SPECIAL SERIES: METHODS IN EMOTION RESEARCH

emotion review

Emotion Review
Vol. 11, No. 2 (April 2019) 184–193

ISSN 1754-0739
DOI: 10.1177/1754073917749880
https://journals.sagepub.com/home/emr

# Bodily Communication of Emotion: Evidence for Extrafacial Behavioral Expressions and Available Coding Systems

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## Abstract

Although scientists dating back to Darwin have noted the importance of the body in communicating emotion, current research on emotion communication tends to emphasize the face. In this article we review the evidence for bodily expressions of emotions—that is, the handful of emotions that are displayed and recognized from certain bodily behaviors (i.e., pride, joy, sadness, shame, embarrassment, anger, fear, and disgust). We also review the previously developed coding systems available for identifying emotions from bodily behaviors. Although no extant coding system provides an exhaustive list of bodily behaviors known to communicate a panoply of emotions, our review provides the foundation for developing such a system.

**Keywords**
bodily expression, emotion expression, nonverbal coding systems

The Facial Action Coding System (FACS; Ekman, Friesen, & Hager, 1978) is widely viewed as the most reliable and well-validated tool for identifying the facial muscle movements that communicate emotion. However, FACS's utility is restricted to the assessment of emotions from the face, and a growing body of research suggests that a number of emotions are communicated with nonverbal behaviors outside of the face. In fact, scholars since Darwin (1872/1998) and James (1932) have observed that the body can also communicate emotional information. Yet, bodily displays of emotion have received a relatively underwhelming amount of research attention. Here, we review the growing literature on bodily expressions of emotion, discuss evidence for specific bodily behaviors that communicate several distinct emotions, and provide an overview of several extant emotion coding systems that include bodily displays. Our aim is to highlight the necessity of analyzing bodily behaviors alongside the face to fully understand and assess nonverbal emotion communication.

## Emotion Communication in the Body

There is evidence to suggest that numerous emotions can be accurately deciphered from bodily displays, including pride, shame, anger, fear, and disgust (e.g., de Gelder & van den Stock, 2011; Keltner, 1995; Tracy, Robins, & Schriber, 2009). In several cases these expressions have been found to generalize across race, disparate cultures, be reliably recognized by young children, or spontaneously displayed by the blind, raising the possibility of universality (Edelmann et al., 1989; Haidt & Keltner, 1999; Sogon & Masutani, 1989; Tracy & Matsumoto, 2008; Tracy & Robins, 2008b; Tracy, Robins, & Lagattuta, 2005; Tracy, Shariff, Zhao, & Henrich, 2013; Watson & de Gelder, 2017; Zieber, Kangas, Hock, & Bhatt, 2014).

Indeed, bodily communication of emotion is likely to be as important as facial communication, for several reasons. First, bodily displays can be visually salient from afar, allowing for successful emotion communication across long distances (de Gelder, 2009, 2016; Martinez, Falvello, Aviezer, & Todorov, 2016). Second, bodily expressions of emotion often can be interpreted from behind an expresser, including when the face is completely hidden (Coulson, 2004; Sogon & Masutani, 1989). Third, like facial expressions, a number of bodily displays are recognized at levels well above chance (Bänziger, Mortillaro, & Scherer, 2012; de Gelder & van den Stock, 2011; Tracy et al., 2009), even when presented as point-light displays that emphasize movement but

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hide faces and other features of the expresser (Atkinson, Dittrich, Gemmell, & Young, 2004; Clarke, Bradshaw, Field, Hampson, & Rose, 2005).

Several researchers have gone so far as to argue that bodily expressions of emotion are recognized at rates higher than those typically found for facial expressions of emotion (de Gelder, 2009), and, in certain circumstances, can override emotion information presented in the face (Aviezer et al., 2008; Hassin, Aviezer, & Bentin, 2013; but see Nelson & Russell, 2011b; Willis, Palermo, & Burke, 2011). Indeed, studies suggest that faces and bodies are processed holistically and both sources of information are perceptually integrated (Aviezer, Trope, & Todorov, 2012; Meeren, van Heijnsbergen, & de Gelder, 2005). Furthermore, facial and bodily expressions share several underlying neural mechanisms, though there are also considerable differences between the two (for a review, see de Gelder, 2006; de Gelder et al., 2010). In sum, there is compelling evidence to suggest that the body may present an effective means of communicating emotion, making it important to consider both facial and bodily information in this domain.

### *Research on Bodily Displays of Emotion*

Nonverbal behaviors are typically studied in terms of two categories: behavior types (including spatial form; e.g., leaning back, tilting the head, hands in fists) and behavior qualities (such as spatiotemporal form, kinematics, and dynamics;[1] e.g., fast, slow, jerky, flowing).[2] Although dynamic stimuli that allow for the perception of both type and quality typically receive the highest recognition rates (e.g., Atkinson et al., 2004), static photographs of bodily displays that show only type and dynamic point-light displays that focus on qualities are also recognized well above chance (Atkinson et al., 2004; de Gelder & van den Stock, 2011; Tracy & Robins, 2007). Both type and quality of behavior therefore provide distinct sources of information that facilitate emotion communication.

Researchers also distinguish between two critical processes involved in the nonverbal communication of emotion: encoding and decoding (see also Müller et al., 2013). Encoding refers to *expressing* one's emotion with nonverbal information, and decoding refers to using nonverbal cues to *interpret* emotional information expressed by others. Successful emotion communication occurs between two people when the same nonverbal behavior is used for both encoding and decoding.

Finally, there are several techniques that researchers use to analyze and assess the bodily communication of emotion. In encoding studies, participants are often instructed to act out an emotional scenario (Wallbott & Scherer, 1986), express an emotion as they narrate a sentence constructed from nonsense syllables (Dael, Mortillaro, & Scherer, 2012a, 2012b; Wallbott, 1998), or portray an emotion with minimal guidance (Atkinson et al., 2004). Other studies capture encoded emotions by observing spontaneously displayed expressions during actually occurring emotional experiences (Tracy & Matsumoto, 2008). Still other studies assess emotion expression with dance (Sawada, Suda, & Ishii, 2003; Shikanai, Sawada, & Ishii, 2013), while walking (Crane & Gross, 2013; Gross, Crane, & Fredrickson, 2012; Montepare, Goldstein, & Clausen, 1987; Roether, Omlor, Christensen, & Giese, 2009; Roether, Omlor, & Giese, 2008), or while engaging in a specific task (e.g., Gross, Crane, & Fredrickson, 2010).

When studying how individuals decode emotion information from bodily expressions, researchers often present visual stimuli with bodily positions manipulated and analyze how these behaviors influence emotion identification (Coulson, 2004; de Meijer, 1989; Tracy & Robins, 2007; see Maricchiolo, Di Conza, Gnisci, & Bonaiuto, 2013, for a review). Perceptions formed from posed expressions of emotion can differ from perceptions formed from spontaneous expressions, but both types of expressions are still recognizable (e.g., Abramson, Marom, Petranker, & Aviezer, 2017). Importantly, spontaneous expressions are often encoded with decreased intensity compared to posed expressions, but qualities of posed expressions can include irregular dynamics (Hess & Kleck, 1990; Schmidt, Ambadar, Cohn, & Reed, 2006).

In the following section, we draw on findings emerging from all of these lines of work to identify the specific nonverbal behaviors that are used to encode and decode specific emotions. We include all behaviors for which there is converging evidence from multiple studies to suggest that the behavior is used to encode, decode, or both encode and decode a clearly labeled emotion.[3] For relevant citations and an overview of all bodily behaviors that have been found to be reliably associated with distinct emotions, see Table 1.

## Bodily Behaviors Used to Communicate Distinct Emotions

### *Positive Emotions*

***Pride.*** The bodily expression of pride is particularly important for the communication of this emotion, as both encoders and decoders utilize bodily cues more than facial expressions (App, McIntosh, Reed, & Hertenstein, 2011). In fact, researchers have argued that facial expressions alone cannot capture the complex message sent via pride expressions (Tracy & Robins, 2004, 2007). The behaviors used to communicate pride include an upward head tilt, expanded chest (often paired with shoulders back; Lewis et al., 1992), and arms akimbo—either spread out from the body with hands on hips or raised above the head with hands in fists (Tracy & Matsumoto, 2008; Tracy & Robins, 2004, 2007; see Table 1). Several studies have shown that these behaviors are used to encode spontaneous experiences of pride; for example, after winning a judo match in the 2004 Olympic Games, athletes from countries all over the world were found to display all components of the pride bodily display (Tracy & Matsumoto, 2008). This same display is reliably recognized as pride at levels comparable to those typically found for facial expressions of basic emotions (e.g., Tracy & Robins, 2004, 2007, 2008a).

Several lines of research indicate that the bodily expression of pride is a human universal. In addition to being displayed by

**Table 1.** Bodily expressions of distinct emotions and supporting evidence from encoding and decoding studies.

| Emotion | Bodily behavior | Encoding evidence | Decoding evidence |
|---|---|---|---|
| Joy and happiness | Head tilted up | 29, 12 | 29, 7, 32, 3, 57 |
| | Expansiveness (e.g., chest out, arms out) | 18, 8, 6, 54, 41 | 55, 8, 7, 13, 33, 36, 37, 3, 43, 53, 45 |
| | Upwards movement (e.g., arms, trunk) | 1, 4, 10, 54, 9, 12, 42 | 7, 13, 20, 36, 3, 43, 53, 45 |
| | Illustrative movements | 54, 42 | - |
| | Opening and closing hands | 1, 54, 42 | - |
| | Fast and energetic movement | 18, 41, 4, 8, 6, 16, 17, 54, 9 | 55, 5, 8, 11, 13, 20, 33, 37, 43 |
| | Jumping | 1, 12 | 37, 43, 40 |
| Pride | Head tilted up | 28, 46, 54, 10, 12 | 25, 35, 37, 47, 48, 51, 3, 30, 50, 49, 52, 44, 15, 57 |
| | Chest expanded/shoulders back | 28, 46, 56, 44 | 30, 50, 49, 52 |
| | Arms out from body with hands on hips | 46 | 35, 47, 48, 51, 30, 50, 49, 52 |
| | Symmetrical upwards arm movements | 10, 46, 9 | 2, 35, 47, 48, 51, 15 30, 50, 49, 52 |
| | Erect posture | 28, 44, 12 | - |
| Shame and embarrassment | Head tilted down | 46, 54, 24, 27 | 25, 51, 27, 19, 30, 15 |
| | Head turned to side (head yaw) | 12, 27 | 27, 15, 19 |
| | Collapsed upper body | 28, 46, 54, 56, 12 | 13, 25, 51, 13, 30 |
| | Shoulders slumped | 42, 46 | 51, 13 |
| | Arms limp at sides | - | 51, 13 |
| | Hands covering or touching face | 54, 14, 27 | 51, 27, 19, 15 |
| Fear | Arm movement in front of body | 1, 22, 23, 12 | 2, 7, 20, 36, 37, 53 |
| | Hands in front of face | 1, 12 | 7, 36, 37, 3, 53 |
| | Collapsed upper body | 1, 23, 54, 42, 37, 12 | 2, 7, 13, 25, 37, 3, 53, 45 |
| | Backwards lean or backwards movement | 1, 10 | 2, 7, 13, 20, 36, 37, 3, 53 |
| Anger | Head tilted down | 1, 54 | 7 |
| | Expansiveness (e.g., limbs) | 18, 55, 1, 8, 54, 12 | 8, 2, 13, 33, 45 |
| | Arms forward | 22, 23, 54, 42 | 7, 53, 3, 45 |
| | Fist clenched/fists shaking | 38, 21, 1, 12, 12 | 2, 20, 36, 37, 3, 53, 45, 39 |
| | Hands opening and closing | 54, 42 | - |
| | Hitting motion | 21 | 38, 45 |
| | Forward lean/forward movement | 38, 10, 1 | 2, 7, 13, 20, 36, 53, 45, 39 |
| | Stomping/heavy footedness | 1 | 34, 37, 3 |
| | Fast movements | 18, 41, 4, 8, 16, 17, 54, 55, 9, 11 | 41, 8, 11, 13, 33, 37, 45 |
| Disgust | Turning away (head yaw or torso) | 1, 6 | 7, 3 |
| | Collapsed upper body and arms | 18, 55, 8, 54, 42, 6 | 8, 7, 25, 3, 43, 53, 45, 42, 13 |
| | Hands covering face or body | 1, 54 | 7, 37 |
| | Hand waving in front of face | 1 | 37, 3 |
| | Backwards lean/backwards movement | - | 7, 13 |
| Sadness | Head tilted down | 55, 1, 6, 29, 31, 26 | 29, 20, 25, 32, 36, 37, 3 |
| | Head in hands | 1 | 20, 37 |
| | Less movement | 41, 6, 4, 55, 9, 11, 42 | 41, 11, 34, 33, 37, 43 |
| | Slower movement | 18, 41, 55, 4, 8, 6, 16, 17, 24, 9, 11 | 41, 5, 8, 11, 33, 37, 43 |

*Note*. Numbers refer to the following references: 1 = Atkinson et al., 2004; 2 = Aviezer et al., 2008; 3 = Beck, Cañamero, & Bard, 2010; 4 = Boone & Cunningham, 2001; 5 = Brownlow, Dixon, Egbert, & Radcliffe, 1997; 6 = Coan & Gottman, 2007; 7 = Coulson, 2004; 8 = Crane & Gross, 2013; 9 = Dael, Goudbeek, & Scherer, 2013; 10 = Dael et al., 2012a; 11 = Dahl & Friberg, 2007; 12 = Darwin, 1872/1998; 13 = de Meijer, 1989; 14 = Edelmann et al., 1989; 15 = Feinberg, Willer, & Keltner, 2012; 16 = Glowinski, Camurri, Volpe, Dael, & Scherer, 2008; 17 = Gross et al., 2010; 18 = Gross et al., 2012; 19 = Haidt & Keltner, 1999; 20 = Häring, Bee, & André, 2011; 21 = Hubbard et al., 2016; 22 = Huis In 't Veld, van Boxtel, & de Gelder, 2014a; 23 = Huis In 't Veld, van Boxtel, & de Gelder, 2014b; 24 = Izard, 1991; 25 = James, 1932; 26 = Kędzierski, Muszyęski, Zoll, Oleksy, & Frontkiewicz, 2013; 27 = Keltner, 1995; 28 = Lewis, Alessandri, & Sullivan, 1992; 29 = Livingstone & Palmer, 2016; 30 = Martens, Tracy, & Shariff, 2012; 31 = Matsumoto, Olide, & Willingham, 2009; 32 = Mignault & Chaudhuri, 2003; 33 = Montepare, Koff, Zaitchik, & Albert, 1999; 34 = Montepare et al., 1987; 35 = Nelson & Russell, 2011a; 36 = Nelson & Russell, 2011b; 37 = Parkinson, Walker, Memmi, & Wheatley, 2017; 38 = Retzinger, 1995; 39 = Rosenberg & Langer, 1965; 40 = Ruffman, Sullivan, & Dittrich, 2009; 41 = Sawada et al., 2003; 42 = Scherer & Ellgring, 2007; 43 = Shikanai et al., 2013; 44 = Shiota, Campos, & Keltner, 2003; 45 = Sogon & Masutani, 1989; 46 = Tracy & Matsumoto, 2008; 47 = Tracy & Robins, 2004; 48 = Tracy & Robins, 2007; 49 = Tracy & Robins, 2008b; 50 = Tracy et al., 2005; 51 = Tracy et al., 2009; 52 = Tracy, Shariff, & Cheng, 2010; 53 = van den Stock, Righart, & de Gelder, 2007; 54 = Wallbott, 1998; 55 = Wallbott & Scherer, 1986; 56 = Weisfeld & Beresford, 1982; 57 = Witkower, Tracy, & Lange, 2018. *Collapsed upper body* encompasses contraction of limbs, bowing of trunk, and narrowing of chest. *Expansiveness* encompasses extended limbs, erect posture, and chest expansion. *Head tilt* refers to head pitch rotation. For a more detailed list of specific behaviors related to specific movements, please contact the first author.

athletes from countries all over the world, the expression was also found to be spontaneously displayed by victorious congenitally blind athletes (Tracy & Matsumoto, 2008). Given that these individuals could not have learned to display pride through visual modeling, this result suggests not only universality, but biological innateness. Furthermore, decoding studies have found that the pride expression is reliably recognized by individuals across a wide range of cultures, including highly isolated small-scale traditional societies in Burkina Faso and Fiji (Tracy & Robins, 2008b; Tracy et al., 2013). Pride displays are also recognized by children as young as 4 years old (Tracy et al., 2005) and by adolescents with autism spectrum disorders (Tracy, Robins, Schriber, & Solomon, 2011).

***Joy/happiness.*** Several bodily behaviors have been identified as communicating joy or happiness: upwards bodily movement (i.e., with the arms, trunk, or shoulders), upwards head tilt, illustrative gestures, opening and closing the hands, expansive bodily displays, and jumping (e.g., Atkinson et al., 2004; Coulson, 2004; de Meijer, 1989; see Table 1). Behavior quality appears to be important for happiness displays as well; these movements tend to be fast and energetic (Dael et al., 2013).

These behaviors have been documented in both encoding and decoding studies. For example, Wallbot (1998) instructed actors to express the happiness they would feel if they were in a specific situation, and found displays that included upwards movement, upwards head tilt, expansiveness, opening and closing hands, and fast energetic movements. In a study that combined encoding and decoding, Shikanai et al. (2013) video-recorded several dancers intentionally expressing joy, sadness, and anger through dance performances. Based on observers' judgments, expansiveness, jumping, and increased frequency and velocity of upward extensions were all perceived as communicating happiness.

It is noteworthy that several bodily behaviors associated with happiness (e.g., expansiveness) overlap with those known to communicate pride. Although most studies examining the pride display included happiness as a control and showed that certain behaviors were specific to pride (e.g., Tracy & Robins, 2004, 2007), studies examining happiness tend not to control for pride, which is a major limitation of this research.

### *Negative Emotions*

***Sadness.*** Studies have examined both the type and quality of bodily behaviors associated with sadness. Behavior types include slumped shoulders and a collapsed upper body, downwards head tilt, arms in front of the body, and the head cradled in hands (e.g., Parkinson et al., 2017; Sawada et al., 2003; Wallbott & Scherer, 1986; see Table 1). Behaviors tend to be slow and include less overall movement. These behaviors have been documented in both encoding and decoding studies. For example, Atkinson et al. (2004) instructed drama students to express emotions however they saw fit, but provided them with vignettes to help trigger the experience. Sadness was characterized by three movement types: "dropping the head, bringing the hands to the face or head, and bringing and often crossing the arms in front of the body" (p. 723). Consistent with these results, decoding studies have shown that head tilted down with a collapsed upper body or with the head cradled in hands, as well as slower and less overall bodily movement, are used to interpret sadness in others (Crane & Gross, 2013; Livingstone & Palmer, 2016; Sawada et al., 2003; see Table 1). There is also evidence to suggest that these behaviors are used to encode sadness in a small-scale traditional society in Cambodia, providing preliminary evidence for universality (Parkinson et al., 2017).

***Shame and embarrassment.*** As is the case for pride, the bodily expressions of shame and embarrassment are particularly important when compared to their facial expressions. In fact, researchers have argued that facial expressions alone cannot capture the complex message sent by shame expressions (Tracy & Robins, 2007), and both encoders and decoders utilize bodily cues more than facial cues when communicating shame (App et al., 2011; Tracy & Matsumoto, 2008; Tracy et al., 2009).

Despite evidence that shame and embarrassment are distinct emotions (e.g., Edelmann et al., 1989; Keltner, 1995; Tangney, Miller, Flicker, & Barlow, 1996), the bodily behaviors associated with the two expressions are largely overlapping. Both are communicated with the head tilted down and sometimes turned to the side, a collapsed upper body (e.g., narrowed chest), shoulders slumped, arms limp at sides, and hands covering or touching the face (see Table 1). For example, in Wallbott's (1998) encoding study, actors expressed shame with a collapsed upper body, downwards head tilt, and face-touching; very similarly, in Keltner's (1995) encoding study, young adults made to feel embarrassed spontaneously displayed many of these same behaviors, most notably downwards head tilt and face-touching.

Decoding studies suggest that these same behaviors are used to interpret others' shame displays; Keltner (1995) found that a nonverbal display with head tilted down, shoulders slumped, and arms at sides was reliably identified as shame. In contrast, displays with the head turned down and slightly sideways while moving the hands to touch the face were reliably identified as embarrassment. However, shame can also be communicated with face-touching and head-turning behaviors (Keltner, 1995). Across both encoding and decoding studies, the behaviors that seem to most effectively distinguish shame from embarrassment reside in the face (e.g., smiling, smile control, blushing; Keltner, 1995; Keltner & Buswell, 1997; Tracy et al., 2009).

There is evidence suggesting that the bodily behaviors used to encode and decode both embarrassment and shame generalize across cultures. Tracy and Matsumoto (2008) found that Olympic-level judo athletes from numerous countries spontaneously displayed a head tilted down, shoulders slumped, and chest narrowed after losing a match—presumably an intense shame experience. Narrowed chest and slumped shoulders were displayed even by congenitally blind athletes, making it unlikely that the shame expression is a learned response to failure. However, these blind athletes did not display a downwards head tilt, raising questions about the innateness or universality of that particular behavior in encoding shame. Decoding studies have also found that head movements alone (i.e., Action Units 54 and 64; head tilted down and gaze averted down, respectively) may not be sufficient to identify shame in certain cultures (Haidt & Keltner, 1999). However, shame displays that include bodily information from the waist up—revealing slumped posture—are reliably identified as shame even in highly isolated cultures (Tracy & Robins, 2008b). In sum, the same bodily behaviors are used to communicate embarrassment and shame across cultures, but the head and the face in isolation may not be sufficient to do so (see also App et al., 2011).

***Anger.*** There is strong evidence to suggest that anger is communicated with bodily behaviors including moving or leaning forward, expansiveness, closing hands into fists, shaking fists, holding the arms forward, stomping, and engaging in fast movements (see Table 1). These behaviors are used to encode and decode anger; for example, Wallbott (1998) found that individuals encoded anger with expansive bodily displays, forward stretched arms, and hands closing and opening (possibly into fists), with fast and energetic movements. Correspondingly, De Meijer (1989) found that forward movements with open arm displays received high ratings of anger from decoders.

***Fear.*** The bodily expression of fear includes backwards movement or leaning backwards, a collapsed upper body, arms out in front of the body, and the hands shielding the face (see Table 1). Atkinson et al. (2004) found that participants instructed to act out scenarios of fear “almost without exception” moved away from the camera, displayed “contracting or cowering movements,” and often hands raised in front of the face (p. 723). Other studies have found that individuals encoding fear will collapse their upper bodies (Wallbott, 1998) and activate their arm and calf muscles as they move backwards and defensively place their hands in front of their body (e.g., Huis In ’t Veld, van Boxtel, & de Gelder, 2014). These same behaviors are also used to decode fear; Coulson (2004) found that mannequins observed to be transferring their weight backwards with upper body collapsed and arms bent in front of them were judged as displaying greater fear.

***Disgust.*** The few studies that have examined bodily displays of disgust have suggested that it is encoded with a collapsed upper body, head tilted downward, torso turned, and covering the face with hands, often waving hands in front of one’s face (Atkinson et al., 2004; Wallbott, 1998; see Table 1). Decoding studies point to similar behaviors (e.g., Coulson, 2004; see Table 1), but also include backwards movement (Coulson, 2004; de Meijer, 1989). However, it is not clear whether this behavior occurs during disgust experiences.

## Limitations in Research Identifying Bodily Expressions

One major limitation in prior research on bodily expressions of emotion involves the question of distinctness; although many of the emotions found to have bodily expressions are theoretically and empirically distinct (in terms of self-report, facial expression, eliciting cognitions, etc.), their bodily expressions overlap. Distinct bodily expressions—often including facial components—have been identified for only certain emotions. In particular, pride has been shown to have a bodily display that is distinct from displays of happiness; studies examining pride recognition have typically included happiness as a control and found that observers reliably distinguish between the two emotions and only rarely make confusions (e.g., Tracy & Robins, 2007). In a similar vein, although sadness, shame, and embarrassment share associations with head tilted down and contracted upper body, there is also evidence that these three expressions can be accurately categorized when decoders view faces along with bodies (Keltner, 1995; Tracy et al., 2009). Future studies examining bodily displays should use similar approaches to effectively determine whether particular behaviors are distinct to particular emotions, at least when coupled with certain facial behaviors.

A second limitation is the imprecise way in which bodily behaviors tend to be measured, resulting in the loss of valuable information. For example, several studies identify head tilt as a behavior that communicates emotion, but the head is a complex body part that can move in many ways, including turning (head yaw/rotation around the vertical axis/“no” gesture), tilting (head pitch/rotation around the frontal axis/“yes” gesture), rolling (rotation around the sagittal axis; e.g., raising an ear to the sky), and backward versus forward (e.g., neck extension forward and backwards). In fact, FACS includes eight action units to categorize head movement, and the Body Action and Posture Coding System (BAP) includes 12 different head movements. Increased precision of behavioral measurement is likely to yield greater insight into the distinct bodily expressions associated with various emotions.

Another limitation is a frequent reliance on methods that involve instructing actors to pose expressions without guiding specific muscle movements. This approach results in displays that are entirely dependent on actors’ intuitive beliefs about various expressions, and it is often unclear whether these intuitions map onto the expressions individuals actually display when feeling various emotions. Studies assessing the behaviors individuals display while actually experiencing emotions are ideal for circumventing this limitation, and while a handful of these exist (e.g., for pride and shame, as noted before), more are needed.

## Existing Coding Systems for Bodily Expressions of Emotion

For researchers who wish to code bodily displays of emotion, several previously published coding systems exist. These vary in comprehensiveness, validity, and ease of use. Here, we identify the most widely used systems in emotion research and discuss their benefits and drawbacks.

### *Pride and Shame Nonverbal Coding System*

This system was developed by Tracy and Robins (2007) and further validated by Tracy and Matsumoto (2008). It identifies several bodily and facial behaviors used to communicate pride and shame. Not all of the included behaviors are necessary for pride or shame recognition, but because all have been identified as part of one of the two expressions in at least some encoding or decoding studies, researchers are advised to code for all included behaviors. Studies have demonstrated the reliability and validity of this system; it has good interrater reliability for coded behaviors, and nonverbal behaviors coded for pride and shame have been found to emerge spontaneously during pride- and shame-eliciting situations and to predict pride- and shame-relevant consequences (Randles & Tracy, 2013; Tracy & Matsumoto, 2008; Tracy & Robins, 2007). Consistent with the research summarized in Table 1, the behaviors outlined in this coding system thus constitute a valid and generally exhaustive list of nonverbal behavior types that communicate pride and shame.

### *Specific Affect Coding System*

The Specific Affect Coding System (SPAFF; Coan & Gottman, 2007) is one of the most widely cited emotion coding systems, and has been effectively used to analyze the behaviors of married couples and predict marital outcomes on this basis (Jones, Carrere, & Gottman, 2005; see also Heyman, 2001). The SPAFF includes behaviors for several emotions expressed from multiple channels of communication, including bodily displays, facial expression, and verbal communication. Of these various modalities, bodily communication has thus far received the least attention. Nonetheless, several bodily expressions of emotion are recognized by the SPAFF: disgust is identified from the head turned to the side; joy from fast behavior, expansiveness, sitting up and forward; sadness from low-energy movements, slouching, and a downwards head tilt; and fear/anxiety from fidgeting, arms folded across the chest, and face touching. Behaviors coded using the SPAFF (including bodily movement, facial expressions, and discourse cues) typically show sufficient reliability and good validity; most of the bodily behaviors included in the SPAFF are supported by prior research (Heyman, 2001; see Table 1). However, the SPAFF does not include several behaviors known to be associated with each of the emotions included, making it a less than fully comprehensive assessment tool for those emotions' bodily displays.

### *Body Action Coding System*

The Body Action Coding System (BACS I and II; Huis In 't Veld et al., 2014a, 2014b) is an anatomically based coding system that identifies muscle activation in the body—focusing on the trapezius, biceps, deltoid, triceps, forearm, calves, and lower back—which occurs during the communication of fear and anger. The system suggests that calf muscles tend to become more activated during expressions of fear, whereas forearm muscles tend to become more activated during anger. The BACS cannot be used to identify distinct emotions in its current form because only nuanced differences in muscle activation—potentially invisible to the naked eye—are suggested to discriminate among emotions. However, with more precise measurement, this system could evolve into a useful means of identifying visible behavioral movements on the basis of underlying muscular activity, similar to the technique used by FACS. Furthermore, although the BACS needs further development to identify more distinct behaviors, the muscles described by the BACS do correspond to the behaviors associated with each emotion, as indicated in Table 1.

### *Other Systems*

Several other available coding systems include fairly exhaustive lists of bodily behaviors, but do not classify these behaviors into emotional categories. For example, the Body Action Posture coding system (BAP; Dael et al., 2012b)—likely the most comprehensive system—describes 141 bodily behaviors (nearly every movement the body can possibly make) that can be examined in exploratory research (e.g., see Dael et al., 2012a). The BAP provides clear guidelines for each behavior, and because of this clarity, interrater reliability for each behavior is likely to be high (see Dael et al., 2012b). However, the large number of behaviors included means that using the full system requires a large amount of time, particularly given that many behaviors are likely to occur with low frequency.

While the BAP can be an effective tool for identifying types of bodily movement, other systems better capture bodily movement qualities. Laban Movement Analysis (LMA; see Kennedy, 2013) and Effort Shape Analysis (ESA)—which was derived from LMA (Crane & Gross, 2013; Gross et al., 2012)—have been developed for this purpose. Although LMA was initially constructed to analyze movement in dance (Laban, 1950), it has been applied to the coding of emotion expressions. LMA separates movement into six categories—body, space, effort, shape, relationship, and phrasing—which capture a range of information about the qualities of bodily expressions. Similarly, ESA separates movement into space, energy, time, and flow, but also considers general bodily movements involving the limbs and torso (expanded or contracted).

Finally, several automated coding systems extract both behavior types and qualities. These systems often provide a high level of precision and do not require manual coding, allowing researchers to test narrow hypotheses about movements that might not be easily observed by human coders (e.g., Roether et al., 2009; Roether et al., 2008). Furthermore, recent advances have integrated automated recognition systems with existing coding systems such as the BAP (AutoBAP; Velloso, Bulling, & Gellersen, 2013) to help identify behaviors in coding languages that might be familiar to nonverbal behavior researchers. It is noteworthy that although automated systems have the potential to eliminate the copious time and resources typically devoted to manual coding, these systems often include large financial costs and expertise in computer software and programming.

### *Summary and Limitations of Existing Coding Systems*

While several of the existing coding systems may be useful tools for identifying bodily behaviors involved in the communication of emotion, no single system provides the full package: an exhaustive representation of all bodily behaviors known to communicate a panoply of emotions. For example, although the Pride and Shame Nonverbal Coding System provides a comprehensive list of bodily behaviors used to communicate pride and shame, it does not address behavior qualities, nor does it code for emotions other than pride and shame. In contrast, the SPAFF codes for a somewhat wider (yet not exhaustive) array of emotions, but very few bodily behaviors are identified for each emotion, and for several emotions no bodily behaviors are provided.

The BACS is fundamentally different from other bodily coding systems because it focuses on muscle activation rather than bodily movement. One major limitation is its difficulty to be implemented as a diagnostic tool due to the financial costs and background knowledge necessary to measure and understand muscle activation. In addition, in contrast to the movements delineated by FACS, the relationship between bodily muscle activation and visible behavior is often uncertain, because there are many more degrees of freedom for bodily movements than facial ones (see Cruse, Brüwer, & Dean, 1993; Neff & Fiume, 2006). For example, bicep activation occurs anytime an individual flexes an arm, including during a hugging or lifting movement. As a result, a single muscle activation can lead to a variety of observed behaviors. It is therefore difficult—and perhaps impossible—to draw clear one-to-one mappings between muscle activation and visible behavior in the body. An additional issue is that clothing often conceals muscle activation (whereas this is much less likely with facial actions), making the BACS difficult to implement in ecologically valid contexts.

Given the differences among these various systems, it is important to strategically select a coding system based on one's specific research goals. For example, if a researcher wishes to conduct exploratory work on bodily displays that may or may not be associated with emotion communication, the BAP may be a particularly powerful choice. However, if movement qualities are a central focus, LMA or ESA may make more sense. If one's aim is to identify specific emotions like pride or shame, the Pride and Shame Coding System is ideal (Tracy & Robins, 2007), whereas the SPAFF allows for assessment of sadness, joy/happiness, disgust, and fear.

### *Guidelines for Future Coding Systems*

Given that no single system provides a comprehensive list of all bodily behaviors—including both type and quality—known to be associated with all distinct emotions, we recommend that researchers who wish to develop a new coding system use Table 1 as a resource. We would suggest that such systems consider behavior qualities in addition to behavior types, as certain behaviors may communicate different emotions when paired with different behavior types (e.g., a fast downwards head movement might communicate anger, whereas a slow downwards head movement might communicate sadness). Currently, few systems account for both behavior types and behavior qualities, and no system does so comprehensively.

Future coding systems should also identify precise behaviors rather than focusing on categories that encompass a broad range of behaviors. For example, the SPAFF suggests that "expansiveness" is associated with communicating joy, but the precise behaviors that constitute "expansiveness" can vary (e.g., chest expansion, erect posture, arms away from body, arms up in air). In fact, different forms of expansive behavior can communicate very different interpersonal messages (Witkower, Tracy, Cheng, & Henrich, 2018).

In addition to including precise rather than broad behavior categories, future coding systems should clearly define the movements that constitute each precise behavior. The BAP provides a good example of a system that usefully follows this rule by detailing thorough descriptions of each behavior (e.g., an upward head tilt is defined as "an upward rotation of the head around the transversal axis"; Dael et al., 2012b, p. 105). This same level of detail is provided by the FACS, but most bodily coding systems fail to delineate precise movements to this extent.

## Conclusion

There is strong evidence to suggest that bodily behaviors are used to encode and decode several emotions. Not only are these expressions identified at levels well above chance, but at times they override perceptions from facial expressions. Although bodily expressions of emotion have received increased research attention in recent years, the current article provides the first systematic review of all bodily behaviors known to communicate distinct emotions. Furthermore, although several existing coding systems delineate many of these behaviors, researchers have yet to develop a single succinct system that provides a comprehensive list of all bodily behaviors used to communicate a large array of emotions—as FACS/EMFACS do for facial expressions of emotion. We believe that the behaviors identified in Table 1 constitute a strong foundation for the construction of such a system.

### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Notes

1 The distinction among spatiotemporal form, kinematics, and dynamics is often emphasized in decoding research but lies outside the scope of the present work. For more information, see Atkinson, Tunstall, and Dittrich (2007).

2 Some researchers label the identification of behavior types as behavior coding, and the identification of behavior qualities as behavior rating. Here, we refer to both as behavior coding.

3 Due to space limitations, we have not included every instance in which a particular behavior has been associated with a particular emotion; instead, we focus on those behaviors that have emerged most consistently and unambiguously across several studies. For a more comprehensive list of behaviors—many of which have not been replicated across studies—please contact the first author.

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