaks to their emerging agency in creating these intensely joyful interchanges. Between two and six months, infants become more active participants in interactive smiling, becoming more likely to initiate smiles at the parent even when the parent is not smiling.

### *Smiling Between Six and Eighteen Months: The Development of Referential Smiling.*

Through six months, infant expressions of positive emotion during face-to-face

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interactions represent non-reflective communications of their immediate experience (Kaye & Fogel, 1980). After six months of age, infants become increasingly likely to use smiling to intentionally communicate positive affect. Beginning with a discussion of mastery smiling, we review the development of expressions of happiness and joy between six and eighteen months and discuss how these expressions are increasingly integrated into patterns of intentional communication and pretense play.

*Happiness and mastery.* Cognitive differentiation theory holds that success at a challenging task produces happiness. This does not appear to be the case among older children (Harter, Shultz, & Blum, 1971). Between 9 and 11 months, however, infants are more likely to smile and laugh when engaging in newly acquired competencies such as pulling to stand than when involved in tasks which are less difficult such as pulling to sit (Mayes & Zigler, 2006) (but see Yarrow, Morgan, Jennings, Harmon, & Gaiter, 1982). For infants who walk early (before a year), the transition is associated with an increase in expressions of happiness such as smiling (Campos et al., 2000). Mischievous happiness may develop around this age as new walkers smile toward the parent from a distance to ascertain the strictness of parental prohibitions. Such patterns of toddler actions would reflect a developing awareness of another intentions (secondary intersubjectivity), the focus of the next section.

*Happiness in referential communication.* Between 6 and 12 months, infant smiles increasingly occur during coordinated joint engagement when infants actively shift attention between a social partner and toy (Adamson & Bakeman, 1985; Striano & Bertin, 2005). When gesturing to and looking at an adult examiner to communicate about objects and events, infant smiles enhance the communicative meaning of these joint attention gestures. Infants are more likely to smile during gestural sequences which show or share an object than they are to smile

during sequences that request an object (Kasari, Sigman, Mundy, & Yirmiya, 1990; Messinger & Fogel, 1998). More broadly, infants begin to communicate happiness and joy while referencing objects in the environment. In what is known as triadic communication, they communicate happiness *about* objects and events outside of the infant-partner dyad. These bouts of triadic communication tend to increase between 5 and 9 months of age (Striano & Bertin, 2005). Infants between 5 and 9 months of age are more likely to only gaze between a partner and toy than they are to add a smile to this interchange, suggesting that the smile adds to the complexity of the triadic communicative communication.

*Anticipatory (referential) smiling.* A more specific form of triadic communication, anticipatory smiling, begins to increase in frequency between 8 and 12 months. Anticipatory smiling occurs when an infant attends to and smiles at an interesting object or event and continues to smile as they shift their attention to their social partner (see Figure 5) (Venezia, Messinger, Thorp, & Mundy, 2004). Anticipatory smiles are typically elicited during periods of joint engagement where an experimenter activates and places a wind-up toy on a table and the temporal sequence of infants' smiling and gazing between the toy and the experimenter is recorded (Mundy, Hogan, & Doehring, 1996; Seibert, Hogan, & Mundy, 1982). Under these conditions, infants gaze at the interesting object, smile at the object, and subsequently turn to and smile at the experimenter to communicate something like, "that was funny, wasn't it?". The likelihood that infants engage in anticipatory smiling is linked to the development of more general capabilities, including their ability to comprehend means-end relationships and their ability to communicate intentionally with others (Jones & Hong, 2001). This suggests that anticipatory smiling indexes infants' emerging ability to understand that their experiences of pre-existing positive affect can be shared with another (Venezia et al., 2004). The real-time process

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of smiling and then referencing an object to a social partner demonstrates the mechanism by which positive emotion may motivate the development of early triadic communications (Adamson & Bakeman, 1985; Fogel & Thelen, 1987; Jones & Hong, 2005; Venezia et al., 2004).

*Happiness and pretense.* Between 5 and 18 months, infants become more likely to express happiness and joy in response to pretense and incongruous events. By 5 months of age, infants smile and laugh more in response to an assistant enacting an absurd action (e.g., poking a clown nose while saying ‘beep’) than an ordinary action (e.g., playing with a ball), even when parents remained neutral (Mireault et al., 2018). Additionally, between 5 and 7 months of age, the duration of infants’ smiles and laughs are longer and infants are faster to initiate smiles and laughs when their parents provide them with positive affective cues (Mireault et al., 2015). At 18 months, similar patterns are evident when mothers engage in pretend activities (Lillard et al., 2007; Nishida & Lillard, 2007). Mothers smiled more when pretending versus really eating a snack with their 18-month-olds. The 18-month-olds also exhibited more happiness and participated in the pretend activities when mothers smiled more. These findings suggest that incongruity elicits joyfulness early in life, with the parent’s positive expressions serving as a social signal which enhance the infant’s enjoyment of those events.

### *Expressions of happiness and joy in older children*

*Overview.* Between one and two years of age toddler’s smiling and laughter become increasingly tied to pretense play with parents. Through four years, children use different types of smiling in response social success experiences, and to foster emerging patterns of social affiliation. Between 6 and 8 years of age, smiles decrease when alone but remain a powerful social signal.

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*Positive expressiveness in peer play.* By two years of age, peer play becomes an increasingly important venue for expressions of positive emotion. Three- to five-year-olds indicate that they prefer smiling versus nonsmiling potential playmates (Schultz, Ambike, Buckingham-Howes, & Cheah, 2008). Moreover, between two and five years of age observational research in preschools indicates that different types of smiling have different social functions (Cheyne, 1976; Sarra & Otta, 2001). Closed mouth smiling, akin to simple smiling, which involves neither mouth opening nor eye constriction, tends to occur when children are alone (Cheyne, 1976), and is *negatively* associated with teacher ratings of happiness (Sarra & Otta, 2001). Closed mouth smiles are distinct both from upper smiles in which the upper teeth are visible (which appear to index Duchenne smiling) and from broad smiles in which both sets of teeth are visible, which are likely to include open mouth smiles with Duchenne eye constriction (Sarra & Otta, 2001). Broad smiles covary with laughter, and the frequencies of upper smiles, broad smiles, and laughter were positively associated with rated happiness (Sarra & Otta, 2001). Moreover open-mouth smiles, with and without Duchenne eye constriction, appear to reflect increasing levels of gender-specific social activity between two and four years of age. Over this age range, boys increasingly direct these smiles to their male peers and girls increasingly direct these smiles to their female peers (Cheyne, 1976).

*Positive expressiveness in games with an adult experimenter.* Experimental research suggests that open-mouth and Duchenne smiles are associated with success experiences and sociality in early childhood. Between 3 and 6 years of age, the components of Duchenne smiles (smiling and eye constriction) are linked to social proximity, occurring more frequently when a child played a game next to an adult experimenter than when the experimenter was seated at another table (Schneider & Josephs, 1991). Smiling of any type was more frequent in response to

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successful trials in which children produced a rewarding light and sound display than failure trials (when they were shown the same display) at all ages. Around 4 years of age, children produced stronger smiles in a game involving success and failure experiences than in a game that did not, and by five years Duchenne smiles also exhibited this specificity (Schneider & Uzner, 1992). The results suggest an increasingly specific use of Duchenne smiles in the context of social success experiences. Likewise, an examination of 2 – 6 year olds perceptions of adult Duchenne smiles in photographs suggests increasingly sophisticated awareness of this joyful expression (Song, Over, & Carpenter, 2016). Three-year-olds, but not two-year-olds, spent more time gazing at a Duchenne than a paired non-Duchenne smile. Four-year-olds, but not three-year-olds, expressed a verbal preference for the Duchenne smiles when asked to identify ‘real smiles.’ Moreover, four- and five-year-olds expected individuals with Duchenne smiles to be nicer and more generous.

*Covert joy.* Holodynski (2004) argues that at younger ages the expression of joy is both emotional and social, a marker for oneself and for others. At older ages, the expression of joy is miniaturized when alone, but continues to be employed socially to communicate enjoyment to another. Specifically, Holodynski (2004) examined expressions of strong positive emotion—receiving candy from a previously recalcitrant vending machine—between 6 and 8 years of age. Younger children exhibited similar levels of joyful expressions with and without an experimenter present. However, older children exhibited weaker joyful expressions when alone than when in the social condition, although reported levels of joy did not decline. In a finding conceptually in concert with Holodynski’s, Kromm et al. found that by 6 (but not 4) years of age, children were adept at using smiles to convince observers that they are pleased with a disappointing gift (Kromm, Färber, & Holodynski, 2014). Taken together, these results suggest that between 6 and

8 years of age is important to children's development of the ability to exert volitional control over their emotional expressions of happiness.

### Joyful expressivity and developmental associations with social competence and life outcomes

The expression of positive emotion may elicit reciprocal interactions with one's social partners, providing engaging experiences which promote social competence. This section reviews evidence for associations between early joyful expressivity and indices of social competences such as rule-following, (low levels of) inhibition, and attachment security. Proceeding developmentally, it is then concerned with evidence that the intensity of joyful expressions in iconic self-presentations (e.g., Yearbook photographs) is associated with self-reports of life satisfaction.

#### *Happiness, joy, and social competence in early childhood*

*Social joy.* Infant's positive smiling reactions to more social elicitors (e.g., peek-a-boo) and to less social elicitors (e.g., pop-up toys) have different correlates. Only smiling to more social elicitors is associated with observed positive emotional tone during infant interactions with their parents, and with their parent ratings of day-to-day positive emotion (Aksan & Kochanska, 2004). During early smiling interactions, infants and parents engage in mutual, enjoyable exchanges. Motivated by their own enjoyment, contributing to the parent's joyful expressions may lead infants to experience the joyfulness of others as key to their own happiness. In fact, shared infant-mother positive expressions such as smiles, together with overall maternal responsiveness to the infant, are associated with children's internalization of social norms (obeying the rules) as manifested in committed compliance to maternal requests such as cleaning up without reminders (Kochanska, 2002; Kochanska, Forman, & Coy, 1999). In this way,

experiences of reciprocal joyful responsivity appear to shape the infant's developing social competence into childhood.

*Joy as temperament.* Positive reactions to novelty in early infancy show associations with reduced behavioral inhibition and reticence at two years of age. Using an extreme group design, four-month-olds' positive emotional responses to standardized auditory (nonsense syllables) and visual (mobiles) stimuli showed moderate stability between one and two years of age (Fox et al., 2001). Infants who responded to the stimuli with high levels of smiling, positive vocalizations and motor movement exhibited different developmental trajectories than infants who were non-responsive or exhibited more negative reactions. The infants who exhibited higher levels of positive emotion expressions were less behaviorally inhibited with unfamiliar toys and adults at 14 and 24 months of age. However, four-month emotional positivity was not associated with inhibition with peers at four years. The results indicate that exuberant responses to relatively nonsocial stimuli in early infancy are associated with non-inhibited responses through two years of age, when other factors—including prior inhibition and daycare experience—become more powerful correlates of peer play behavior.

*The predictive validity of interactive smiling.* Early positive expressivity shows some associations with later attachment security and social competence. Infants who exhibit increases in smiling during face-to-face interaction with the parent between two and eight months, tend to exhibit secure attachment with the parent at 2.5 years of age (Malatesta et al., 1989; Malatesta, Grigoryev, Lamb, Albin, & Culver, 1986). Infants who smile when their parent adopts a non-responsive still-face may be more likely to develop secure attachments than other infants (Mesman et al., 2009). Levels of anticipatory smiling at 9 months toward one year of age shows associations with parent reports of social expressivity at 30 months (Parlade et al., 2009).

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Likewise, Duchenne smiling during and preceding reunions with mother in the Strange Situation at 18 months predicted the mothers' ratings of extraversion and openness to experience two years later (Abe & Izard, 1999). It appears that positive emotion expression may elicit positive engagement from social partners that fosters security and social competence.

### *Positive expressiveness and positive life outcomes in adulthood*

*Early joy and later satisfaction.* There is a dearth of information on associations between early joy and later life satisfaction. In a long-range longitudinal study, Coffey et al. (Coffey, Warren, & Gottfried, 2015) found that parent reports of infant happiness and adolescent self-reported happiness—although not associated with one another—were both individual predictors of life satisfaction at age 29. The results suggest that early joy is a significant, though not especially stable, predictor of life satisfaction. There is ample evidence, however, that more intense expressions of joy in photographs are associated with positive life outcomes.

*Joyful expressiveness in photos and life satisfaction.* The relationship between expressions of joy and positive life outcomes has been instantiated by a corpus of studies examining intriguing associations between Duchenne smiling intensity in photographs of young adults and later well-being. In college-aged adults, individual differences in Duchenne smiling intensity in yearbook and Facebook photos are associated with later life satisfaction. Harker and Keltner (2001) found that women with more intense Duchenne smiles in their college yearbook photos at age 21 scored higher on a self-report measure of well-being at 21, 27, and 52 years of age than women with less intense smiles. In a more recent cohort, students with more intense smiles in their Facebook profile pictures during their first semester of college were more satisfied with their lives at graduation than students with less intense smiles (Seder & Oishi, 2012). Moreover, Hertenstein and colleagues (2009) found that individuals who smiled more intensely in

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photographs from childhood and early adulthood were less likely to be divorced later in life (but see Harker & Keltner, 2001). In sum, self-presentations of joyful expressiveness in photographs are robustly associated with later positive social and emotional outcomes. These findings suggest links between joyful expressivity and later life outcomes which may be mediated by actions of the individual and/or the reactions they elicit in their social partners.

### Gender, cultural and risk-based difference in happiness and joy

*Overview.* The development of happiness and joy are contextualized by gender and cultural differences in the expression of these positive emotions. Gender differences in positive emotion expression (more female smiling) are highest in adolescence, but may be constrained to interactions with unfamiliar persons. Cultural differences in positive emotion expression (high levels of Western smiling) begin early in development, and are influenced by parental and more general emotional values and perceptions of smiling. Finally, differences in positive emotional expressivity enhance our understanding of blindness, maternal depression, Down syndrome, and autism.

*The development of gender differences in positive emotion expression.* Gender effects in the expression of positive emotion emerge developmentally (Chaplin & Aldao, 2013). In a meta-analytic review of facial, vocal, and bodily expression of positive emotion between infancy and adolescence, girls expressed more indices of positive emotions such as happiness and surprise than boys (Chaplin & Aldao, 2013). Age, however, moderated this small gender difference. Gender differences in positive emotion expression were not evident in infancy or toddlerhood. From middle childhood through adolescence, girls exhibited more positive emotion expressions than boys, a difference characterized by small to medium effect sizes (Chaplin & Aldao, 2013). However, gender differences in the expression of positive emotion do not follow a linear pattern

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of development throughout the lifespan. Gender differences in smiling are largest for adolescents, with females smiling more than males, and gradually decrease over adulthood (from 18-65 years of age) (LaFrance, Hecht, & Paluck, 2003). Taken together, these findings point to a U-shaped pattern of development for gender differences in the expression of positive emotion in which gender differences emerge in middle childhood, steadily increase throughout the adolescent period where they reach their peak, and begin to gradually decrease beginning in young adulthood. Changes in the magnitude of sex differences across development are likely to reflect the differing influence of social norms on emotion expression in males and females.

*Context affects gender differences.* Further evidence in support of the influence of social norms involves contextual moderation of the tendency of females to exhibit more positive emotion expressions than males. From middle childhood on, the tendency of girls to exhibit more positive expressions than boys is evident in the presence of unfamiliar others but not when alone or in the presence of familiar others (e.g., parents or peers) (Chaplin & Aldao, 2013; LaFrance, Hecht, & Paluck, 2003). This finding, which is consistent with other investigations which have shown that women have a propensity to exhibit more positive emotion expressions than men in the face of social tension (LaFrance, Hecht, & Paluck, 2003), suggests that smiling may be a gender-biased index of happiness.

*Cross-cultural research on the development of happiness and joy.*

*Cross-cultural overview.* Research on the development of positive emotion is often conducted with Western infants, often from more educated families (Henrich, 2010). This restricted pattern of sampling may limit awareness of similarities and differences in the development of positive emotions across cultures (Sauter et al., 2014). Available data suggest that culture plays an important role in shaping early signals of happiness and joy (Fogel, Toda, &

Kawai, 1988; Keller & Otto, 2009). Specifically, parents and caregivers affect positive emotional expression by the ways they play or do not play with their infants (Halberstadt & Lozada, 2011). Kuchner (1989), for example, found that Chinese-American mothers were less encouraging of expression of positive affect than European-American mothers. In a potentially related result, Camras et al. (1998) found that Chinese 11-month-olds exhibited fewer overall smile expressions and fewer Duchenne smile expressions than both their European-American and Japanese counterparts in a baseline procedure with the parent present.

*Early differences in positive expressivity.* In an attempt to systematically classify cross-cultural differences in the development of expressions of happiness and joy, Keller and colleagues (Keller, Borke, Lamm, Lohaus, & Dzeaye Yovsi, 2011; Wörmann, Holodynski, Kärtner, & Keller, 2012, 2014) contrasted a more independent cultural group (middle-class Germans from Munster) with a more interdependent group (Nso farmers in Cameroon). Mutual gazing, which tends to be fertile soil for dyadic smiling was 2 to 5 times higher in the Munster than in the Nso sample between 6 and 12 weeks. Durations of both infant and mother smiles (the latter during periods of mutual gaze) were somewhat higher in the German (Münster) than the Camerooniam group at 6 weeks, and diverged increasingly at 8, 10 and 12 weeks. The two groups exhibited a similar divergence in rates of infant and mother smile imitation (responding in kind to increases and decreases in the partner's smiling) in this period, indicating cultural differences in responses to smiling.

*Developmental differences in predictors of infant smiling.* The German and Cameroonian groups also exhibited developmental similarities and differences in the influence of parent smiling on the development of infant positive emotional expression (Wörmann et al., 2014). At six weeks, higher levels of maternal smiling during periods of mutual gaze were associated with

longer infant smiles in both the German and Cameroonian cultural contexts. At 8 and 12 weeks, maternal imitation of infant smiles was associated with increases in the duration of infant smiles in the German sample, an association not evident in the Cameroonian sample until 12 weeks. The results shed light on cultural differences in the influence of maternal behaviors on infant expressions of joy.

*Cross-cultural differences in parental expectations.* Parental expectations and practices with respect to the expression of happiness and joy, are culture-specific (Kärtner, Holodynski, & Wörmann, 2013). More highly educated, Western parents value intense expressions of positive affect, and appear to structure their interactions to elicit and amplify intense expressions of positive affect, which may be seen as manifestations of autonomous delight. By contrast, cultural groups in subsistence economies tend to value states of quiet contentment, which are perceived to be consonant with harmonious social relationships. The emergence of intense display of mutual affect may be one among multiple potential dyadic attractors. Caregiver responsiveness to infant expressions of positive affect are experience expectant. However, the imitative and amplified expressions of parental positive affect common in Western cultures appear to be experience dependent. Continued investigation of the influence of socialization practices on the expression of happiness and joy could suggest mechanisms for cross-cultural variability in the development of these emotional states.

*Cross-cultural perspectives on the meaning of smiles.* Although smiles are a universal facial expression, the functions of the smile appear to vary systematically across cultures. Smiles can be understood to index both positive emotion, to facilitate social cooperation, and to express dominance. Rychlowska and colleagues (2015) found that cross-cultural variation in the meaning of smiles varies with the historical heterogeneity of a society (Rychlowska et al., 2015).

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Individuals from ethnically heterogeneous societies with a history of migration from diverse source countries differ from individuals in less heterogeneous societies with respect to their understanding of the meaning of smiles. In historically heterogeneous societies, rewarding positive affect and social cooperation are more likely to be endorsed as motivating smiles. In historically less heterogeneous societies, smiles are more likely to be understood as being motivated by negotiation of social hierarchy (communicating or accepting dominance). The results suggest that the role of smiles in communicating happiness and joy, at least among adults, may vary cross-culturally.

### *Smiling as an Index of Developmental Risk and Disability*

*Developmental risk factors impact the expression of happiness and joy.* Amount of smiling differs between infants who are typically-developing and those who at risk for disturbed development due to a variety of risks. Here we review differences in the expression of joy associated with maternal depression, prematurity, blindness, Down Syndrome and Autism Spectrum. Results suggest that the development of joyful expressiveness is differentially sensitive to these risk factors.

*Maternal depression and infant prematurity.* Infants whose mothers are chronically depressed or display long-lasting depressive symptomatology smile less, especially when interacting with their mothers (Moore, Cohn, & Campbell, 2001). This is likely due to a lack of positive maternal responsiveness to the infant's bids for engagement. The less joyful expression from the mother, the less likely the child is to appear happy when interacting with her. Premature infants also display decreased smiling as compared to full-term infants. During peek-a-boo with an experimenter premature infants exhibit fewer strong smiles and exhibit fewer strong open-mouth smiles during face-to-face interactions with a parent (Eckerman, Hsu, Molitor, Leung, &

Goldstein, 1999; Segal et al., 1995). This may be driven by the difficulty premature infants experience coping with even positive affective arousal, curtailing the intensity of joyful expression in these infants in the first year of life.

*Smiling in blind infants and children.* Blind infants smile when they hear a familiar voice and social smiling increases from 4 to 12 months, just as it does for sighted infants. However, without visually-mediated reciprocal interchange with a social partner, blind infants smile less often and more fleetingly than their seeing peers. Seeing one's partner smile, is likely a motivation to sustain the duration of smiles. This lack of mutually reinforcing feedback may also play a role in the decrease in smiling seen in blind children after they reach the age of two or three (Fraiberg, 1975; Freedman, 1964; Ganchrow, Steiner, & Daher, 1983; Rogers & Puchalski, 1986; Thompson, 1941; Troster & Brambring, 1992).

*Joyful expressiveness and Down syndrome.* The emergence of shared joy and positive affect between infant and parent appears to develop similarly in infants with and without Down syndrome (trisomy) (Carvajal & Iglesias, 2002). However, the cognitive deficits, psychomotor delays and difficulties with sensorimotor integration present in children with trisomy all contribute to differences in the rate of development and response to changes within the environment (Carvajal & Iglesias, 2002). When interacting with their mothers, two-month-olds and five-month-olds with Down syndrome are rated as less lively but not less happy than infants without Down syndrome (Slonims & McConachie, 2006). Infants with Down Syndrome, like infants without trisomy, tend to smile when they gaze at their parent's face during play in the first year of life (Carvajal & Iglesias, 2000). Whereas typically developing infants demonstrate more Duchenne-open mouth smiles when interacting with their mothers than when they play with toys, infants with Down syndrome display Duchenne open-mouthed smiles more often

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overall and with less discrimination in context (Carvajal & Iglesias, 2001). In response to the still-face, infants with Down syndrome show less of a decrease in smiling than typically developing infants (Carvajal & Iglesias, 1997). These results combined suggest that infants with Down syndrome experience similar levels of happiness as typically developing children, but their cognitive delays diminish the specificity of environmental influences on their expression of joy.

*Happiness and Down syndrome.* Overall, 99% individuals with Down syndrome report that they are happy with their lives (Skotko, Levine, & Goldstein, 2011), and teachers and parents report that these children frequently have a cheerful orientation toward others (Carr, 1995; Gibbs & Thorpse, 1983; Gilmore, Campbell & Cuskelly, 2003). In middle childhood, children with Down syndrome smile more frequently than children without trisomy (Fidler et al., 2005). This pattern of smiling social behavior has led to the perception that individuals with Down syndrome are happier than typically developing individuals (Carr, 1995; Fidler, 2006). Cheerful social signals from individuals with Down syndrome appear to index high levels of joy, and may also be used as a coping strategy to compensate for cognitive limitations (Carr, 1995; Kasari & Freeman, 2001).

*Autism Spectrum Disorder overview.* Autism Spectrum Disorder (ASD) is characterized by social-communication impairments which are evident early in development and pervasive over the lifetime. Approximately 20% of children who have an older sibling with autism will themselves develop autism (Messinger et al., 2015). Using a high-risk sibling design, infants at elevated risk for developing ASD are followed through toddlerhood when ASD can be reliably diagnosed. In the first year of life, differences in the expression of joy, particularly in social

contexts, begin to differentiate infants who will go on to develop ASD from other infants, but the timing of these differences is not yet clear.

*Early joyful expression and autism.* Ozonoff et al. (2010) found that social smiles to an examiner did not distinguish infants with later ASD from low-risk infants at 6 months, and Rozga et al. (2011) found no difference in the duration of smiling toward the mother throughout the FFSF. However, Lambert-Bown et al. (2015) found differences among six-month-olds in the frequency of smile onsets to the parent before and after the still-face. Low-risk infants showed a decrease in the frequency of smile onsets after the still-face perturbation while high-risk infants with later ASD did not (their smile frequency remained low from the initial to the post still-face interaction). Put another way, a break in interaction with the parent did not alter the expression of joy in the six-month-olds who later developed autism. By one year (and through diagnosis at three years) it is relatively clear that infants who will go on to develop ASD show fewer social smiles with an examiner than other infants (Ozonoff, et al., 2010; Zwaigenbaum, 2005). When interacting with an examiner during an autism assessment, high-risk 15-month-olds showed fewer social smiles than the low risk group. Infants from the high-risk group who went on to develop ASD also had fewer non-social smiles than the typical controls (Nichols, Ibanez, Foss-Feig, & Stone, 2014). However, Harker et al. (2016) found that when interacting with their mothers, high-risk infants showed an increased growth in social smiling between 9 and 18 months, but only when controlling for the responsivity and directiveness of the mothers. Overall, these results indicate that between 6 and 12 months, infants developing autism exhibit lower levels of expressed happiness and joy that persist through at least three years of age.

*Later happiness and autism.* People with ASD exhibit differences across the lifespan in the expression of happiness and joy. In toddlers and children, lower levels of shared enjoyment

contribute to a index of symptom severity on central ASD diagnostic protocol (Hus, Gotham, & Lord, 2014). Although individuals with ASD show impairments in recognizing emotions in others, a meta-analysis of published papers found limited evidence for specific impairment in the recognition of happiness (Uljarevic & Hamilton, 2013). Nevertheless, social impairments can make it difficult for individuals with ASD to understand humor or sarcasm in others.

Consequently, in adults with ASD, humor is less likely to be self-reported as a character strength and is less likely to be associated with life satisfaction than in non-ASD adults (Samson & Antonelli, 2013). Adults with autism also report higher emotional valence ratings for images associated with their circumscribed interests and lower emotional valence ratings for social images than controls (Sasson, Dichter, & Bodfish, 2012). Taken together, these results indicate that happiness in adults with ASD may be less socially-based than in other groups.

### Limitations and future directions

Although we have a detailed understanding of the development of positive emotions in infancy, current understanding of the psychological and social functions of happiness and joy between preschool age and adolescence is more limited. In part, these limitations derive from difficulties in valid, economical measurement of behavior beyond the laboratory. In this vein, recent computational approaches to the measurement and modeling of positive emotion including objective facial expression analysis, mobile neuroimaging technologies such as functional near infrared spectroscopy, and automated sentiment monitoring of digital communication represent powerful tools for future developmental research.

Current understanding of positive emotion is primarily derived from research conducted in developed societies. Despite the onset of robust research programs, relatively little is known about how happiness and joy develop in other cultural contexts despite strong evidence for the

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role of context and culture in socializing the development of positive emotion. Moreover contextual pressures influence positive expressiveness as illustrated, for example, by the rise in female smiling in the presence of unfamiliar persons during adolescence. Ascertaining the type of smiling produced in such interactions may aid in detecting positive emotion. To wit, , Duchenne smiling is perhaps the most studied behavioral expressions of happiness. However, research incorporating other behavioral markers such as mouth opening, laughter, and body movement—and their synchronization—may prove equally valuable in understanding more aroused positive emotional states such as joy.

### Conclusion

Happiness and joy motivate social approach, and are frequently seen as elements of a fulfilled life. However, the value placed on states such as joy may differ by culture, as do interpretations of joyful expressions such as smiles. Nevertheless, available evidence indicates that signals of smile and joy are strongly (and perhaps increasingly) linked to social interaction from infancy through the first eight years of life. The Duchenne smile, perhaps especially when accompanied by mouth opening and laughter, appears to signal happiness and joy throughout the lifespan. Moreover, such joyful expressiveness appears to be linked to positive social competencies in childhood and life satisfaction in adulthood. Finally, joyful expressiveness varies systematically in response to child risk and disability, offering an index of the importance of happiness and joy in both typical and atypical development.

*Figures.*



*Figure 1. This six-month-old infant's strong smile involves the Duchenne marker (eye constriction) and mouth opening.*

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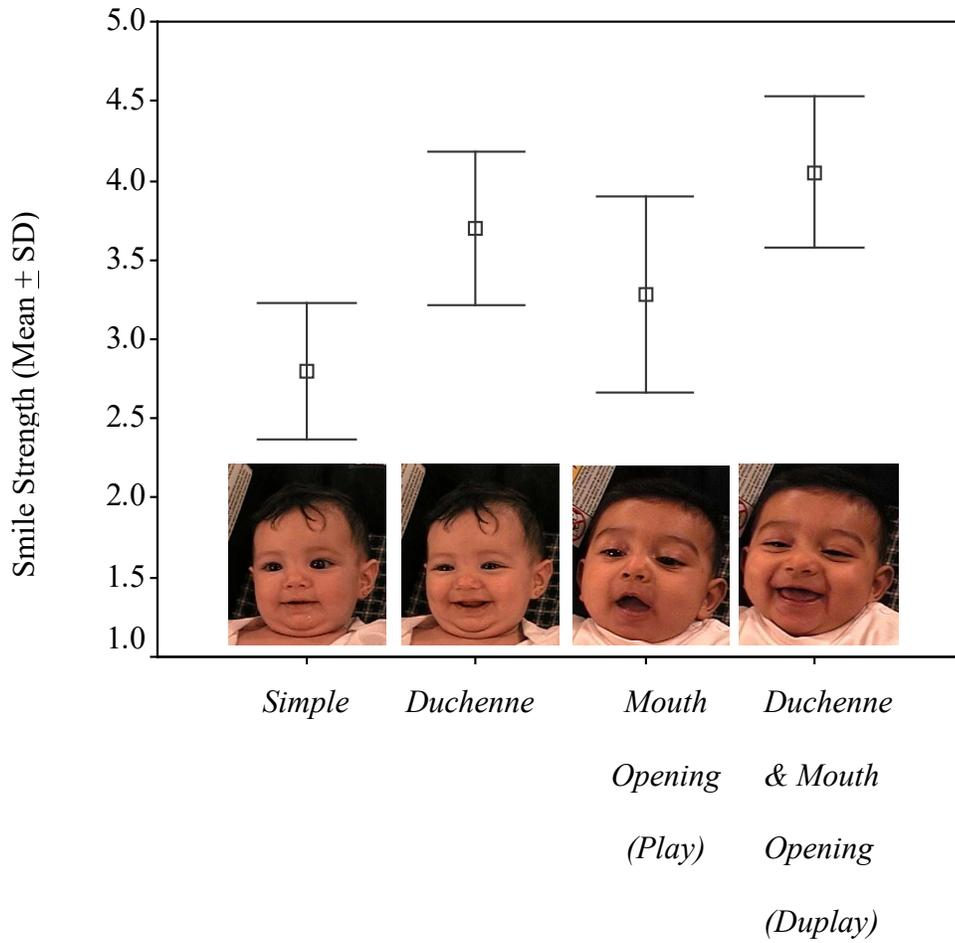
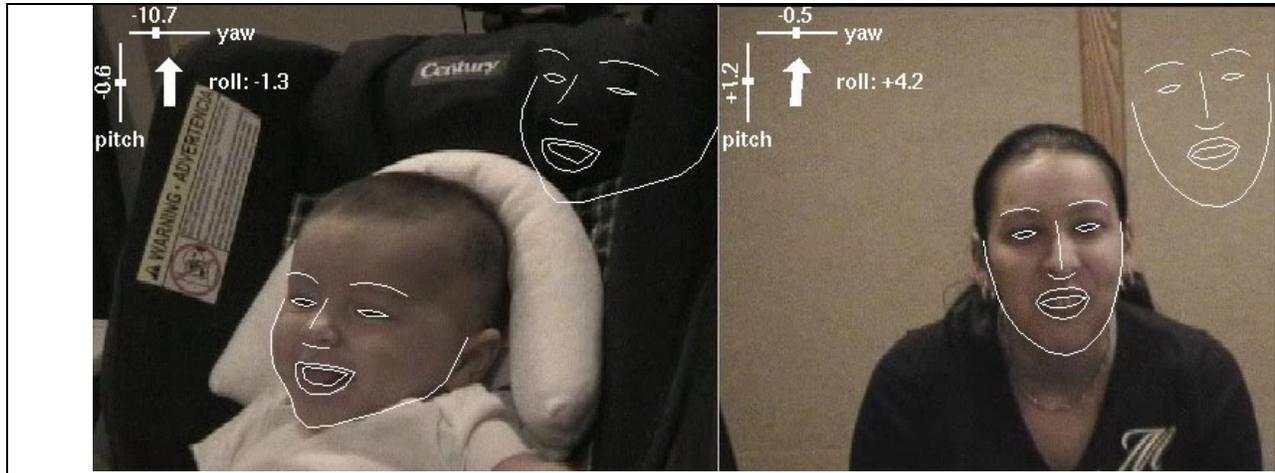


Figure 2. Mean smile strength of different smile types.

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*Figure 3. Four-month-old infant and mother smiling interaction as captured by Automated Face Analysis at the Carnegie Mellon University, Robotics Institute, compliments of Jeffrey Cohn, Ph.D. The infant and mother's faces are outlined to illustrate lip movement, mouth opening, and eye constriction.*

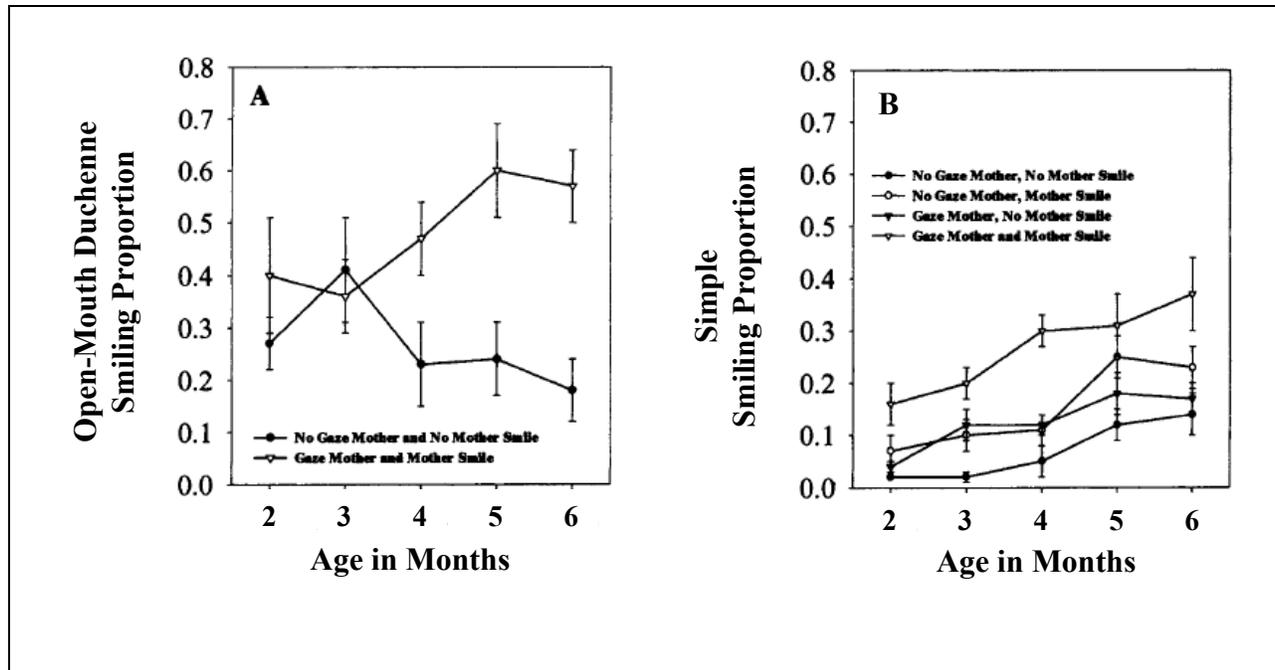


Figure 4. *A. Open-mouth Duchenne smiling increases when infants are gazing at their mothers' faces while their mothers are smiling. It decreases when infants are not gazing at their mothers while their mothers are not smiling. B. By contrast, simple smiling with neither characteristic tends to increase irrespective of where the infant is gazing and whether or not the mother is smiling. Messinger, D., Fogel, A., & Dickson, K. L. (2001). All smiles are positive, but some smiles are more positive than others. *Developmental Psychology*, 37(5), 642-653. Publisher APA, reprinted with permission.*

## Happiness and Joy



*Figure 5. Anticipatory Smile. A 12-month-old infant gazes at an object (left), smiles at the object (middle), and gazes at the experimenter while continuing to smile (right).*

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