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Not All Emotions Are Created Equal: The Negativity Bias in Social–Emotional Development

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There is ample empirical evidence for an asymmetry in the way that adults use positive versus negative information to make sense of their world; specifically, across an array of psychological situations and tasks, adults display a negativity bias, or the propensity to attend to, learn from, and use negative information far more than positive information. This bias is argued to serve critical evolutionarily adaptive functions, but its developmental presence and ontogenetic emergence have never been seriously considered. The authors argue for the existence of the negativity bias in early development and that it is evident especially in research on infant social referencing but also in other developmental domains. They discuss ontogenetic mechanisms underlying the emergence of this bias and explore not only its evolutionary but also its developmental functions and consequences. Throughout, the authors suggest ways to further examine the negativity bias in infants and older children, and they make testable predictions that would help clarify the nature of the negativity bias during early development.

Keywords: negativity bias, affective asymmetry, social–cognitive development, emotion, social referencing

Infants are exposed to a great deal of social information from birth, and their ability to use this information effectively is critical for development in many domains and for survival in general. This raises several important questions: Do infants attend equally to all facets of social information, or do they attend to certain facets more than others? Do they, in addition, learn and remember particular kinds of information better than others? What evolutionary and developmental consequences do these ways of approaching the environment have? In this article, we propose that infants display a negativity bias: That is, infants attend more to, are more influenced by, and use to a greater degree negative rather than positive facets of their environment. We propose possible ontogenetic pathways for the emergence of the negativity bias, and we argue that this bias serves important evolutionary and developmental functions.

While the issue of a negativity bias has not been extensively explored in infant development, it has been explored in myriad lines of adult and animal research. Although the traditional view of the impact of valenced information has been as a bipolar scale with positive and negative information having equal but opposite impact on an organism's behavior (e.g., Thurstone, 1931), much recent research has challenged this assumption. Evidence from learning research indicates a powerful negativity bias at a very basic psychological level: Negative reinforcement, as opposed to comparable positive reinforcement, leads to faster learning that is more resistant to extinction in both human adults and in animals (e.g., Garcia, Hankins, & Rusiniak, 1974; Logue, Ophir, & Strauss, 1981; see Öhman & Mineka, 2001, for a review).

Concerning a higher cognitive level, negative stimuli are hypothesized to carry greater informational value than positive stimuli and to thus require greater attention and cognitive processing (Peeters & Czapinski, 1990). Accordingly, adults spend more time looking at negative than at positive stimuli, perceive negative stimuli to be more complex than positive ones, and form more complex cognitive representations of negative than of positive stimuli (e.g., Ducette & Soucar, 1974; Fiske, 1980; H. Miller & Bieri, 1965).

Looking at a still more complex level of psychological functioning, the negativity bias has also repeatedly been revealed in adults' judgment and decision making. When making judgments, people consistently weight the negative aspects of an event or stimulus more heavily than the positive aspects (Kahneman & Tversky, 1984; see Peeters & Czapinski, 1990, for a review). This

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is also true of impression formation: When given descriptions of a hypothetical person's moral and immoral behaviors or adjectives describing the person's good and bad traits, subjects process and use the negative more than the positive information in arriving at a final impression of the person, even when the positive and negative information are equally intense (Abelson & Kanouse, 1966; Fiske & Taylor, 1991; Kanouse & Hanson, 1972; but see Skowronski & Carlston, 1987). Furthermore, people need less negative trait information to make trait inferences about others (Aloise, 1993; see also N. H. Anderson, 1965, and Czapinski, 1988).

There is also recent neuroscientific evidence for a negativity bias (e.g., Ito, Larsen, Smith, & Cacioppo, 1998; Schupp et al., 2004). For example, Ito, Larsen, et al. (1998) measured undergraduate students' event-related brain potentials (ERPs) as they showed them neutral pictures (as a kind of *context*) embedded with occasional positive or negative pictures (*targets*). The major ERP component of interest was a late positive potential (LPP), which is typically enhanced in response to evaluatively inconsistent targets (e.g., a positive stimulus embedded in a sequence of neutral stimuli) as compared to evaluatively consistent targets (e.g., a positive stimulus embedded in a sequence of positive stimuli; Cacioppo, Crites, & Gardner, 1996). As expected, Ito, Larsen, et al. found LPP enhancement in response to evaluatively inconsistent targets, both when targets were positive and when they were negative. Importantly, though, they found that the LPPs elicited by the negative pictures were significantly larger in amplitude than the LPPs elicited by the positive pictures despite the fact that both positive and negative pictures were equally probable, equally evaluatively extreme, and equally arousing. Similarly, Crites, Cacioppo, Gardner, and Berntson's (1995) data, when reexamined by Cacioppo, Gardner, and Berntson (1999), revealed larger amplitude LPPs to negative stimuli embedded in a sequence of positive stimuli as compared to the reverse. Furthermore, even when subjects are not asked to explicitly evaluate the valence of stimuli, negative stimuli implicitly receive greater neural processing (as reflected in an enhanced LPP) than do positive stimuli (Ito & Cacioppo, 2000).

Candidate brain regions that may be involved in the negativity bias have been identified in a recent functional magnetic resonance imaging (fMRI) study by Cunningham, Raye, and Johnson (2004). In this study, an area of the right inferior frontal/insular cortex was associated with implicit and explicit valence-based evaluations of stimuli, showing greater activity to stimuli rated as more negative than to stimuli rated as more positive. Interestingly, although the amygdala is often found to show more activation to negative than positive stimuli, Cunningham et al. found that, in agreement with recent reports (A. K. Anderson et el., 2003; Small et al., 2003), the amygdala is more involved in processing emotional intensity than valence. These two sets of findings make sense in light of the fact that negative stimuli are generally rated as emotionally more intense than positive stimuli (Ito, Cacioppo, & Lang, 1998). Indeed, although the amygdala has been found to be sensitive to both positive and negative stimuli, the relative modulation by the same amounts of intensity change is greater in response to negative than to positive stimuli (Lewis, Critchley, Rotshtein, & Dolan, 2007; Winston, Gottfried, Kilner, & Dolan, 2005). There does therefore seem to be an approximate encoding of the negativity bias at the neural level.

There is thus ample evidence for an asymmetry in the way that adults process and use positive versus negative information: Adults are far more attentive to and much more influenced in most psychological domains by negative than by positive information (for thorough reviews, see Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001; Taylor, 1991). Importantly, however, there has to date been no theoretical or empirical consideration of the negativity bias in development. Given the bias that adults ubiquitously display, there is a distinct possibility that even very early in development humans pay particular attention to negative information and that this special attention has significant functions and consequences in development. Furthermore, the study of the negativity bias in early development can contribute to our understanding of its origins and mechanisms throughout the life span.

If our primary goal is to understand whether humans display a negativity bias early in development, then the most promising extant developmental area to examine is infant emotional development. Infants receive vocal emotional information prenatally (e.g., Mastropieri & Turkewitz, 1999) and facial emotional information from the moment they are born, and they continue to receive these in increasingly diverse forms and via multiple modalities throughout development. Very early in development, therefore, infants have rather extensive experience with this form of information. Furthermore, most emotional information is positively or negatively valenced, thus providing even young infants with the opportunity to attend to, respond to, and use positive versus negative information. Finally, emotional information is available and useable even without more complex processes such as object permanence, symbolic representations, or language (Repacholi, 1998). This allows us to search for the negativity bias in young infants who have not yet hit advanced cognitive or linguistic milestones.

We were thus motivated by the following questions: Do infants and children display a negativity bias in the emotional realm? If so, when and through what mechanisms does such a bias emerge in ontogeny? And finally, what are the functions and consequences of this bias?

Accordingly, this article is organized as follows: In the first section, The Negativity Bias in Development, we look at evidence for the negativity bias in emotion processing. We mainly focus on social referencing because this is the phenomenon most naturally related to the understanding and use of positive and negative information about the environment, but we also briefly examine two other areas that might reveal a negativity bias: children's discourse and memory. In the second section, The Emergence of the Negativity Bias, we consider the ontogenetic emergence of the negativity bias in the emotional realm by exploring work on young infants' attention to emotional expressions as well as emotional contagion, and we use ideas and theories from developmental as well as adult psychology to propose ontogenetic explanations for the emergence of the negativity bias. The third section, Functions and Consequences of the Negativity Bias: Evolution and Development, is devoted to exploring the evolutionary and ontogenetic functions of the negativity bias. We propose that not only is this bias important for sheer survival but that it also might influence what children learn about their environments and might assist in children's social–cognitive and social–emotional development.

Finally, in the fourth section, we present possible future directions for this important but unexplored area of research.

Before continuing, it is important that we clarify two issues. The first concerns the terms *positive* and *negative*. We use these terms much like Baumeister et al. (2001) used the terms *good* and *bad*; thus, by *positive*, we mean "desirable, beneficial, or pleasant outcomes including states or consequences," whereas by *negative*, we mean "undesirable, harmful, or unpleasant" outcomes (pp. 324–325; note that for our purposes, these concepts include both psychological and external outcomes, states, and consequences). Positive information therefore includes any information about the environment that signals a desirable, beneficial, or pleasant outcome, whereas negative information includes any information that signals the opposite (see also J. A. Russell, 2003, for the argument that human core affect and the affective qualities of environmental stimuli are experienced, in part, along a positive–negative dimension; but see Lazarus, 2003, and Campos, 2003, for issues with the simplistic "positive versus negative" classification of emotions). Although in this article we deal with these concepts primarily in the affective, evaluative realm, it is also possible to examine the impact on people's nonaffective information-processing activities, such as the complexity of their cognitive representations of or causal thinking about positive versus negative information (see Peeters & Czapinski, 1990). An asymmetry or a bias in the impact of positive versus negative information means that one of the two kinds of information has a greater impact on us (at one or more levels of functioning) than the other kind.

The second issue to clarify is that in focusing on the impact of negative information, we do not want to deny in any way the critical impact of positive information and experiences on development; this point will become clearer throughout the article. Let us turn, then, to an examination of the evidence for an asymmetry in the domain of emotional development.

The Negativity Bias in Development

Despite the ubiquity of the negativity bias in adulthood, no explicit theoretical or empirical work has examined this bias in development. However, we suggest that there is a large body of research examining other developmental processes that could, as a byproduct, speak to this issue. We focus here on research on the social–emotional realm.

Evidence From Social Referencing

An important way that infants learn about their environment is by using the emotional information that they receive from their caregivers. This is especially true toward the end of the 1st year, when infants begin independent locomotion and become relatively self-sufficient in exploring their surroundings. Campos and colleagues (Campos et al., 2000; Campos, Hiatt, Ramsay, Henderson, & Svejda, 1978; Campos, Kermoian, & Zumbahlen, 1992) have reported that the onset of locomotion is accompanied by an increased interest in distal objects or people as well as an increased "checking back" with caregivers. This checking back is part of *social referencing* whereby, when infants around 1 year of age encounter new or ambiguous situations, they use others' perceptions and interpretations of the events to form their own interpretations of those events (Campos & Stenberg, 1981; Feinman, 1982; but see Baldwin & Moses, 1996). The ability to gather and receive information about novel or ambiguous events allows infants to vicariously learn about environmental stimuli (Campos & Stenberg, 1981). Social referencing is thus a sociocognitive skill that not only aids our basic survival but also permits the successful transmission of culture (Tomasello, 1999; Tomasello, Kruger, & Ratner, 1993).

In keeping with the common view that the impact of emotional information is organized on a bipolar scale, a frequently tested hypothesis about infant social referencing is that when infants receive positive information about a novel, ambiguous event from an adult, they will react positively to the event, whereas if they receive negative information, they will react negatively to the event (e.g., Campos & Stenberg, 1981; Klinnert, 1984). In tests of this hypothesis, infants in multiple studies have been exposed to ambiguous situations such as novel toys (e.g., Hornik, Risenhoover, & Gunnar, 1987; Walden & Ogan, 1988), strangers (e.g., Clarke-Stewart, 1978; Feinman & Lewis, 1983), or the visual cliff (e.g., Sorce, Emde, Campos, & Klinnert, 1985; Vaish & Striano, 2004). In these studies, caregivers or experimenters provided infants with positive or negative emotional information about the novel situation. The effectiveness of the information is typically measured by the infants' subsequent reactions to the situation.

In several social referencing studies in which the effects of positive versus negative emotional messages were compared, infants were found to behave as predicted: They interacted more with the ambiguous stimuli if they had received positive messages than if they had received negative messages from the adult (e.g., Camras & Sachs, 1991; Walden & Ogan, 1988). On the face of it, this consistent finding seems to support the bipolar scale model and to preclude the possibility of a negativity bias in infant social referencing behavior. However, a significant difference between the impact of positive and negative messages could as well be caused by only one of the two valences actually influencing infant behavior. Without a neutral or baseline measure of infant behavior, it is difficult to conclude that both kinds of messages impact infants (for similar arguments, see Feinman, Roberts, Hsieh, Sawyer, & Swanson, 1992; Mumme & Fernald, 2003).

We should thus first consider those studies that have systematically compared the impact of positive, negative, and neutral messages in social referencing situations (for a summary of studies on social referencing, see Table 1)[1]. In one classic study, Hornik et al. (1987) had mothers use facial, vocal, and gesture cues to display positive affect, disgust, or no affect about an ambiguous toy to their 12-month-old infants. In support of the social referencing hypothesis, Hornik et al. found that maternal displays of emotion appropriately influenced infants' responses to the toy. Interestingly, however, infants in the disgust condition played less with the ambiguous toy than did infants in the positive or neutral conditions, whereas infant behavior did not differ across neutral

[1] To search for relevant studies on social referencing, we first conducted a search on PsycINFO with the keyword *social referencing* and limited the search to empirical, experimental, and published work on typically developing infants and children. Furthermore, we relied on the overviews of the social referencing literature by Baldwin and Moses (1996), Toshihiko and Tetsushi (2001), and Feinman (1992) to direct us to relevant literature that did not show up in the PsycINFO search.

Table 1
Summary of Studies on Social Referencing

				Emotions or cues										Modalities			
Study	Age	Stimuli	Referee	Neutral	Inattentive	Happy	Fear	Disgust	Sadness	Anger	Surprise	Interest	Other	Face	Voice	Gestures	Touch
Showed a negativity bias																	
Sorce et al. (1985)	12 mo.	Visual cliff (ambi., flat)	Mother			√	√		√	√	√	√		√			
Hornik et al. (1987)	12-13 mo.	Positive, neutral, & aversive toys	Mother	√		√		√						√	√	√	
Walden (1993)	27-95 mo. (*M* = 52 mo.)	Box with toy inside	Exp.	√		√	√								√		
Mumme et al. (1996)	12 mo.	Ambi. & positive toys	Mother	√		√	√							√	√		
Hertenstein & Campos (2001)	12 mo.	Ambi. toys	Mother	√		√	√										√
Moses et al. (2001)	12 & 18 mo.	Ambi. toys	Exp.			√		√							√		
Mumme & Fernald (2003)	10 & 12 mo.	Ambi. toys	Exp.	√		√	√							√	√		
Hertenstein & Campos (2004)	11 & 14 mo.	Ambi. toys	Exp.			√		√						√	√	√	
L. J. Carver & Vaccaro (2007)	12 mo.	Ambi. toys	Parents	√		√		√						√	√		
Did not show a negativity bias																	
Klinnert et al. (1983)	12-13 mo.	Ambi. toy	Stranger			√	√							√			
Klinnert (1984)	12 & 18 mo.	Ambi. toys	Mother	√		√	√							√			
Uninformative with regard to the negativity bias																	
Sorce & Emde (1981)	15 mo.	Mildly to highly uncertain situations	Mother		√	√								√	√		
Feinman & Lewis (1983)	10 mo.	Stranger	Mother	√		√								√	√		
Feiring et al. (1984)	15 mo.	Stranger–mom, stranger–stranger interactions	n/a: indirect cues from interactions	√		√								√	√		

Table 1 (*continued*)

Study	Age	Stimuli	Referee	Emotions or cues									Modalities			
				Neutral	Inattentive	Happy	Fear	Disgust	Sadness	Anger	Surprise	Interest	Other	Face	Voice	Gestures	Touch
Gunnar & Stone (1984)	12-13 mo.	Positive, ambi., & aversive toys	Mother	√		√								√	√	√	
Zarbatany & Lamb (1985)	14 mo.	Ambi. toy spider	Mother & stranger			√	√							√			
Dickstein & Parke (1988)	11 mo.	Stranger	Mother vs. father	No emotions or cues provided													
Hornik & Gunnar (1988)	12 & 18 mo.	Black, caged rabbit	Mother			√								√	√		
Walden & Ogan (1988)	6-9; 10-13; 14-22 mo.	Ambi. toys	Mother			√	√							√	√		
Walden & Baxter (1989)	6-12; 13-23; 24-40 mo.	Ambi. toys	Parents			√	√							√	√		
Hirshberg (1990)	12 mo.	Ambi. toys	Mother, father, or both			√	√							√	√		
Hirshberg & Svejda (1990)	12 mo.	Ambi. toys	Mother, father, or both			√	√							√	√		
Camras & Sachs (1991)	10-19 mo. (M = 14.6 mo.)	Ambi. toys	Female daycare workers			√	√							√			
Rosen et al. (1992)	12 mo.	Ambi. toys	Mother			√	√							√	√		
C. L. Russell et al. (1997): with chimpanzees	26 mo.	Ambi. toys	Human caregiver			√	√							√	√		
Stenberg & Hagekull (1997)	12 mo.	Ambi. toys	Mother			√	√							√	√		
Blackford & Walden (1998)	11-15; 16-22 mo.	Ambi. toys	Parent			√	√							√	√		
Repacholi (1998)	14 & 18 mo.	2 boxes with positive or negative toys	Exp.			√		√						√	√		
Stenberg (2003)	12 mo.	Ambi. & unambi. toys	Mother	√	√	√	√							√	√		
Slaughter & McConnell (2003)	8-14 mo.	Ambi. toys	Primary caregiver			√		√						√	√		
Friend (2003)	4 yr.	Attractive, novel toy	Exp.										√	√	√		
Vaish & Striano (2004)	12 mo.	Visual cliff (ambi.)	Mother			√								√	√		

Note. The boldface checkmark denotes approval versus disapproval cues. Ambi. = ambiguous; unambi. = unambiguous; exp. = experimenter.

and positive conditions. Similarly, Mumme, Fernald, and Herrera (1996) had mothers display either facial-only or vocal-only happy, neutral, or fearful messages about some ambiguous toys. Their results revealed that fear cues, especially vocal cues, were effective in inhibiting 12-month-olds' exploration of novel toys, whereas positive cues were no more effective in increasing exploration than were neutral cues. Specifically, infant behavior in happy- versus neutral-voice conditions did not differ, whereas infants in the fear-voice condition showed an increase in their looking to mothers and a decrease in toy proximity. Such clear differences were not revealed in the face-only conditions, possibly because facial-only cues tend to be less powerful social referencing cues than vocal-only cues (a point to which we return shortly).

In another social referencing study, Mumme and Fernald (2003) showed 12-month-old infants an experimenter on a television screen displaying happy, neutral, or fear facial and vocal cues toward one ambiguous toy (the target) while ignoring another ambiguous toy (the distractor). These same toys were then presented to infants, and infants' interactions with the toys were assessed. Again, similar to Hornik et al. (1987) and Mumme et al. (1996), there was no significant difference in the amount that 12-month-olds touched the target in the positive compared with the neutral conditions, whereas infants in the fear condition touched the target less than in the neutral condition.

Hertenstein and Campos (2001) assessed 12-month-olds' responses to positive, negative, and neutral tactile cues (see Hertenstein, Keltner, App, Bulleit, & Jaskolka, 2006, for evidence that tactile cues can communicate distinct emotions). Mothers held infants around the abdomen, using pressure from their hands to convey emotions about ambiguous toys that were presented one at a time. In the positive condition, mothers relaxed their grip and their posture when the toy was presented (to convey happiness or relief); in the negative (fear) condition, mothers tensed their fingers around the infants' abdomen and inhaled abruptly; mothers in the neutral condition simply held the infants' abdomen with a consistent amount of pressure. After each presentation, infants could explore the object that had just been presented. The results showed a negativity bias: Infants in the negative condition waited longer to contact the toy and touched the toy less than did infants in the neutral condition; these behaviors were not different across positive and neutral conditions. Thus, compared to the neutral condition, whereas the negative condition affected infant behavior, the positive condition did not.

Evidence for an asymmetry has also begun to emerge in the new field of developmental neuroscience. For example, in L. J. Carver and Vaccaro's (2007) study on the neural correlates of social referencing, 12-month-olds saw an adult display positive affect, disgust, and neutral affect about three ambiguous toys. Infants were then shown pictures of the three toys while their ERPs were measured. The results suggested that, compared to the negative component (Nc) elicited by the toys that had received positive and neutral displays, the amplitude of the Nc elicited by the toy that had received negative displays was significantly greater. The Nc is a negative deflection over frontal and central electrodes that occurs between 400 and 800 ms after the onset of the stimulus and is generally interpreted as reflecting infants' allocation of attention, with greater amplitude indexing greater allocation of attention (Courchesne, Ganz, & Norcia, 1981; Nelson, 1994). Thus, L. J. Carver and Vaccaro's results indicate that infants allocated greater attention to the toy associated with a negative emotion than to the toys associated with positive or neutral emotions. These results parallel the finding by Ito, Larsen, et al. (1998; see introduction of this article) that adults' ERPs show enhanced activity in response to evaluatively negative as compared to positive or neutral stimuli.

The social referencing studies described above can clearly address the issue of the relative influence of positive versus negative emotional messages because they employ neutral conditions. All of them indicate the more immediate and greater impact of negative cues (e.g., fear, disgust) versus positive cues (e.g., happiness), suggesting that a negativity bias is already in place, at least in the context of social referencing, by the end of the 1st year. There are, in addition, several social referencing studies whose designs do not permit such direct comparisons but that nonetheless further support the idea that negative cues are more powerful than positive ones. For instance, in a recent study, Hertenstein and Campos (2004) used a social referencing paradigm to examine how well 11- and 14-month-old infants retain emotional information about novel toys over time. Infants watched the experimenter emoting either positively or disgustedly toward one toy (the target) while ignoring another toy (the distractor). In Study 1, infants' behavior toward the novel toys was examined an hour later, at which time 14-month-olds (but not 11-month-olds) showed the predicted behavior: Infants touched the target less and waited longer to touch the target in the negative than in the positive conditions. A closer analysis of these data suggested that the negative condition was driving the differences obtained across the conditions: The duration of time the infants touched the target objects was approximately the same across all 11-month-olds as well as the 14-month-olds in the positive condition; it was the 14-month-olds in the negative condition who touched the target significantly less than the other infants.

In Study 2, when Hertenstein and Campos (2004) tested 11-month-olds with a delay of only 3 min, they found that these younger infants showed a similar pattern of results as the 14-month-olds in Study 1. Again, however, Hertenstein and Campos (2004) pointed out that the 11-month-olds in the positive condition behaved much like the 11-month-olds in Study 1; it was the 11-month-olds in the disgust condition that, after a brief delay, behaved differently from the other 11-month-olds and thus caused a significant difference. Thus, these results suggest that the experimenter's negative affect had a much greater impact than did positive affect on both 11- and 14-month-old infants' behavior toward novel, ambiguous stimuli, even after a delay.

In another study (Moses, Baldwin, Rosicky, & Tidball, 2001), conducted to assess infants' referential understanding, infants received happy or disgust vocal cues about a target object from either an in-view experimenter who was looking at the target object (affect-relevant condition) or an out-of-view experimenter who had no visual access to the target object (affect-irrelevant condition). Moses et al. (2001) found that 12- and 18-month-old infants in the affect-relevant condition interacted less with the target after receiving negative than positive cues, but this difference did not emerge in the affect-irrelevant condition. Interestingly, these findings again seemed to be driven by the negative emotion condition: Infants were more likely to avoid the target object in the affect-relevant, negative condition than in the affect-irrelevant, negative condition, whereas infants did not approach the target more in the affect-relevant, positive condition than in the affect-irrelevant, positive condition. Thus, infants' behavior was affected by negative but not by positive emotional signals.

Evidence for an asymmetry also comes from a classic study (Sorce et al., 1985) designed to assess whether infants would heed their mothers' facial expressions when deciding to cross over to the deep side of a visual cliff. Infants were placed on the shallow end of a 30-cm visual cliff, and when they looked toward their mothers, they received fear, anger, happy, or interest facial cues. (The study also included expressions of sadness, but these were not very appropriate for the situation, and it is unclear what behavior they should have elicited on the visual cliff; see Feinman et al., 1992. We therefore do not discuss this condition further.) None of the 17 infants in the fear condition crossed the cliff, and 89% (16 of 18 infants) in the anger condition did not cross, whereas 74% (14 of 19 infants) in the happy condition and 73% (11 of 15 infants) in the interest condition crossed. In other words, the negative cues had a significantly greater impact on the infants than did the positive cues, $\chi^2(1, N = 69) = 5.55$, $p = .019$, providing support for a negativity bias.

Research with older children has also revealed evidence for a negativity bias in a social referencing context. For instance, Walden (1993) conducted a study in which an experimenter told children what to expect when they opened a box. Children either were made to expect something positive, scary, or neutral or were not given any information about the box (control). They were then taken to the room with the box and allowed to interact with it for a few minutes. Walden found that for children as young as 2 years, being told that the stimulus was frightening virtually eliminated all proximal behavior toward the stimulus, whereas the other three conditions (positive, neutral, and control) were equivalent in all aspects of these young children's behavior.[2]

Despite this substantial body of evidence suggesting an asymmetry in infants' use of positive versus negative affective cues, a few studies have not supported this idea. One such study (Klinnert, Emde, Butterfield, & Campos, 1986) was concerned with whether 12- to 13-month-old infants can use a friendly stranger's facial expressions to guide their behavior toward ambiguous toys. Infants were shown an ambiguous toy, which their mothers looked at neutrally while a familiar experimenter smiled at it or looked fearful of it. The results showed that 13 of 19 infants in the smile group approached and touched the ambiguous toy, whereas 8 of 19 infants in the fear group did so, suggesting that both emotions had a comparable impact on infant behavior. However, Klinnert et al. (1986) did not employ a neutral condition, making it difficult to determine whether one emotion was more effective than the other. Nevertheless, these results seem to be at odds with the differences between happy and fear facial-only expressions revealed in Sorce et al.'s (1985) visual cliff study, a discrepancy that we return to shortly.

In another study that did not reveal an affective asymmetry (Klinnert, 1984), 12- and 18-month-olds saw mothers displaying smiling, fearful, or neutral facial expressions about an ambiguous toy. Infants moved closest to the mother when she posed fear, moved farthest from her when she smiled, and maintained an intermediate distance when she was neutral. This finding seems to go against findings from other similar social referencing studies (e.g., Hornik et al., 1987; Mumme et al., 1996) and against the negativity bias hypothesis. However, infant behavior in Klinnert's (1984) study was not significantly different across emotion conditions; thus, although the means were in the right directions, neither negative nor positive emotions produced significantly different behavior toward the mothers as compared to the neutral condition. Infant behavior toward the toy was also not significantly different as a function of emotion condition. It is therefore not possible to say whether one emotion influenced infant behavior more than the other or whether both influenced it equally.

Furthermore, in both of the studies discussed above (Klinnert, 1984; Klinnert et al., 1986), infants received facial-only cues about ambiguous situations. Past work has shown facial-only cues to be less effective than vocal-only or multimodal cues in guiding infant behavior, especially in nonthreatening ambiguous situations such as novel toys (Hirshberg & Svejda, 1990; Mumme et al., 1996; Walker-Andrews, 1997). Specifically, whereas vocal-only and multimodal cues are effective regulators of infant behavior in ambiguous and threatening situations, facial-only cues seem to be weaker regulators that function better in threatening than in ambiguous situations, and even then less effectively than vocal-only cues (e.g., Mumme et al., 1996; Sorce et al., 1985; Vaish & Striano, 2004). This might also explain the apparent discrepancy in results between Klinnert et al.'s (1986) study, which employed facial-only cues in an ambiguous situation, and Sorce et al.'s (1985) study, which employed facial-only cues in a threatening situation.

It should be pointed out that in the studies reviewed above, differences in the intensities of positive versus negative signals might have confounded the effects of valence. That is, if participants perceived the negative signals to be more extreme or intense than the positive signals, then the resulting bias is not a negativity bias but merely an intensity bias (e.g., Fiske, 1980). It is thus important that the intensity of positive versus negative cues be either equalized or systematically varied so that the effects of the valences are isolated. Unfortunately, the intensity of positive versus negative signals has been controlled in only a few social referencing studies. For instance, L. J. Carver and Vaccaro (2007) had independent coders rate the intensities of the facial and vocal cues provided by the caregivers to the infants and found the intensities of the expressions of happiness and disgust to be very similar. Similarly, Mumme et al. (1996) found that mothers in their study produced equivalent intensities of happy and fearful vocal cues, and moreover, that the intensity of the neutral signal was very close to zero. The fact that both of these studies revealed a negativity bias suggests that such a bias does exist in addition to any intensity bias that might also exist.[3] Nevertheless, many studies do not report intensity ratings, in addition to which it is often

[2] Interestingly, Walden (1993) found that children 5 years and older opened the box the most quickly when they had received negative information about it. Walden offered several possible explanations for this anomalous finding, including "impression-management" (older children not wanting to appear weak), lack of believability because the experimenter cued negatively about the box but then did not try to prevent the children from opening it, and so on. It thus seems likely that these findings can be explained by factors other than the absence of a negativity bias (see also Walden & Ogan, 1988).

[3] A counterargument to this claim might be that even if the positive and negative stimuli have objectively equivalent intensity, they might still have different psychological intensity, that is, negative stimuli (e.g., −$100) might be perceived or experienced more intensely than positive stimuli of equal intensity (e.g., +$100). However, this is not really a counterargument; it is, in fact, our argument precisely: that negative stimuli have a greater psychological impact than do equivalent positive stimuli (see also Kanouse & Hanson, 1972, for a similar argument).

difficult to establish whether a neutral signal truly falls at the midpoint between positive and negative signals of equal intensity. Thus, often, a negativity bias might be found to be due partially to differences in signals' intensities rather than due to negativity alone.

One way to tease apart the effects of negativity and intensity would be to assess the impact of extreme positive information, because negativity would not contribute to the impact of extreme positive information, whereas intensity would. This has, to some degree, been addressed in the adult social psychology literature (e.g., Fiske, 1980; Skowronski & Carlston, 1992) and has revealed mixed results. Another way would be to obtain a priori ratings by naive subjects about the intensities of various positive and negative stimuli and to then use stimuli rated as having equal intensities in tests of the negativity bias. This method, too, has been employed in adult social psychology work (e.g., Ito, Larsen, et al., 1998), and importantly, has revealed a negativity bias. However, similar work needs to be conducted with infants and children before any conclusions about the individual contributions of intensity and negativity can be drawn with respect to developmental data.

To summarize, the traditional way of visualizing the effects of positive versus negative information (in a bipolar manner) has not been supported by the research on social referencing. Instead, the evidence suggests that by 12 months, infants display a strong negativity bias. More research is needed to address remaining questions, such as whether the differential impact of the communicative channel (e.g., facial vs. vocal) indeed plays a role in this bias as well as whether differences in the intensities of positive versus negative emotions partially contribute to the negativity bias. We now examine how prevalent this bias is by exploring a few areas of development related to but distinct from emotional development.

Evidence From Other Developmental Domains

We consider here two areas of development: discourse and memory. Both domains are multifaceted and complex; however, here, we consider only those facets of these domains that clearly deal with valenced information.

Let us first consider discourse. Positive and negative emotion words first appear in children's speech around 20 to 24 months (Bretherton, Fritz, Zahn-Waxler, & Ridgeway, 1986; Ridgeway, Waters, & Kuczaj, 1985), and words such as *happy*, *sad*, *mad*, and *scared* are common by 2 to 2.5 years (Dunn, Bretherton, & Munn, 1987; Wellman, Harris, Banerjee, & Sinclair, 1995). Lagattuta and Wellman (2002) reported that children younger than 3 years use equivalent numbers of positive and negative words; however, after 3 years, whereas the number of positive words remains the same, the number of unique negative words used almost doubles.[4] Fivush (1991) also showed that when 2.5- to 3-year-old children and their mothers discussed past emotional events, both used more negative than positive emotion words. Furthermore, Dunn et al. (1987) found that children between 18 and 24 months most commonly discussed themes of distress, pain, and fatigue with their mothers. By the 3rd year, 51.2% of children's causal conversational turns focused on the distress theme, whereas only 7.3% focused on the theme of pleasure or liking (see Dunn & Brown, 1991a). Overall, then, children's discourse, like their social referencing behavior, is suggestive of a negativity bias.

Some research on children's memories of positive and negative events also indicates a negativity bias. In a longitudinal study, P. J. Miller and Sperry (1988) found that 1.5- to 2.5-year-old girls' talk with their mothers about distant past events was primarily about negative events, especially those involving physical harm. A longitudinal case study that examined a child's ability to talk with her mother about the past between 20 and 28 months (Hudson, 1991) revealed that both mother and daughter discussed past negative emotions far more than positive emotions: Negative emotions comprised 68% of emotions mentioned by the mother and 76% of those mentioned by the daughter.[5] Further evidence for a negativity bias in children's memories comes from Ornstein (1995), who compared results from two studies: Baker-Ward, Gordon, Ornstein, Larus, and Clubb's (1993) study examining 3-, 5-, and 7-year-old children's memories for a routine physical examination and Merritt, Ornstein, and Spicker's (1994) study on how well children between 3 and 7 years remembered an invasive and stressful medical procedure. Ornstein (1995) found that children who had experienced the invasive procedure provided more exhaustive and accurate reports of that procedure, and had higher levels of recall in response to open-ended questions, than did children reporting about the regular checkup (although note that factors other than valence, such as different parental responses to the two events, the novelty of the stressful procedure, or the extreme nature of the stressful procedure might also have contributed to this effect).

Interestingly, children not only discuss and recall negative emotions and events more but also display more sophisticated sociocognitive abilities while doing so. For instance, preschoolers spontaneously talk with their mothers more often about the causes of unpleasant than of pleasant emotions (Dunn & Brown, 1993). Moreover, as opposed to issues that 18-month-olds laugh at or are neutral about during disputes, it is the issues that they become most distressed or angry about (e.g., their rights) that, at 36 months, they are most likely to produce justifications for (Dunn, 1988; Dunn & Munn, 1987; see also Eisenberg, 1992). Similarly, Lagattuta and Wellman (2002) found that children talked about past emotional experiences, discussed the causes of emotions, and asked open-ended questions at higher rates when talking about negative than about positive feelings (see also Stein & Miller, 1993). Children in Lagattuta and Wellman's (2002) study also talked more about the relationships between negative emotions and other mental states

[4] This finding could be thought to reflect not a negativity bias in children's language but rather the fact that there simply are fewer discrete or basic positive emotions than negative ones, and subsequently fewer positive emotion words than negative ones in the English language (see Fredrickson, 1998). However, this fact is itself evidence for a negativity bias: As Nesse (1990) argued, natural selection has shaped our emotions only for situations that present threats or opportunities, and there are more negative than positive emotions because there is a larger variety of threats than opportunities. Also, the rest of the evidence presented with regard to discourse is not open to this criticism because children's language shows a negativity bias even when we look beyond their negative versus positive vocabulary.

[5] However, note that none of the studies discussed here clarify whether the tendency to focus on negative emotions and events is driven by children, driven by caregivers, or is bidirectional (see Lagattuta & Wellman, 2002, for a relevant discussion).

than between positive emotions and mental states (for a review of similar findings with adults, see Taylor, 1991). In contrast, when discussing positive emotions, both children and adults focused on people's current, ongoing emotional *attitudes* (such as "like" or "love") rather than on more discrete emotional *states* (such as "happy").

These results correspond with work on children's understanding about the causal precursors of negative versus positive emotions. For example, Lagattuta and Wellman (2001) found that 3- to 7-year-old children consistently used a person's past experiences to explain that person's current negative emotions (sadness or anger) more than they did to explain the person's current positive emotions. These children also made more frequent references to the person's thinking about the past when the person was currently experiencing a negative versus a positive emotion.

Work on children's memories has led to similar findings. For instance, Fivush (1991) found that when discussing past emotional events with their children, mothers were more likely to explicitly discuss as well as emphasize explaining and understanding the causes and consequences of negative more than of positive emotions (see also Sales, Fivush, & Peterson, 2003). Furthermore, and in line with Lagattuta and Wellman's (2002) findings, Fivush, Hazzard, Sales, Sarfati, and Brown (2003) found that children between 5 and 12 years recalled negative events more coherently and with more focus on internal states than was true for positive events, whereas they reported more descriptive details, objects, and persons when recalling positive versus negative events. Overall, then, children display more sophisticated sociocognitive skills when talking about and recalling negative emotions and events; possible reasons for this interesting asymmetry are discussed in the section Functions and Consequences of the Negativity Bias: Evolution and Development.

In summary, children's discourse and memories about emotions and valenced events indicate a negativity bias. Of course, we have just skimmed the surface of the developmental research that could be explored for the presence or absence of the negativity bias, but we hope we have provided a sense of how rich the examination of the negativity bias in developmental research could be. All in all, the negativity bias does emerge in the way infants and children use, communicate about, and recall emotional events and information. We now move on to considering the beginnings of this bias.

The Emergence of the Negativity Bias

If a negativity bias is robust and active in the emotional domain in humans 12 months and older, when and how does it first emerge? This section is a first pass at answering these questions. We review the literature on two of the earliest forms of emotion processing: attention to emotional expressions and emotional contagion. An asymmetry in these domains would mean that infants show a particularly strong response to negative emotional expressions. A "strong response" could entail paying more attention or showing stronger affective responses to negative than to positive emotions. For each domain, we propose ontogenetic mechanisms to account for the pattern of findings.

The Negativity Bias in Attention to Emotions

In this subsection, we review some work on young infants' attention to emotional expressions and explore whether an asymmetry exists in this respect. The bulk of this literature examines infants' responses to facial expressions and reveals a developing sensitivity to affective information from very early on (e.g., Barrera & Maurer, 1981; Field, Woodson, Greenberg, & Cohen, 1982; see Nelson, 1987, for a review). Newborns discriminate happy from fearful, but not fearful from neutral, facial expressions (Farroni, Menon, Rigato, & Johnson, 2007). Four- and 6-month-olds discriminate happy from angry and neutral expressions, but not angry from neutral expressions (LaBarbera, Izard, Vietze, & Parisi, 1976; but see Caron, Caron, & Myers, 1985). Thus, very young infants seem to discriminate happy expressions better than negative ones.

Infants younger than 6 months also look longer at happy than at fearful, angry, or neutral facial expressions (Farroni et al., 2007; LaBarbera et al., 1976; but see Montague & Walker-Andrews, 2001). Moreover, Wilcox and Clayton (1968) presented motion pictures of a smiling, frowning, and neutral expression to 5-month-old infants and found that infants' looking time to the smiling expression was greater than that to the frowning or neutral expressions. These studies suggest that, contrary to the negativity bias, very young infants may in fact attend more to positive than to negative facial expressions (see also Schwartz, Izard, & Ansul, 1985).

The limited extant research on infants' responses to vocal expressions suggests a similar pattern. Aldridge (1994, as cited in Walker-Andrews, 1997) used a sucking procedure to examine whether newborn infants would suck harder on a pacifier to generate happy, angry, or sad voices and found that neonates sucked harder (i.e., preferred) to listen to happy compared to angry and sad voices (see also Mastropieri & Turkewitz, 1999). Also, Fernald (1993) found that 5-month-olds preferred to listen (as measured by looking time to the side of the stimulus presentation) to infant-directed approval than prohibition vocalizations, even in unfamiliar languages (see also Singh, Morgan, & Best, 2002). Thus, very young infants may prefer to listen to positive than to negative vocal expressions.[6]

Later in the 1st year, infants begin to pay more attention to negative emotions. Thus, Ludemann and Nelson (1988) found that 7-month-olds looked longer at fearful than at happy faces, a finding that has since been replicated and extended (e.g., de Haan, Belsky, Reid, Volein, & Johnson, 2004; Kotsoni, de Haan, & Johnson, 2001; Nelson & Dolgin, 1985). In a social referencing paradigm (Mumme, DiCorcia, & Wedig, 2004), 10-month-olds viewed an experimenter displaying happy, neutral, or fearful facial and vocal cues toward some toys. Although infants did not modify their behavior toward the toys according to the emotional displays, they did pay more attention to the experimenter in the fearful than in the neutral or happy conditions, whereas attention to the exper-

[6] Note, however, the difficulty in distinguishing between preferences for versus attention to stimuli. For instance, for our purposes, Aldridge's (1994, as cited in Walker-Andrews, 1997) and Fernald's (1993) findings are problematic because infants may *prefer* to listen to positive vocalizations, but negative vocalizations might still demand more *attention* because they carry more information or because they are rarer. Infants' looking times to facial expressions suffer from similar interpretation problems. It is thus important to design studies that can tease attention from preference and to use other methods (e.g., ERPs, as discussed below) that provide additional evidence regarding what infants' responses index.

imenter was not different in the neutral versus happy conditions. Converging evidence comes from infants' ERPs. Nelson and de Haan (1996) and de Haan et al. (2004) found that the Nc in 7-month-old infants' ERPs was greater in amplitude to fearful than to happy faces. Recall from the section *Evidence From Social Referencing* that the Nc is thought to reflect infants' allocation of attention. Thus, in the second half of the 1st year, infants seem to visually attend more and allocate more attentional resources to fearful than positive expressions.

Infants' processing of angry faces presents a slightly different picture. Looking time measures reveal that both 7- and 12-month-old infants look longer at happy than at angry facial expressions; on the other hand, 7-month-olds' ERPs reflect a larger Nc to happy than to angry faces, whereas 12-month-olds' ERPs show an adult-like enhanced posterior negativity to angry faces (Grossmann, Striano, & Friederici, 2007; Schupp et al., 2004). This pattern of behavioral and electrophysiological findings suggests that by 7 months, infants may not detect the threat conveyed by an angry face and may allocate more attentional resources (as indicated by their ERPs) and also look longer to the preferred happy than to angry faces. By 12 months, the adult-like pattern of brain responses suggests that infants detect an angry face as a threatening signal and thus, in the behavioral experiment, look less at the angry face in order to withdraw from the threat (see Adams & Kleck, 2005). Thus, similar behavior (i.e., longer looking to happy faces) at the two ages might be due to different neurocognitive processes. This illustrates the power of using ERPs, which provide insight into the ongoing neural processes while the infant is attending to a stimulus, in conjunction with observing the behavioral outcomes of these processes. Interestingly, an ERP study comparing infants' brain responses to happy, angry, and neutral prosody (Grossmann, Striano, & Friederici, 2005) suggests that in the vocal domain, a negativity bias is evident by 7 months. The discrepant findings from the facial and vocal domains is not surprising given that the vocal modality is in many ways a more powerful channel of emotional communication than the visual modality (see the *Evidence From Social Referencing* section).

Based upon this review, we tentatively suggest that in typical development, a negativity bias might emerge as early as the second half of the 1st year (and younger infants might show a positivity bias). However, this preliminary idea needs to be tested in studies of infants both early and late in the 1st year using behavioral and neuroscientific methods in order to chart, using converging evidence, infants' responses during the 1st year. Further work also needs to be conducted using other negative emotions (e.g., sadness, disgust) in order to understand whether this pattern emerges across all or only some negative emotions.

What mechanisms underlie this emergence? One suggestion (Nelson, Morse, & Leavitt, 1979) is that certain negative expressions (such as anger or fear) may cause a defensive response in infants, resulting in greater arousal and therefore slower habituation. This response might be due to a species-specific predisposition to code negative expressions as signaling aversive situations. That is, it may be inherently more important for an infant to attend to fear or anger than to happy expressions, as fear and anger signal danger. Such an evolution-based theory seems to imply that the negativity bias is innate, that is, built right into our neural circuitry and consequently into our psychology (e.g., Rozin & Royzman, 2001). Ontogenetically, this might suggest that an asymmetry should be evident from very early on, if not from birth. Such reasoning would be flawed, however, because abilities that are sculpted by evolution need not be developmentally innate (McClintock, 1979; Gottlieb, 1992, 2007). Moreover, the data (discussed above) appear not to support this ontogenetic prediction, because infants seem not to show a negativity bias in the first few postnatal months, at least in the emotional domain. Thus, even if the bias is a product of evolution, early experience may play a role in its ontogenetic emergence (see Johnson, 2005, for a systematic discussion and classification of gene–environment interactions during individual development).

To assess the nature of this early experience, let us first consider *range-frequency* theory (e.g., Helson, 1964; Parducci, 1995; see also *figure-ground* theory, Kanouse & Hanson, 1972), which is based on the premise that people perceive the majority of their outcomes as positive, hold positive expectations for the future, perceive other people positively, and generally view the world in a positive light (Klar & Giladi, 1997; Peeters, 1991; Pulford & Colman, 1996). This disproportionate positivity skews our psychological reference point in a positive direction. Negative events are thus more surprising and unexpected and therefore draw disproportionate attention and resources (e.g., Fiske, 1980). Thus, according to range-frequency theory, it is not the negativity of negative events per se but rather their unexpectedness that is responsible for a negativity bias.[7]

The range-frequency hypothesis might provide one explanation for the ontogenetic emergence of the negativity bias. Specifically, if young infants typically had positive everyday interactions, then their evaluative neutral point, rather than being equidistant from positive and negative evaluations, would shift closer to positive evaluations; this would make subsequent negative interactions stand out and demand more attention and resources, resulting in a negativity bias. Indeed, there is evidence that early on, infants have primarily (although not exclusively) positive interactions. For example, mother–infant face-to-face play, which begins around 2 or 3 months, consists primarily of positive affective synchronization, that is, mothers and infants mutually sharing positive arousal (Brazelton, Tronick, Adamson, Als, & Wise, 1975). Moreover, mothers of 3- to 6-month-old infants rarely display any negative emotions to their infants (Malatesta & Haviland, 1982; see also Malatesta, Grigoryev, Lamb, Albin, & Culver, 1986; Kuchuk, Vibbert, & Bornstein, 1986). Finally, there is evidence that only when infants begin independent locomotion (around 7 to 8 months) do mothers begin to use prohibitions and to express negative emotions such as anger and fear toward their infants, as infants are now mobile enough to face real dangers (Bertenthal &

[7] Some researchers (e.g., Bohner, Bless, Schwarz, & Strack, 1988; Kellermann, 1984) have attempted to rule this out by manipulating the probability and the negativity of events independently and revealing a negativity bias even when the negative and positive events occurred equally frequently (see also Eastwood, Smilek, & Merikle, 2001; Fox et al., 2000; Hansen & Hansen, 1988; Öhman, Lundqvist, & Esteves, 2001; and Pratto & John, 1991). Note, however, that if in our daily lives, we do generally experience more positive than negative outcomes, and negative outcomes do therefore stand out, then when faced with an artificial research situation in which there is an equal or higher probability of negative outcomes, we might nevertheless display a negativity bias (Baumeister et al., 2001; Taylor, 1991).

Campos, 1990; Campos et al., 1978, 2000; Campos, Kermoian, & Zumbahlen, 1992). This early predominance of positive expressions might positively skew infants' psychological reference point so that later on, the novelty of negative emotions causes a negativity bias (see also Baldwin & Moses, 1996; Mumme, 1993).

Support for the range-frequency idea comes from de Haan et al.'s (2004) work, which revealed that 7-month-olds who had had more frequent exposure to happy expressions (because they had very happy, positive mothers) showed a greater negativity bias (i.e., more visual attention and a larger Nc in their ERPs to fearful than to happy expressions) than did 7-month-olds whose mothers were not as happy and positive. The converse effect is found in infants of depressed mothers who, compared to nondepressed mothers, display flatter affect, more negative facial expressions, and fewer positive facial expressions toward their infants (e.g., Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986; Field, 1992). At 3 months, infants of depressed versus nondepressed mothers looked for less time at a sad face-and-voice stimulus (Field, Pickens, Fox, Gonzalez, & Nawrocki, 1998), and at 6 months, infants of mothers who reported more depressive symptoms showed a greater preference for smiling faces than did infants of mothers who reported fewer depressive symptoms (Striano, Brennan, & Vanman, 2002). These findings suggest that early and frequent exposure to positive emotions might be required for development of the negativity bias; moreover, early and frequent exposure to negative facial expressions might prevent infants' psychological reference point from being positively skewed, thus making positive expressions more salient and negative expressions less salient than is typically the case.

Interestingly, some work with children suggests a heightened, rather than attenuated, sensitivity to certain emotions. For example, maltreated children show a greater response bias and enhanced ERP responsiveness to angry versus fearful or happy expressions (e.g., Pollak, Cicchetti, Hornung, & Reed, 2000; Pollak, Klorman, Thatcher, & Cicchetti, 2001). However, anger might be processed distinctly from other negative emotions. For instance, in adults, repeated presentations of angry expressions cause an increase in neural responses in emotion-processing circuits, whereas repeated presentations of other negative emotions (e.g., fear) lead to attenuated neural responses (Strauss et al., 2005). Moreover, work with maltreated children has been conducted with older children (e.g., 6–12-year-olds in Pollak et al., 2000), by which age, heightened sensitivity to an expression is presumably no longer driven primarily by perceptual novelty but by a fuller, conceptual understanding of the expression and its consequences. Thus, the range-frequency hypothesis, which functions at a perceptual level in infancy, does not necessarily conflict with the findings with maltreated children at older ages.

Related to the range-frequency theory are two other theories that deserve mention. The first is diagnosticity theory, or the idea that negative information is more informative, insofar as it deviates from the norm (Baumeister et al., 2001; Skowronski & Carlston, 1989). Thus, for instance, since people are supposed to be and generally are moral and good, an immoral or bad act defies social and situational pressures and is hence more revealing or "diagnostic" of the actor's character. It is thus not the negativity of negative information per se but rather the diagnosticity of it that leads one to pay more attention to and place more weight on such information. Importantly, only if a norm of positive information is established and expected can negative information be more diagnostic. Thus, both range-frequency and diagnosticity theories require the establishment of a neutral point shifted in the positive direction. These two theories are not necessarily mutually exclusive, however; one possibility is that the range-frequency theory explains the more perceptual-level negativity bias (e.g., which facial expressions infants will pay more attention to at various ages) whereas the diagnosticity theory explains the negativity bias in more social situations (e.g., impression formation).

The second theory is that a negativity bias is explained not by the negativity but by the greater intensity of negative than of positive stimuli (e.g., Fiske, 1980). This is a plausible explanation for the presence of the negativity bias. Importantly, however, and as mentioned in the *Evidence From Social Referencing* section, there is some evidence from adults that a negativity bias exists in addition to or at least in combination with any intensity bias that also exists (Ito, Larsen, et al., 1998; Lewis et al., 2007; Winston et al., 2005). This reiterates the point that the confounding effects of intensity need to be taken into account when designing or interpreting studies on the negativity bias and that future work needs to separate the individual contributions of intensity and negativity on the negativity bias (see the *Evidence From Social Referencing* section for ways in which this has been accomplished in work with adults).

The Negativity Bias in Emotional Contagion

Infants not only attend to but also react affectively to others' emotions. Thus, another area of development in which a negativity bias may be apparent early on is emotional contagion, that is, the tendency to automatically mimic others' emotional expressions facially, vocally, and behaviorally, thus to oneself experience traces of the same emotions (Hatfield, Cacioppo, & Rapson, 1993, 1994; see also Dimberg, 1982). Developmentalists have also argued that others' expressions might directly induce emotional responses in infants (Fernald, 1993; Klinnert, Campos, Sorce, Emde, & Svejda, 1983).

Rozin and Royzman (2001; see also Thompson, 1987) proposed that negative emotions are likely more contagious than positive ones, and recent work with adults supports this idea (Bennenbroek et al., 2003; de Gelder, Snyder, Greve, Gerard, & Hadjikhani, 2004). Although this has not been directly studied in development, some work with infants does support this claim. Emotional contagion is present in neonates, as evidenced by their crying at the sound of another infant's cries (Sagi & Hoffman, 1976; Simner, 1971; see Hay, Nash, & Pedersen, 1981, for evidence from 6-month-olds). By 10–12 weeks, infants match and respond to facial and vocal displays of happiness, sadness, and anger to approximately the same degree (Haviland & Lelwica, 1987; Kreutzer & Charlesworth, 1973; see also Spitz & Wolf, 1946; but see Montague & Walker-Andrews, 2001).

However, emotional contagion later in the 1st year does display a negativity bias, as evidenced in social referencing studies (discussed in detail in the *Evidence From Social Referencing* section). For instance, in Mumme and colleagues' (Mumme, Fernald, & Herrard, 1996; Mumme & Fernald, 2003) studies, 12-month-olds not only modified their behavior more in response to fear than to happy cues but also showed more negative affect in the fear than in the neutral conditions, whereas infants did not show more

positive affect in the happy than in the neutral conditions. Similar results have been reported in several other social referencing studies as well (e.g., L. J. Carver & Vaccaro, 2007; Hertenstein & Campos, 2001; Hornik et al., 1987). Furthermore, Klinnert et al.'s (1986) study (discussed in the *Evidence From Social Referencing* section), which did not reveal a negativity bias in 12-month-olds' social referencing behavior, did suggest such a bias in infants' affect. Specifically, infants in both positive and negative conditions displayed positive affect before referencing the adult. However, after referencing, infants who received fear signals showed significantly lower affect, whereas infants who received a smile signal showed no increase in their positive affect.

Interestingly, an asymmetry in emotional contagion is present before infants can use emotions to modify their behavior. Thus, in the study by Mumme et al. (2004; discussed in the *The Negativity Bias in Attention to Emotions* section), although 10-month-olds did not modify their behavior toward ambiguous objects according to an experimenter's emotional cues, they did display more negative affect in response to fearful than to neutral or happy cues, whereas their affect in the neutral versus happy conditions did not differ. Overall, emotional contagion in infants does seem to demonstrate a negativity bias in the second part of the 1st year, before which it may show no bias.

It should be pointed out that these studies on social referencing were not designed to address the issue of emotional contagion and could seem inappropriate to take as evidence for emotional contagion, because they involved infants receiving messages about other stimuli (e.g., novel objects) rather than simply "witnessing" others' emotions. However, the concept of emotional contagion does not include the condition that the subject be a witness and not the recipient of emotional messages (see, e.g., Hatfield et al., 1993, 1994), and we think it plausible that even when infants are receiving and using emotional cues about an ambiguous object in the environment, they could in addition be experiencing traces of those same emotions (see Baldwin & Moses, 1996). If this is accurate, then the fact that infants display more negative affect in response to negative cues than positive affect in response to positive cues suggests a negativity bias in emotional contagion. Nevertheless, much more work is certainly needed that specifically examines emotional contagion with infants of different ages and that can directly assess the negativity bias in this domain. In the absence of such work, we have had to rely on indirect examinations of this process, and we find that a negativity bias in emotional contagion might emerge in the later part of the 1st year.

If this is the case, what ontogenetic mechanisms might account for this emergence? We suggest that infants' markedly greater attention to negative emotions in the second half of the 1st year (see the *The Negativity Bias in Attention to Emotions* section) might enhance their mimicry of these emotions more than that of positive emotions, enhancing, in turn, the emotional contagion to negative than to positive emotions (see also Hatfield & Rapson, 1998; see Ochsner & Gross, 2005; Pessoa, 2005; and Pessoa, Padmala, & Morland, 2005, for evidence on how attention influences the affective and neural responses to emotions).

Interestingly, infants' ability to catch certain negative emotions might especially develop during the second half of the 1st year, when their own experiences of those negative emotions become more differentiated and intensified. For instance, Campos, Kermoian, and Zumbahlen (1992) found that mothers of 8.5-month-old locomoting infants reported a recent increase in the frequency and intensity of their infants' anger responses to events, a change that was likely related to infants' new goals (e.g., to reach or explore new or distant objects) often not being met (see also Goodenough, 1931; Zumbahlen, 1997). Relinquishing such goals due to an inability to accomplish them might also lead to increasing experiences of sadness (Bertenthal & Campos, 1990).

Infants' experiences of fear might also dramatically increase later in the 1st year, again perhaps due to locomotion, which has been found to contribute to the emergence of a fear of heights (Campos, Bertenthal, & Kermoian, 1992). Locomotion also takes infants farther away from caregivers, which might lead to an increased sense of insecurity and fear. Furthermore, the stranger anxiety that emerges around this time (e.g., Waters, Matas, & Sroufe, 1975) may also contribute to a higher frequency of fear. Finally, the increasing independence, motoric and otherwise, that accompanies development probably causes an increase in parent–child and sibling–child conflict (Laible & Thompson, 2002), causing, in turn, more frequent and intense negative feelings in children. This relative increase in the frequency and intensity of infants' own experiences of negative emotions could facilitate their experience of such emotions, and in conjunction with the heightened attention to others' negative emotions, could lead to a negativity bias in emotional contagion. This is, however, a tentative proposal that needs further empirical support.

The Negativity Bias in Decoding Emotional Information

We have seen that infants' attention to emotional expressions as well as emotional contagion display a negativity bias by the second half of the 1st year. Of course, it is not enough simply to attend to and catch others' emotions; infants must also learn to use them effectively. How infants come to assign meanings to emotions has been discussed extensively (e.g., Campos & Stenberg, 1981; Darwin, 1872/1965; Nelson et al., 1979); suffice it here to say that a rudimentary ability to decode and categorize affective messages is present already by 7 months (e.g., Phillips, Wagner, Fells, & Lynch, 1990; Walker-Andrews, 1986) but continues to develop in the 2nd year (Baldwin & Moses, 1996; Nelson, 1987).

More relevant to our current purposes is the possibility that an early negativity bias in attention and contagion could feed into a later negativity bias in the use of emotions in contexts such as social referencing. This could occur in several ways. First, infant social referencing behavior might be partly explained by emotional contagion (or mood modification): Infants' own affect might be influenced by the emoters' affect, leading infants to interact differentially with the stimulus without a conceptual understanding of the referential quality of the message (Baldwin & Moses, 1996; Feinman & Lewis, 1983; but see Hornik et al., 1987, for evidence suggesting that mood modification does not entirely explain the social referencing phenomenon). A negativity bias in emotional contagion, then, is likely to lead to a similar bias in social referencing.

A second mechanism might be simulation, or the idea that we decode others' mental states by putting ourselves in their shoes, experiencing their mental states, and then attributing those mental states back to them (e.g., Decety & Sommerville, 2003; Goldman, 1995; Goldman & Sripada, 2005; Harris, 1995). Some have argued that emotional contagion is an early form of simulation: Once an

infant shares another's affect due to emotional contagion, he or she subsequently attributes the emotion to the observed other and thereby decodes the other's emotion (e.g., Hess, Philippot, & Blairy, 1998; Nielsen, 2002; see also Atkinson & Adolphs, 2005). Thus, the fact that infants share others' negative states more than their positive ones (due to the negativity bias in emotional contagion) might lead infants to decode others' negative expressions better than their positive ones, a difference that becomes apparent in infants' social referencing behavior.

Finally, direct and vicarious learning might constitute a third mechanism, that is, infants might learn to decode others' emotions by themselves experiencing or by watching another (e.g., a sibling) experience the consequences of those emotions (a form of conditioning; Hatfield et al., 1994). For instance, perhaps caregivers' anger or fear signals begin to be understood as such only after the infant does not heed these signals and subsequently experiences negative consequences (e.g., punishment, pain). Since infants pay more attention to negative emotions late in the 1st year, they are likely to learn better the consequences and meanings of negative than of positive emotions.

In sum, the negativity bias in the emotional domain might emerge late in the 1st year, and there are multiple plausible ontogenetic contributors to this emergence. More research is required before we know which explanation holds, and it is likely that more than one will; it is also likely that the various proposed mechanisms do not function in isolation but rather interact with each other throughout ontogeny. We next consider possible evolutionary and developmental functions and consequences of this bias.

Functions and Consequences of the Negativity Bias: Evolution and Development

The negativity bias is thought to serve the evolutionarily adaptive purpose of helping us safely explore the environment while appropriately avoiding harmful situations. This theory is extensively discussed by Cacioppo and colleagues (Cacioppo & Berntson, 1999; Cacioppo, Gardner, & Berntson, 1997; Cacioppo et al., 1999), who have argued for two significant characteristics of our affect system. The first is a *positivity offset*, which means that when there is no affective information available about a novel stimulus, we exhibit a weak drive to approach that stimulus. The positivity offset motivates us to learn about our environment by approaching novel stimuli and also promotes social cohesion even when very little other information about conspecifics is available (see also C. S. Carver, 2003; Fredrickson, 1998). However, because it is harder to reverse the consequences of a harmful or fatal event than of missing an opportunity to interact with the environment, our affect system also displays a *negativity bias*. This bias causes us to respond more strongly to negative than to positive or neutral stimuli. Thus, for the same absolute amount of positive and negative input, our response to the negative input is greater than that to the positive input. We thus have the benefit of exploring the environment in the absence of negative input, and of rapid self-preservative behavior at relatively low levels of negative input. Furthermore, Cacioppo et al. (1999) argued that negative emotions serve as a call for mental or behavioral adjustment whereas positive information indicates that we are safe to pursue the course that we want to pursue, whether that course is exploring the stimulus or avoiding it (see Kopp, 1989, and Lagattuta & Wellman, 2002, for similar arguments). Thus, positive information does not necessarily increase our approach toward a stimulus; it simply allows us to stay on course with our initial behavior (which is often a weak approach tendency, as indicated above).

Borrowing from this evolutionary theory, we propose that the negativity bias in early development also serves evolutionarily adaptive functions. This function is clearest in the social referencing context: The earlier an organism learns that it should avoid those stimuli that its conspecifics find aversive, the better are its chances for survival. This is especially true for infants, who do not yet have an extensive store of experience to inform their evaluation of novel stimuli. It is thus extremely adaptive for infants to pay attention to and then quickly and effectively use any information about which stimuli should be avoided (see also Campos & Stenberg, 1981).

The negativity bias in social referencing would be especially useful if infants could retain the information received in one situation and then apply it to similar situations in the future. Otherwise, infants would have to repeatedly seek information about the same kinds of stimuli, leading to a very inefficient process of learning and cultural transmission (Bandura, 1992; Hertenstein & Campos, 2004). The only work on infants' retention of such information was conducted by Hertenstein and Campos (2004), and it did reveal a powerful negativity bias in the way that 11- and 14-month-olds use emotional information after short delays (see the *Evidence From Social Referencing* section). More work is needed to extend these findings to clarify how infants learn from the information gathered during social referencing.

An important finding in the social referencing work reviewed above is that when infants receive positive evaluations about a novel stimulus, they are not necessarily more likely to approach it. For instance, Sorce et al. (1985) found that all infants who received fear cues refrained from crossing the visual cliff, whereas not all those who received positive cues crossed. Past work suggests individual differences across infants such that some infants are willing to cross an ambiguous visual cliff whereas others are not (Feinman et al., 1992; Striano, Vaish, & Benigno, 2006; see also Zarbatany & Lamb, 1985). If positive and negative cues impacted infant behavior equally, then all infants in Sorce et al.'s (1985) happy condition would have crossed the cliff, or alternatively, some of the infants in the fear condition would also have crossed. Because none of the infants in the fear condition crossed, it seems possible that the negative cues caused even those infants who wanted to cross to adjust their behavior. On the other hand, when given happy cues, some of the infants who did not want to cross stayed on that course and did not cross. As reviewed above, work by Mumme et al. (1996), Mumme and Fernald (2003), Hertenstein and Campos (2001, 2004), Walden (1993), and various others has revealed similar results. These results fit well with Cacioppo et al.'s (1999) suggestion that negative information serves as a call for mental or behavioral adjustment, whereas positive information requires no adjustment but rather is a cue to stay on course.

Moreover, the lack of difference in most studies between positive and neutral conditions is suggestive of a positivity offset (Cacioppo & Berntson, 1999; Cacioppo et al., 1997, 1999) because it indicates that in the absence of any negative information about a novel stimulus (whether because the information is positive, neutral, or entirely absent), most infants initially display a ten-

dency to explore the stimulus. Thus, positive information does not increase infants' exploration of novel stimuli; negative information decreases it. A possible implication of this positivity offset is that because it leads infants to explore the stimulus, it results in the infants "deciding" for themselves whether they like the stimulus or not. That is, positive information about a stimulus allows infants to express and act upon their own preferences and tastes regarding the stimulus rather than necessarily engendering in the infants a strong liking for the stimulus.

If infants do not use positive information about a stimulus as an indication of something objective about the stimulus (other than that it is safe), they then have the opportunity to instead learn something about the signaler's subjective preferences. That is, when a signaler indicates a positive evaluation of a stimulus, infants can draw two conclusions: First, that the stimulus is safe to explore, and second, that the signaler feels positively about it but that they and other people need not. Over time, then, infants might generalize an individual's positive evaluations of an object only to that one individual, not to others. On the other hand, when infants receive negative affect about a novel stimulus from a signaler, they might accept this information as an objective signal, and over time, might not only expect the signaler to avoid the stimulus but might also themselves avoid it and expect others to avoid it; that is, they might generalize a negative evaluation of an object not only to the signaler over time but also to other people, including themselves. Thus, positive and negative information from someone about the world might generalize differently and inform the learner about the world and people in qualitatively different ways. Social referencing work thus far has focused primarily on how infants use information from a signaler to interpret a stimulus; there has been almost no work on how infants use the signaler's information to understand something about the signaler herself or to generalize the information to other individuals (although see Gergely, Egyed, & Király, 2007). The possibility that in social referencing situations, negative versus positive cues might be used to interpret and learn about distinct aspects of the environment is yet to be tested.

Importantly, however, this distinction is not always going to hold. Recall that the positivity offset and negativity bias are theorized to function primarily in situations of ambiguity (e.g., Cacioppo et al., 1999). Thus, if an infant knows from prior experience that an entity (x) is safe or if he or she already has a positive evaluation of x, then receiving negative information about x is unlikely to change the infant's evaluation of it because he or she can, by virtue of his or her knowledge, rule out the possibility that x should be avoided. The infant could, in this case, treat the negative evaluation as information only about the emoter's subjective preferences ("she does not like x") rather than also treating it as objective, generalizable information about x. Thus, the distinction between the informative values of positive versus negative evaluations is likely to hold primarily in situations in which the entity being evaluated is unknown or ambiguous to the infant.

Let us now consider possible functions or consequences of the negativity bias in the other two developmental domains discussed above: discourse and memory. It is unclear what evolutionarily adaptive functions a negativity bias in these domains might serve, but we do believe it serves some more immediate developmental functions. For instance, Lagattuta and Wellman (2002) suggested that because negative emotions are intense, unpleasant, and disruptive, they need to be more regulated than do positive emotions. Fivush et al. (2003) similarly suggested that negative events create problems that need to be resolved. Children thus have to create meaning out of these experiences, leading to more coherent, story-like memories of such events. Positive emotions and events, on the other hand, do not create as strong a motivation for resolution or explanation; thus, when experiencing positive emotions, children are less motivated to focus on their own internal states or the meaning of the positive events and can instead focus on external attributes of the world (see also Fredrickson, 1998); similarly, when the positive emotions are someone else's, children are less motivated to analyze them causally or mentalistically and can instead focus on that person's current attitudes (see Lagattuta & Wellman, 2001). Note that this last idea is quite close to our proposal regarding positive social referencing cues: that they inform the infant about the attitudes and preferences of the emoter.

Dunn and colleagues (Dunn, 1988; Dunn & Brown, 1991b; Dunn & Munn, 1987) have also proposed mechanisms to explain why negative emotions and interactions lead to more complex discourse involving causality and justifications. One is that children simply apply their intelligence more or generally display relatively advanced behavior in response to issues that emotionally matter more to them. A second is that children's arousal during negative emotions or interactions "heightens their vigilance and attentive powers," leading them to attend more to and analyze negative emotions or interactions (Dunn, 1988, p. 42). Yet another possibility is that children learn these patterns from their mothers (Dunn & Munn, 1987), who, as mentioned in the *Evidence From Other Developmental Domains* section, more often reason through and talk about the causes and consequences of negative rather than positive emotions (Fivush, 1991; but see Lagattuta & Wellman, 2002, for evidence that the parent-to-child direction of causality does not account for all the findings).

Similarly, Lagattuta and Wellman (2001) proposed that conversations about negative emotions provide young children with the opportunity to think constructively and causally about past experiences, emotions, and internal states. In attempting to communicate about negative emotions (their own and others'), children likely acquire an increasingly complex and lucid network of causal and mentalistic understandings. This initially leads to a better grasp of negative emotions but perhaps eventually contributes to the development of children's emotional and psychological knowledge in general and provides an ideal situation for the early development of a coherent mental and historical understanding of people[8] (see also Brown, Donelan-McCall, & Dunn, 1996; Dunn & Brown, 1993; Fabes, Eisenberg, Nyman, & Michaelieu, 1991; Laible & Thompson, 2002; Taumoepeau & Ruffman, 2006; Trabasso, Stein, & Johnson, 1981). Overall, then, researchers have proposed important developmental roles that a negativity bias in children's talk and memories might play as children learn to regulate and understand their powerful negative feelings and recollections.

[8] These ideas might seem to contradict our proposal that negative social referencing information is taken to be about the world and thus generalizable across people. However, note that our argument regarding negative social referencing information is not that children do not learn anything about the emoter but that they in addition learn something about the stimulus itself, which they might then generalize to others.

To summarize, the negativity bias seems to have far-reaching evolutionary and developmental implications, including helping children avoid harmful stimuli, determining how children learn about their environment and conspecifics, regulating emotion, understanding others' emotional and mental states, and generally assisting in children's developing understanding of others. As children become adults and the negativity bias spreads into other psychological domains, it no doubt serves still other functions, whether evolutionary, emotional, social, cognitive, or all of the above. We end this article by presenting some important implications of our proposal as well as directions for future work.

Discussion and Future Directions

Human adult psychology has been shown, time and time again, to display a strong negativity bias. This article is a first attempt at examining the negativity bias in early development, and it was motivated by three questions: Do infants and children, like adults, display a negativity bias? If so, when and why might this bias emerge ontogenetically? And finally, what are the evolutionary and developmental functions and consequences of this bias? Our review of the literature shows that infants and children display a strong negativity bias in social referencing behavior as well as in discourse and memories about valenced events. The potential roots of this bias are evident by 7 months in infants' attention to emotional expressions and emotional contagion. Drawing on these findings, we suggested potential developmental mechanisms that could contribute to this emerging negativity bias, including range-frequency and changes in infants' own emotional experiences and social interactions. Finally, we argued that the negativity bias serves the crucial evolutionarily adaptive function of helping infants avoid potentially harmful stimuli and likely also serves important social–emotional and social–cognitive functions.

Here, we present the fundamental theoretical and methodological implications of our review and conclusions for the study of emotional development. First and foremost, it is astonishing that the negativity bias, which has been so extensively observed and studied in one area of psychology (adult social, emotional, and cognitive psychology), has received so little systematic attention in another area (child social, emotional, and cognitive psychology). We hope this article makes it clear that this phenomenon serves some crucial evolutionary and developmental functions for infants and children and that it deserves to be studied as widely as possible. Furthermore, although we have focused in this article on developmental areas that are closely linked to the emotional realm, the negativity bias likely also exists in many areas that are not as closely linked to this realm. This is clear from the numerous nonemotional areas of adult psychology in which the negativity bias has been observed (see introduction). There is thus an obvious need to thoroughly search the extant developmental literature for a negativity bias in those areas of research in which it might be present but has not yet been noticed (as we have done with the social referencing literature).

One such area is children's impression formation. Aloise (1993), for instance, found that children require fewer negative behaviors to infer negative traits about other people than positive behaviors to infer positive traits (see also Wynn, 2006). Another area is children's moral judgments; for example, recent work by Leslie, Knobe, and Cohen (2006) showed that children judge a side effect of an action to have been brought about "on purpose" if that side effect is morally bad but not if it is morally good (see also Leslie, Mallon, & DiCorcia, 2006). Once discovered, it will be important to consider what functions and consequences the negativity bias has in these domains. Moreover, it will also be important to assess the cultural generalizability of the negativity bias. We thus urge developmental researchers to begin conducting research specifically designed to search for and understand the negativity bias, and to do so within a wide range of psychological domains and contexts. We also urge researchers from the areas of developmental and adult psychology to work and theorize together in order to answer many of the questions that have been raised in this article.

A significant theoretical implication of our article is that, contrary to classical conceptualization, the underlying mechanisms by which infants process positive versus negative stimuli are not necessarily the same, and the effects of positive and negative emotions are not best understood as existing on a single continuum. Instead, positive and negative stimuli are processed along separate (albeit related) paths and have both qualitatively and quantitatively distinct effects on infant learning and behavior. Although this idea has been proposed by other theorists (e.g., Cacioppo et al., 1999; Cacioppo & Berntson, 1999), it has not received much attention from developmental researchers. Given the evidence presented in this article, however, it seems clear that the bipolar conceptualization of positive and negative emotions deserves serious reconsideration.

A basic methodological implication of this idea is that future studies assessing emotional development need to assess the separate impact of positive and negative emotions instead of only assessing their impact with relation to each other. One way to do this would be to include neutral conditions. As should be clear from our review, results that show significant differences between the impact of positive and negative stimuli but without comparisons with neutral stimuli are misleading because they suggest that the valenced stimuli had equal and opposite effects, even though they might not have. Of course, in order to appropriately compare the effects of positive, negative, and neutral information, it is essential that we compare equivalent intensities of positive and negative information, which will require developing ways of measuring and controlling the distance between positive and negative from neutral information. Furthermore, it is important to systematically control for and vary the intensities of positive versus negative information in order to better understand the separate as well as interactive effects of valence and intensity.

Based upon our review, we argue that infants do not possess or develop a single "emotion reading" capacity. Rather, they develop a sensitivity to and understanding of the various emotions in different settings and at different times in ontogeny. These differences are apparent between valences, that is, infants seem to be exposed to and learn about positive emotions in different kinds of interactions and perhaps earlier than negative emotions (although similar differences are certainly possible within valences as well). Importantly, the context in and time at which infants are exposed to and learn about an emotion are likely to influence what precisely is learned and how well. If, for instance, positive emotions are experienced, perceived, and learned about relatively more in the first half of the 1st year, then we must take into account the fact that the cognitive tools available to infants at this early age are

more limited than those available later in the 1st year, when negative emotions are experienced, perceived, and learned about. Such differences likely lead to differences in the way these emotions are processed and used later in development and might themselves be partial explanations for the negativity bias.

Two important methodological implications emerge from this. First, future studies on emotion discrimination or categorization should take into account levels of infants' experiences with the emotions being presented. Moreover, longer looking times to some emotions should not be assumed to represent an understanding of those emotions because often, a more parsimonious explanation is that the emotion attended to more is also more novel. Accordingly, it is important to design studies and develop models and new methods that can clarify what infants' looking times mean (e.g., preference vs. attention, familiarity vs. novelty; see, e.g., Sirois & Mareschal, 2004).

Second, future work should tease apart the effects of different negative emotions (e.g., Lerner & Keltner, 2000; Schwartz et al., 1985). In this article, we have not attempted to distinguish between negative emotions such as fear, anger, or sadness in the way that they elicit the negativity bias. However, clearly, not all negative messages convey the same information about the world or entail the same "state of action readiness" (Frijda, 1988, p. 351). Experiencing or perceiving someone's fear certainly signals something very different about the world and about actions one should take than does experiencing or perceiving someone's anger or sadness (Adams & Kleck, 2005; Campos, 2003; Lazarus, 2003). Moreover, the impact of each emotion needs to be assessed in its own right because one emotion might significantly impact responses that others do not. Teasing apart the effects and functions of different negative emotions will further our understanding of both the form and functions of the negativity bias.

Critically, much of the force of our argument for the potency of negative emotions and information lies in the equally important argument that positive emotions and information typically dominate human psychology (Peeters, 1991; Taylor, 1991). Without this positive context, the negativity bias would be attenuated if not absent. We argue that this positive context may be established very early in development, when infants largely experience positive emotions and interactions, and that this early positive context might be a building block for the negativity bias. The implication is that if this building block is not in place by the time an infant begins to be exposed more frequently and intensely to negative emotions and interactions, the infant may not show a normative negativity bias, which could dramatically impact her learning and behavior because the critical functions of the negativity bias would not be served. Furthermore, without this positive status quo, we would more often be preoccupied with negative events. Taylor (1991) argued that in the long-term, focusing on negative events is maladaptive, as it hinders the formation and maintenance of social bonds, prevents us from engaging in productive and creative work, and can result in depression and a lower sense of well-being. Thus, once the negative stimulus has passed, we typically minimize or dampen the negative state and restore a mildly positive state (see also Fredrickson, 1998; Fredrickson & Levenson, 1998). If the positive building block is absent in an infant's early development (e.g., because his or her caregiver is depressed or abusive), the infant may not develop the normative positive status quo, which could result in maladaptive development. This emphasizes the more general point that a prevalence of positive events is critical to typical development, and our emphasis in this article on negative events does not in any way detract from that.

Moreover, although we have strongly argued for a negativity bias in development, there are likely many situations in which positive information has significant impact (J. J. Campos, personal communication, April 2005). For instance, infants do sometimes increase their behavior toward novel objects in response to positive cues (Hornik et al., 1987), children do remember positive events such as family outings reasonably well (Fivush et al., 2003), and adults have been shown to pay particular attention to extreme positive information (Fiske, 1980). It is thus important to identify situations in which positive information significantly impacts psychology and behavior and to assess why it does so in those but not in most other situations.

In summary, the negativity bias displayed by human adult psychology has been argued to be "one of the most basic and far-reaching psychological principles" (Baumeister et al., 2001, p. 362). Although the bias, its underlying mechanisms, and its functions have been extensively discussed, we believe that these discussions are incomplete in the absence of a developmental perspective. In particular, theories about the mechanisms underlying the emergence of the negativity bias are inadequate without an actual understanding of the emergence of the negativity bias. Moreover, the frequently proposed evolutionary arguments for the negativity bias do a fine job of explaining the end product that is observed in adults, but they do little to explain the appearance of the bias in a given individual. Finally, the negativity bias might serve distinct or additional functions during development than those it serves in adults. The way to resolve these issues is to assess the negativity bias in early ontogeny. Thus, to begin the construction of a critical piece of the negativity bias puzzle, we have presented here what is only the beginning of a description of the negativity bias, its mechanisms, and its functions in development. With this and future work in this area will emerge a much more comprehensive understanding of the nature and foundation of this pervasive bias.

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