

# Children's Interpretation of Facial Expressions: The Long Path from Valence-Based to Specific Discrete Categories

Sherri C. Widen

*Department of Psychology, Boston College, USA*

## Abstract

According to a common sense theory, facial expressions signal specific emotions to people of all ages and therefore provide children easy access to the emotions of those around them. The evidence, however, does not support that account. Instead, children's understanding of facial expressions is poor and changes qualitatively and slowly over the course of development. Initially, children divide facial expressions into two simple categories (feels good, feels bad). These broad categories are then gradually differentiated until an adult system of discrete categories is achieved, likely in the teen years. Children's understanding of most specific emotions begins, not with facial expressions, but with their understanding of the emotion's antecedents and behavioral consequences.

## Keywords

children, emotion categories, facial expressions, differentiation

Knowing how children understand emotion, including facial expressions, and how that understanding changes with development is an important field of study in its own right. This knowledge also has implications for parents, teachers, and others who work with children because children's understanding of emotion is related to their cognitive and linguistic development (Blair, 2002), their later school readiness (Garner & Waajid, 2008), and their likelihood of showing psychopathology (Southam-Gerow & Kendall, 2002). There is a clear need to accurately describe children's understanding of emotion and facial expressions as well as how that understanding develops.

Since 1980, 452 articles, books, and chapters have been published on children's understanding of facial expressions (PsycInfo keyword search: child\*, facial expression\*, recognition or understanding; October 27, 2011). A common assumption in many of these articles holds an underlying common sense assumption that children understand facial expressions in terms of specific discrete emotions (e.g., a smile as happy, a scrunched nose as disgusted, a scowling face as angry, etc.) and that children can use that understanding to learn about other aspects of emotion, such as causes and consequences. Although some evidence is consistent with this assumption, as this review shows, the majority is not.

The field of research on emotion is notably lacking a theory that explains children's understanding of emotion and facial expressions. The assumption that children understand facial expressions in terms of specific discrete emotions is suggested by basic emotions theory (Denham, 1998; Izard, 1971, 1994), but no detailed account has been laid out. On this theory, facial expressions are assumed to have evolved to signal specific emotions and to be universally, easily, and perhaps innately recognized (Izard, 1994; Shariff & Tracy, 2011). If facial expressions are signals, then recognition and production of emotion from a facial expression had to coevolve. This view is presupposed when researchers use terms such as *recognition*, *decoding*, *signals*, and *accuracy*, and sometimes when standardized sets of facial expressions are used to measure understanding of "basic emotions" (happiness, sadness, anger, fear, surprise, disgust, and sometimes contempt) (e.g., Pictures of Facial Affect, Ekman & Friesen, 1976; NimStim Set of Facial Expressions, Tottenham et al., 2008; Amsterdam Dynamic Facial Expression Set, van der Schalk, Hawk, Fischer, & Doosje, 2011).

Knowing the meaning of facial signals would have adaptive value for preverbal children. Indeed, researchers in the basic emotions theory tradition have suggested that both production and recognition of facial expressions are in place as early as the

first half year of life (e.g., Haviland & Lelwica, 1987; Walker-Andrews, 2005). If so, then facial expressions would provide the basis for children's acquisition of knowledge about the causes, consequences, labels, and so on for each emotion category (e.g., Denham, 1998; Harris, 1989).

Although some findings are consistent with basic emotions theory, many findings are not. Here I argue that the evidence is more consistent with what I call the broad-to-differentiated hypothesis. Based on the data, I propose that emotion categories are acquired gradually, change over the course of development, and, in their final adult form, show some variation with culture and language. Children lack an innate or easily acquired system of universal categories linked to faces. Facial expressions are more easily interpreted in terms of valence (feels good, feels bad), level of arousal, and other physical information (e.g., gaze direction, whether the person is yelling, crying, etc.) than in terms of specific discrete emotions (Russell & Carroll, 1996). Children can attribute a specific emotion based on a facial expression alone, but this is the more difficult task. Other components of emotion scripts (e.g., cause, behavioral consequence, etc.) provide stronger cues to specific discrete emotions, and it is easier for children to attribute a specific emotion to one of these components than to a facial expression.

To attribute an emotion to facial expressions, children interpret facial expressions in light of all of the information available. That information includes, of course, the actual facial movements seen, but also the context (including situational causes, behavioral consequences, postures, vocalizations, etc.), the implicit instructions in the experiment (e.g., forced choice studies limit the emotions that may be attributed to the facial expressions to those in the list), and so on. Thus, the face is a puzzle that the child tries to solve based on whatever information is available. The solution to the puzzle varies as the parts of the puzzle vary—thus, the same facial expression may be interpreted in different ways in different situations. Adults also solve the puzzle of how another feels based on all of the available information (Aviezer et al., 2008; Hassin, Aviezer, & Bentin, 2013; Mondloch, 2012).

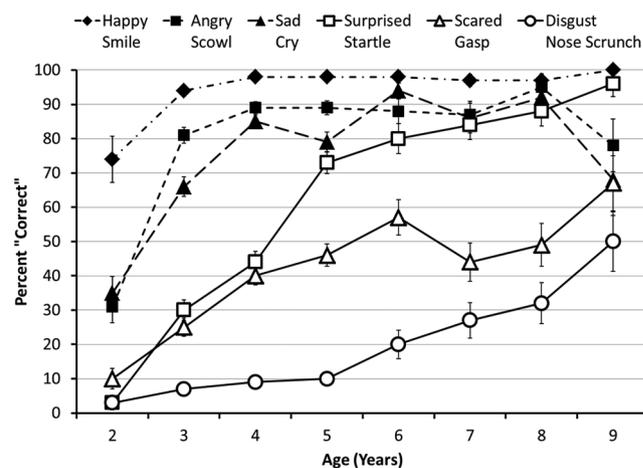
I argue that children do not understand facial expressions early, before other aspects of emotion, and in terms of discrete categories. Instead, they initially understand facial expressions in terms of broad valence-based categories and only gradually associate them with specific discrete categories (i.e., fear, disgust, etc.). This differentiation is accomplished as a part of learning the links between the different components of an emotion category—a process that may take several years. Facial expressions are not primary in the process of acquiring these more discrete categories, and, when facial expressions are added to a category, they are cues (not signals).

## Understanding Facial Expressions: Broad-to-Differentiated Categories

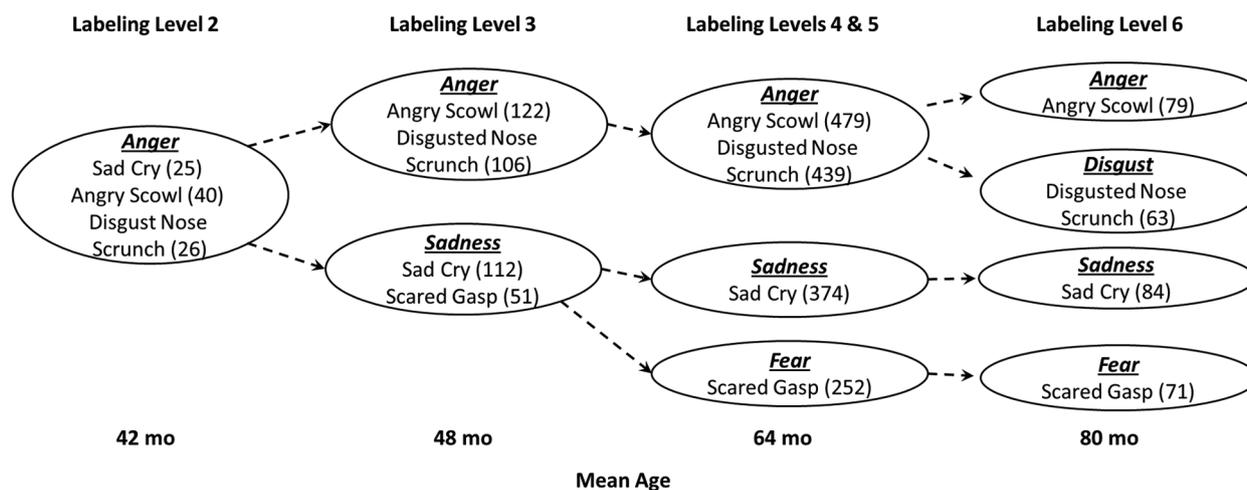
A recent literature review found that infants', toddlers', and even the youngest preschoolers' understanding of facial

expressions and other aspects of emotion is broad and valence-based (Widen & Russell, 2008a). Infants younger than 10 months of age respond emotionally and behaviorally to the valence of facial expressions (Caron, Caron, & Meyers, 1985; Haviland & Lelwica, 1987; Soken & Pick, 1999), but do not interpret faces in terms of discrete negative emotions. Infants older than 10 months and toddlers can use the valence of facial expressions to guide their own behavior in ambiguous situations such as the social referencing paradigm (e.g., Klinnert, Emde, Butterfield, & Campos, 1986). For example, in an ambiguous situation (e.g., visual cliff, novel toy), infants may look to their caregiver for clarification. Infants approach the stimulus if the caregiver displays a positive emotion, and withdraw if a negative emotion is displayed. But these studies do not indicate that infants recognize or discriminate specific emotions from facial expressions.

Older children begin to interpret faces in terms of discrete negative emotions (e.g., Denham & Couchoud, 1990; Izard, 1971; Massarani, Gosselin, Montembeault, Gagnon, & Suurland, 2011; Vicari, Reilly, Pasqualetti, Vizzotto, & Caltagirone, 2000), but the change from valence to specific discrete categories is gradual. This gradual change cannot be attributed to children's vocabulary because children have and use labels for basic emotions before their third birthday (e.g., Bretherton, McNew, & Beeghly-Smith, 1981; Ridgeway, Waters, & Kuczaj, 1985). Figure 1 shows the aggregated data from 11 studies in which children ( $N = 1065$ , 2–9 years) freely labeled facial expressions of "basic emotions." Children use the expected label at an early age for some facial expressions (happy smile, sad cry, angry scowl). But for others (fear gasp, surprise startle, disgust nose scrunch), children's use of the expected label increased only gradually.



**Figure 1.** Children use the expected ("correct") labels (with standard errors) for the happy smile, angry scowl, and sad cry from an early age but for each of the other facial expressions use of the "correct" label increases gradually with age. Data were aggregated from 11 studies, (Widen & Russell, 2002, 2003, Study 2, Study 3, 2008b, 2008c, 2010a, Study1, Study 2, 2010c, 2012b, 2012c). The  $N$  for each age group was: 2 years ( $N = 94$ ), 3 years ( $N = 229$ ), 4 years ( $N = 299$ ), 5 years ( $N = 209$ ), 6 years ( $N = 74$ ), 7 years ( $N = 66$ ), 8 years ( $N = 61$ ), 9 years ( $N = 33$ ).



**Figure 2.** Modal labeling response (and number of children who gave that label) for each facial expressions at each labeling level. The dotted lines show the flow of differentiation. No differentiation occurred between Labeling Levels 4 and 5 so these two levels were combined for this figure. Data aggregated from 10 studies (Widen & Russell, 2002, 2003, Study 2, Study 3, 2008b, 2008c, 2010a, Study 1, Study 2, 2010c, 2012b).

Children seem to label the happy smile, angry scowl, and sad cry “correctly” from an early age, but are these labels really correct? Participants are more likely to use some emotion labels more frequently than others (Wagner, 1993). For example, when children (2–10 years) are asked to freely label facial expressions or emotion stories, the labels they use most frequently, both “correctly” and “incorrectly,” are *happy*, *sad*, and *angry* (Massarani et al., 2011; Widen & Russell, 2003, 2008b, 2010a, 2011). Conversely, though they used *scared*, *surprised*, or *disgusted* “correctly” less frequently, they also rarely used these labels incorrectly.

Analyses of “incorrect” responses show that children’s “errors” are systematic rather than random: Children are more likely to “mislabel” a face with a label from an emotion category of the same valence and similar levels of arousal (e.g., labeling the disgust nose scrunch as *angry* or the surprise startle as *scared*) than from a dissimilar one (*happy* or *sad*, respectively). For example, the unbiased hit rate (Wagner, 1993) shows that 2-year-olds aggregated from five studies ( $N = 94$ , Widen & Russell, 2003, Study 2, 2008b, 2010a, Study 1, Study 2, 2010b) used *angry* at above chance levels for the angry scowl, sad cry, and disgust nose scrunch but did not use *angry* at above chance levels for the scared gasp, surprised startle, or happy smile.

Valence-based categories also emerge on other, less verbally demanding emotion categorization tasks (Bullock & Russell, 1984; Gao & Maurer, 2009; Roberson, Kiutani, Döge, Whitaker, & Majid, 2012; Székely et al., 2011; Widen & Russell, 2008a, 2008b, 2008c). In one task, the category was presented as a box into which only people who felt the target emotion could go (Russell & Widen, 2002a). In the angry box, 2-year-olds included the negative expressions (range: 55%–64%) with equal probability and were unlikely to include the happy smile (11%).

### Differentiation of Emotion Categories

Children’s understanding of emotion and of facial expressions gradually changes from these early, broad, valence-based categories to more discrete categories via a differentiation process. By examining all of children’s responses (both “correct” and “incorrect”), I’ve found that this process is systematic: It follows the same broad-to-differentiated pattern for over 80% of children in each sample, for various cues to emotion and different tasks (Widen & Russell, 2003, 2008b, 2010a, 2010b).

Based on data from 1,050 children (2–9 years) aggregated from 10 studies (Widen & Russell, 2002, 2003, Study 2, Study 3, 2008b, 2008c, 2010a, Study 1, Study 2, 2010b, 2010c, 2012b), the differentiation pattern for how children label facial expressions is: At Labeling Level 0, children ( $n = 32$ ) use no emotion labels on the free labeling task. At Labeling Level 1, children ( $n = 15$ ) use only one label and are most likely to use *happy*. At Labeling Level 2, children ( $n = 58$ ) use two labels and add either *angry* or *sad*. At Labeling Level 3, they ( $n = 141$ ) use all three labels (*happy*, *sad*, and *angry*). At Labeling Level 4, children ( $n = 327$ ) add *scared* or *surprised*. At Labeling Level 5, they ( $n = 191$ ) use all five labels (*happy*, *sad*, and *angry*, *scared*, and *surprised*). And at Labeling Level 6, children ( $n = 92$ ) add *disgusted* and use all six target labels. Eighty-two percent of the 1,050 children used one of these combinations. Mean age increased from 30 months at Labeling Level 0 to 74 months at Labeling Level 6. This pattern has been supported in another language and culture (French Canadian; Massarani et al., 2011).

At each level, children account for the entire emotion domain with whatever categories/labels they have. For example, children at Labeling Level 2 initially label all negative expressions as *angry* (or *sad*), but children’s implicit definition of the label is not the same as adults’. Instead, for these children, *angry* (or *sad*) corresponds to a broad negative emotion category, means

something like “feels bad,” and they use this label for all negative facial expressions. Figure 2 illustrates the process of differentiation for children’s ( $N = 797$ ) broad negative category beginning with children who labeled it *angry*. With increased age and experience, children at Labeling Level 3 differentiate this initial broad negative category and *angry* is used for the angry scowl and disgust nose scrunch and *sadness* is used for the sad cry and the scared gasp. Children’s implicit definitions of these labels are still broader than for adults. The negative category differentiates further as children acquire *scared* (Labeling Level 4) and, later, *disgusted* emotion categories and labels (Labeling Level 6). As children acquire these later negative emotion categories and labels, the initial broad negative emotion category becomes narrower and children’s implicit definition of the label they use for it (*angry* or *sad*) becomes closer to the adult definition.

This broad-to-differentiated pattern is not specific to label use. It also occurs on other tasks (Russell & Widen, 2002a; Vicari et al., 2000). Children’s differentiation of both facial expressions and brief emotion stories (each describing the cause and behavioral consequence of an emotion) showed the same pattern but was faster for stories than facial expressions (Widen & Russell, 2010a, 2010b). This broad-to-differentiated pattern has also been supported in another language and culture: Palestinian children show the same pattern as American children although their emotion categories narrow at a later age (Kayyal, Widen, & Russell, 2012). Thus, the broad-to-differentiated pattern is robust across method, language, and culture, supporting the hypothesis that children’s categories for emotion begin broad and gradually differentiate and narrow as children acquire the adult category system for emotion.

## The Basis of Differentiation

Of course, “happy,” “sad,” and so on are more than labels for facial expressions. They each represent an emotion concept. For adults, each emotion concept can be unpacked as a script (Fehr & Russell, 1984). To know the script of an emotion is to know a list of component events linked in a prototypical sequence, including typical causes, facial and vocal expressions, behavioral consequences, a label for the concept, and so on. For example, in the script for sadness, the causal event is a loss and the behavioral consequence is crying. These components serve as cues to the identification of emotion in others.

The question is how children move from a broad, valence-based, two-category system to knowing full scripts for specific discrete categories of emotion. If, as I argue, faces do not provide easy access to the emotion of others, how does the child begin to differentiate categories for specific discrete emotions? How do they know fear when they see it? The development of different concepts for each emotion is a key developmental task which is accomplished by adding components to their emotion scripts. For example, children might begin to differentiate fear from their broad negative valence category by adding components related to fight and flight. Thus, the concept does not

emerge fully formed, but is developed gradually, one component at a time.

The basis of each script may be any component (cause, consequence, behavior, etc.). What cues are initially tied to the two early broad categories (positive and negative) is an unanswered but empirical question. For example, the cues could be a primitive theory of mind (when someone gets what they want, they are happy; when they don’t get what they want, they are unhappy), a behavioral consequence (smiling and laughing vs. hitting and yelling), or some other component. Similarly, which cue drives further differentiation (e.g., from one negative emotion category, to multiple negative categories as illustrated by Figure 2) is an empirical question and may be different for different emotions. To identify the components that children associate with specific emotions, the components of the script must be isolated.

If faces are the basis of children’s emotion scripts, then children should associate the expected emotion with facial expressions earlier than with other components of emotion. For example, on a free labeling task, 4- and 5-year-olds should be more likely to label ~~a cause for~~ a fear gasp ~~than for~~ a brief story describing the cause and behavioral consequence of fear (Judd heard something moving in his closet. He didn’t know what it was. He wanted to hide under his bed). Instead, the general finding has been a *face inferiority effect*: Children are less likely to associate the expected emotion with a facial expression than with another component. Thus, 4- and 5-year-olds were more likely to label the fear story than the fear gasp facial expression as *scared* (Widen & Russell, 2002). The general finding holds true whether children (3–7 years) are asked to free label, categorize, or generate the causes of emotions (Balconi & Carrera, 2007; Reichenbach & Masters, 1983; Russell & Widen, 2002a, 2002b; Widen & Russell, 2002, 2004, 2010a, 2010b).

A *label superiority effect* has been found on tasks that compare children’s understanding of emotion labels versus facial expressions and this effect is especially strong for disgust (Camras & Allison, 1985; Russell & Widen, 2002b; Widen & Russell, 2004; see Widen & Russell, 2012a, for a review of the development children’s understanding of disgust). On a storytelling task, children generated the causes for the label *disgusted* that were recognized (by adult judges) as disgust. Those who generated causes for the disgust nose scrunch, generated stories that were recognized as anger (Russell & Widen, 2002b; Widen & Russell, 2004). In addition, children’s first use of *disgust* on free labeling predicts differentiation of the disgust nose scrunch from the anger category. Children who did not use *disgust* (or a synonym) on free labeling included the disgust nose scrunch in the angry category as frequently as they did the angry scowl (Widen & Russell, 2003, 2008b). But children who did use *disgust* were significantly less likely to include the nose scrunch in the angry category. These findings are consonant with research on the role of language in concept acquisition more generally (Gelman, 2003; Gentner & Goldin-Meadow, 2003), in the role of language in emotion understanding in particular (Lindquist, Barrett, Bliss-Moreau, & Russell, 2006; Lindquist & Gendron,

2013), and with research showing that different cultures and languages partition the emotion domain differently (de Mendoza, Fernández-Dols, Parrott, & Carrera, 2010; Russell & Sato, 1995; Wierzbicka, 2009).

Based on the data, it is possible that facial expressions may be the strongest cues for the youngest children's early valence-based categories, behavioral consequences for anger, labels for fear, and both labels and situations (as described in stories) for disgust. But whether these are cues that enable children to differentiate these emotions from the initial broad negative category remains to be shown. An additional question is how children with valence-based categories differentiate facial expressions. As discussed earlier, in the box task, the faces included in the angry box were all negative in valence (Russell & Widen, 2002a), but the basis on which children decide to include these faces is unknown. Children might attend to the global pattern of the facial expression or to a specific muscle movement (such as the brow furrow, or lack of smile) common to these varied negative expressions.

## Conclusion

Although there is no detailed theory, much research is based on the implicit assumption that children understand emotion and facial expressions in terms of specific discrete emotions. The same research focuses on children's "correct" responses and ignores their "incorrect" ones. The evidence reviewed here demonstrates that these assumptions and practices are questionable. At a minimum, the assumptions need to be developed into an explicit, testable theory. An alternative to such a theory is the broad-to-differentiated hypothesis developed here, but other accounts are possible and need to be developed as well.

The question raised at the outset of this article was: Do children understand facial expressions in terms of specific discrete emotions? Based on the data, the answer is no—at least not initially. Children's path to understanding facial expressions and emotion in terms of specific discrete categories is a long one. But before these specific discrete categories are acquired, children have a systematic way of understanding and interpreting facial expressions and other cues to emotion: They begin with valence and from there differentiate within the broad feels-good and feels-bad categories. Gradually their emotion categories come to resemble those that we are more familiar with (e.g., angry, scared, disgusted), complete with situational causes, behavioral consequences, facial expressions, labels, and so on.

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