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Sauter, D.A.; Russell, J.A.

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Disa A. Sauter[1] & James A. Russell[2]

1. University of Amsterdam, The Netherlands

2. Boston College, USA

Correspondence concerning this article should be addressed to Disa A. Sauter, Department of Psychology, University of Amsterdam, Postbus 15900, 1001 NK Amsterdam, the Netherlands, +31 525 8719, d.a.sauter@uva.nl or James A. Russell, Department of Psychology, Boston College, 140 Commonwealth Ave., Chestnut Hill, MA 02067, USA, +1 617 552 4546, james.russell@bc.edu.

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What is a nonverbal expression of emotion? Both the notion of expression and the notion of emotion are contentious in the literature. Everyone knows the clear cases -- smiles, frowns, screams, chuckles, slumps, and so on -- but the category as a whole is not well defined. Writers from different theoretical backgrounds have criticized the implicit assumptions inherent in this phrase (Ekman, 1971; Hinde, 1985; Parkinson, 2005; Zajonc, 1985). Are the referenced behaviors in fact *expressing* something, and is this something an *emotion*? Not all scientific accounts are consistent with the implication that certain nonverbal behaviors express an emotion.

However, for simplicity of reference we will continue to use the phrase "nonverbal expression". But we do so in an inverted-commas sense only, namely, to refer to those nonverbal behaviors that are commonly taken to express emotions. We acknowledge that the category is vague, and we remain agnostic on whether what is expressed is truly an emotion, or, indeed, whether "express" is what such behaviors do.

We are similarly agnostic on the definition of *emotion*, and we do not use that word here in any technical sense. Instead, our focus in this chapter is on short-term *emotion episodes*, which we take to be multi-componential events of limited duration commonly taken to be an emotion. Components include but are not limited to appraisals, physiological changes, subjective experiences, nonverbal expressions, and instrumental behaviors.

We now turn to summarizing how the basic emotion, appraisal, and psychological constructionist research programs account for the production and perception of nonverbal expressions. (See chapters in this volume by Shiota, Ellsworth, and Barrett, respectively, for more general

discussions of each research program and for fuller sets of references.) Although each program is commonly called a theory, they are instead broad research programs: each includes a family of loosely related (indeed sometimes conflicting) theories and assumptions, an interpretation of the history of the field, various background assumptions about human nature, prescribed methods and data analytic procedures, and conclusions drawn from previous research. Furthermore, each program continues to develop. We present a prototypical version of each program, emphasizing differences among the three research programs. That said, the three research programs also share important assumptions, methods, and conclusions, although the emphasis may vary. For example, when we describe one program's account of evolutionary origins, the reader should not infer that the other two programs reject evolution by natural selection or assume special creation. Similarly, the fact that one program emphasizes context does not mean that contextual effects are incompatible with the other programs. We present each program's assertions as if they were established facts, but in fact they are hypotheses. In the conclusion to our chapter, we elaborate on compatibilities and convergences, but we begin by contrasting the three programs.

The Basic Emotion Program

According to the *basic emotion* program, certain nonverbal expressions are the result of basic emotions. Basic emotions are proposed to have evolved in order to aid organisms in dealing with recurring challenges and opportunities over the course of human evolution (e.g., Tooby & Cosmides, 2008). Although the exact criteria for basicness and the set of emotions that is considered basic varies among theorists, the paradigmatically basic emotions are fear, anger, disgust, sadness, and joy. More recently, Keltner and Cordaro (2017) hypothesized 18 basic emotions each associated with a specific facial expression. They also proposed still other basic

emotions expressed by voice and body, rather than by face alone. Each basic emotion constitutes a discrete system characterized by a neural mechanism called an *affect program* (Ekman & Cordaro, 2011; Saarimäki et al., 2015; Scarantino, 2012). The affect program triggers a cascade of components characteristic of that category of emotion, including its nonverbal expression, which occurs unbidden with rapid onset and has universal presence in humans and perhaps in nonhuman primates.

During phylogeny, the affect program evolved to be triggered by specific unconditioned stimuli or to be prepared to be easily conditioned to a type of stimulus. Unconditioned stimuli reflect shared challenges and opportunities in human ancestral environments (e.g., sweet tastes for joy and putrid smells for disgust; Ekman & Cordaro, 2011). New triggers of the affect program can also be learned. Because of preparedness, some learning requires only minimal conditioning; for example, it has been suggested that humans and other primates are prepared to learn to fear snakes (e.g., LoBue & DeLoache, 2009; Mineka & Cook, 2013). In contrast, other learning may be unique to a given culture, as when people become afraid of malevolent deities or stock markets crashes. Whenever the affect program is triggered, the same cascade of components is activated, including the nonverbal expression, regardless of whether the triggering stimulus is unconditioned or learned. As a consequence, learned stimuli can differ dramatically from unconditioned ones, but the resulting emotional episode, including the nonverbal expression, is basically the same. For example, facial expressions of disgust are similar whether elicited by unconditioned stimuli (oral pathogens) or learned ones (moral contamination) (Chapman, Kim, Susskind, & Anderson, 2009).

The basic emotion account is consistent with nonverbal expressions being either signals or signs. As these terms are used in biology, signals are nonverbal expressions that evolved to provide information to a conspecific (Hinde, 1985). The idea that smiles evolved to inform others of one's happiness is to say that smiles are signals. Signs, on the other hand, are nonverbal expressions that are produced without the function of informing a conspecific, but which nonetheless provide information. Indeed, signs are often produced *despite* their providing information. Sounds made when moving and breathing rapidly are a sign of one's route and thus provide valuable information to a predator. Those sounds did not evolve in order to broadcast that information, however.

Evolutionary history is hard to establish empirically, and so there are various possible accounts for the origin of each nonverbal expression. If its origin was as a signal, then its production and perception co-evolved. That is, the signal evolved to become more conspicuous, and the observer co-evolved to recognize its meaning. If its origin was as a sign, it evolved to serve a non-communicative function (or as a by-product), for example aiding perception or preparation for action (Darwin, 1872). In this case, perception of the emotional meaning of the nonverbal expression could have evolved or could be learned during ontogeny. The systematic association between the nonverbal expression and other components of the emotion episode would allow perceivers to learn its meaning in a species-constant fashion. A third possibility is that, through exaptation, some nonverbal expressions began as signs but subsequently took on a signaling function. The original non-communicative function may or may not continue to operate today (Lee & Anderson, 2017).

To illustrate, consider the sound made when orally ejecting food. One possibility is that the retching sound is a signal of the expresser's emotion of disgust. Another possibility is that the retching sound is a sign rather than a signal; that is, it is produced as a by-product of ejecting food, although an observer can infer that the expresser is disgusted. The third possibility is that the retching sound began as a by-product of food expulsion, originally being merely a sign, but eventually evolved into a signal of disgust, which could then become divorced from food.

The basic emotion account predicts a high degree of intercorrelation among the components that are parts of the cascade predicted for each basic emotion. The components are the same for all or most emotion episodes of a given type, and those components are coordinated by an internal emotion-specific mechanism. The nonverbal expression of, for example, anger is predicted to be highly correlated with the subjective experience of, the physiological signature of, and the instrumental behavior of anger.

Still, each episode may also be subject to other influences that can alter one or more of the specified components and hence lower the observed intercorrelation among those predicted components. One such proposed mechanism is a social norm. The production of the nonverbal expression may be initiated, diminished, exaggerated, hidden, or masked, in order for individuals to comply with social norms about who should show which expression to whom and when (Klineberg, 1938). These "display rules" are socially learned and consequently culturally variable, and can even govern facial expressions when the expresser is alone (Ekman, 1997; 2003; Ekman & Friesen, 1969). The notion of display rules emphasizes the fact that humans can learn to produce or suppress nonverbal expressions, and that the resulting expressions can

deceive others about one's true emotional state. Nevertheless, even with a display rule in operation, the true facial expression may leak (Ekman & Friesen, 1969).

To illustrate the paradigm case of a nonverbal expression for a basic emotion theorist, consider a mother and child walking together in a forest. Suddenly, a snake appears in the grass. The snake triggers the fear affect program. The mother produces a cascade of fear components simultaneously. In addition to a subjective experience, peripheral physiological activation in a fear-specific pattern, and flight response, there is a nonverbal expression -- a "fear face" -- her eyebrows rise, her eyes widen, her mouth opens with the lips stretched out to the side and down. She makes a gasping sound and shrieks. From the mothers' nonverbal expression, the child recognizes that the mother is afraid.

The Appraisal Program

The *appraisal* program emphasizes that the emotion episode is not caused directly by the eliciting event but by how that event is cognitively processed, a process known as *appraisal*. Two individuals can have qualitatively different emotion episodes (and hence different nonverbal expressions) in reaction to the same situation – if they appraise it differently. Appraisal uses information from both bottom-up (i.e., from the stimulus) and top-down (i.e., from the individual's past experience) processes. Appraisals can be conscious or non-conscious, fast or slow, and automatic or integrated with other cognitive processes. The appraisal research program has focused on establishing the perceived perceptual-cognitive dimensions of the eliciting event that are relevant to the subsequent emotion episode; these include, but are not limited to, novelty, valence, goal relevance, goal congruence, certainty, coping potential, and

agency. Although appraisal theories differ somewhat in the number and identity of the appraisal dimensions proposed, there is considerable communality.

Although the various appraisal accounts share the proposal that appraisals are at the heart of emotion episodes, the accounts differ widely in other proposals. Here we contrast two qualitatively different versions, or "flavors," of such accounts (Moors, 2014). In Flavor 1, the appraisal triggers a system akin to the affect program posited in the basic emotion account. Some basic emotion theorists are indeed sympathetic to appraisals preceding the activation of the affect program (Ekman, 1992; Keltner, Horberg, & Oveis, 2006); and some theorists maintain both theories (Frijda, 1986; Roseman, 1991). In contrast, Flavor 2 appraisal accounts do not propose that all the components of the episode are produced by a common neural mechanism for that type of emotion. Instead, they propose that each separate appraisal dimension influences each emotion episode component, including nonverbal expressions, separately (Ellsworth this volume, Scherer 2001, Moors 2014). Because Flavor 1 appraisal theories account for nonverbal expressions in a way similar to that of basic emotion theories, and in order to emphasize the differences between research programs, hereafter we use the phrase "appraisal account" to refer only to Flavor 2 proposals.

Modern appraisal theories posit a fair number of appraisal dimensions relatively independent of one another. The result is that there would be many possible appraisal patterns – and hence many different emotion episodes. Despite the potentially large number of combinations, Scherer (1994) proposed that certain patterns were more common throughout evolutionary history and are more common nowadays in humans and other animals. The resulting emotional episodes are known as

modal emotions, with the important hypothesis that their components have evolved to be highly synchronized. Indeed, Scherer and Moors (2018, p. 737) suggested that an emotion episode might be defined as beginning only when synchronization is sufficiently high and as ending when synchronization drops below a threshold.

Somewhat different episodes can be categorized together and labelled as, say, fear. Fear thus constitutes a category of similar but not identical emotion episodes preceded by similar but not identical appraisals. There are no features that are shared by all fear episodes (Moors, 2017; Scherer, 1984). Instead, within each emotion category is found a variety of features, including a variety of facial muscle movements and vocal changes. The specific changes in each token episode are then explained by the specific individual appraisal dimensions evoked by the triggering event, without there being a categorical emotion mechanism mediating between appraisals and behavioural and physiological responses.

To illustrate, Scherer (1986) outlined a detailed set of proposals on how different appraisal dimensions result in different acoustic patterns of vocal expression. Appraisals of novelty are linked to vocalizations characterized by deep, sudden inhalations that could be associated with fear and surprise (see also Johnstone, van Reekum, & Scherer, 2001; Laukka & Elfenbein, 2012; Patel, Scherer, Björkner, & Sundberg, 2011). Since novelty, not fear, is what drives the inhalation, fear without novelty would not be predicted to produce inhalation. Individual facial or postural changes are similarly explained by specific appraisal dimensions – for instance raised eyebrows are explained by appraisal of novelty, and slumped shoulders are explained by appraisal of low coping potential. According to some appraisal theorists, appraisal checks occur

sequentially, albeit rapidly, resulting in individual parts of the nonverbal expression being lagged in occurrence (Scherer, 2001).

The nonverbal expression might be decoded directly in terms of emotion, but an interesting alternative is that the observer's initial inferences are about the expresser's appraisals (Scherer, 1988; Laukka & Elfenbein, 2012). On this theory, recognition of an emotion is thus the reverse of the emotion episode's production. For example, just as an appraisal of novelty makes the eyebrows rise or produces a gasp, the observer can infer from such expressions that the expresser finds the situation novel. The observer can then infer that the expresser is surprised.

To illustrate the paradigm emotion episode according to appraisal theory, return to the example of the mother and child walking in the forest when a snake suddenly appears in the grass. Let us stipulate that the same overt behaviors occur as in that previous example. According to the appraisal account, the mother produces facial and postural muscle movements and sounds based on how she appraises the situation. She had not expected the snake, and so she raises her eyebrows and upper eyelids. On the other hand, had she *expected* the snake (i.e., the snake is lethal but expected), even if she had subjectively experienced fear, she would not raise her eyebrows and eyelids. Next, she judges the snake as incongruent with her goal of staying alive, and so her mouth turns down. These expressions do not occur as constellations based on the type of emotion, but rather as isolable responses to individual appraisal outcomes. The child might recognize the mother's fear directly from the nonverbal expression or might initially infer her appraisals and then infer her fear from the detected appraisal pattern.

The Psychological Constructionist Program

Psychological Construction is a research program in which each emotion episode is said to be constructed at the time of its occurrence rather than by the triggering of a prepackaged set of components determined by the type of emotion it is. Each component of the episode, including a nonverbal expression, is initiated separately, and therefore each component is accounted for separately. The episode is constructed in the sense that it is put together in the same way that non-emotion episodes are put together. Thus, components and their coordination are accounted for by domain-general psychological processes rather than ones specific to emotion.

Although the program is focused on events loosely called in everyday speech *emotions*, the terms *emotion*, *anger, fear*, and so on are not used for scientific purposes: not to taxonomize emotion episodes, nor to designate causal entities (such as affect programs) underlying those episodes, nor to designate a universal emotional meaning of nonverbal signals. English folk concepts are not borrowed to serve as scientific concepts for several reasons. Languages other than English lexicalize concepts that are often somewhat different (Jackson et al., 2019; Wierzbicka, 1999). Each such ordinary language concept denotes a heterogeneous set of variable instances rather than a set with defining features common to all instances (Russell, 1991). The heterogeneity within, say, episodes labeled *anger* speaks against the search for their common cause in the form of an underlying neural program, or for a synchronized pattern of their components, or for a common manifest nonverbal expression -- in all and only anger episodes.

The psychological constructionist studies *emotion, fear, anger, sadness, shame* and so on as everyday English-language folk concepts and studies similar concepts in other languages in the

same way – as folk concepts. Folk emotion concepts in different cultures are of interest for the role they play in everyday categorization, much as an anthropologist studies folk biology or astrology and their role in behavior. Folk concepts are involved mainly in subjective experience, in the interpretation of emotion episodes, and in the production and perception of nonverbal expressions.

Nonverbal expressions are produced by general-purpose processes including core affect, sensory-perceptual-cognitive processing, communication via speech, the formulation of goals and plans, respondent behavior (such as reflexes), and instrumental behavior. Core affect – the general-purpose system by which one feels good or bad, energized or enervated – is always available and therefore not unique to emotion episodes. All the same, it provides emotion episodes with their affective quality. Sensory-perceptual–cognitive processing includes appraisals, but it is more general. It also includes noting characteristics of the on-going culturally defined social context, perceiving the psychological state of other persons (theory of mind calculations), attributing causality, and planning for future behavior. Some nonverbal expressions are reflexive responses (e.g., automatic recoiling), and others are part of instrumental behavior aimed at solving the problem (often an emergency) that initiated the episode (e.g., searching for an exit), including communicating to others (e.g., gesturing for help). These separate general-purpose mechanisms often draw on culturally defined roles enacted in culturally created situations.

To illustrate, consider what is called the “surprise face” (which includes raising the brows and widening the eyes). The “surprise face” may or may not occur when other components of

surprise occur and would be accounted for in different ways in different episodes. In one surprise episode as indicated by a novel situation producing self-reports of feeling surprised, no "surprise face" occurs (indeed, such cases are common, Reisenzein, 2000). In another episode, the "surprise face" might occur when the expresser, whether or not feeling surprised, needs visual information in orientation and visual scanning. In another episode, the "surprise face" might be an emblem (Ekman & Friesen, 1972) used by listeners to communicate that they understand that the event narrated must have been surprising to the speaker (Bavelas & Chovil, 1997). In yet another episode, the surprise face might be an intense form of eye contact signaling eager anticipation of interaction. These hypotheses on brows and eyes are speculations offered to illustrate the general approach. Admittedly, they remain to be tested and honed, but they do point to alternatives that would need to be excluded before concluding that the "surprise face" is an expression of surprise.

No behavior is theorized to have evolved to signal to observers the expresser's emotion; thus, the observer is not said to detect a signal of emotion and does not arrive in the world prepared to detect such purported emotion signals. Instead, observers arrive prepared to detect signals of behavioral trajectories (Fridlund, 1994); for example, a growl might signal "back off or I'll attack," a smile "I acquiesce." In addition, observers probably arrive prepared to attend to faces, vocal sounds, prosody, and posture to learn about signs of the beliefs and desires of others. With cultural scaffolding, the observer infers the expresser's beliefs and desires and *interprets* the nonverbal expression. In some societies, observers interpret nonverbal expressions in terms of their emotion-related folk concepts, such as *anger* and *fear* for English-speaking observers. The observer's interpretation unfolds as the context unfolds (varying with the expresser's other

behaviors and the changing situation faced) and it varies with the observer's background knowledge of the expresser and with the observer's culturally based conceptual framework (including that embedded in language) for understanding psychological events (Scherer, Clark-Polner, & Mortillaro, 2011).

The components of each individual emotion episode are produced to suit the particular situation faced. Components in the token episode can be initiated and change separately, although they are also coordinated with each other to suit the immediate circumstances. The process is domain-general: the brain does so in the same way that it produces and coordinates components of non-emotion episodes. Thus, psychological construction does not posit a neural affect program for emotion types nor predict high correlations among those components included in the "cascade of components" said to characterize a type of emotion. The "surprise face,' for example, is not predicted to be highly correlated with the subjective experience of surprise or a surprise-specific pattern in the autonomic nervous system. The "surprise face" can occur with no subjective experience of surprise and without the peripheral nervous system enacting a surprise-specific pattern. Instead, different episodes of a given emotion type need not have the same components. In other words, components are coordinated into whatever pattern they assume in order to suit the immediate circumstances and goals, regardless of emotion type, with no one coordinating mechanism for all and only episodes of a specific type of emotion. Once domain-general processes describe the initiation and changes in each component, coordination among components, and how an observer (including the person having the emotion) comes to ascribe those components to a specific emotion, there will be nothing left for a "theory of emotion" to explain.

To illustrate psychological construction, return to the mother and child encountering a snake in the grass. Again, let us stipulate that the same overt behaviors occur. On this account, the widening of the mother's eyes, raising her brows, and her staring at the snake are attributed to the sensory-perceptual-cognitive process of gathering visual information during an event perceived as unexpected and potentially important. The mother's scream is attributed to her goal of alerting her child and possibly others nearby. The mother appraises the snake as an emergency and makes a quick plan, perhaps by a simplistic schema, to solve the problem. Her instrumental response might be to flee the snake, but need not be; it depends on context: if the snake headed toward the child, the mother might rush *toward* the snake to pull her child away; if the mother had relevant training, she might capture the snake; or, if she had expertise, she might realize the snake is harmless and show her child how to handle a snake. In each case, the nonverbal expression would be the one suited to gathering information and to the execution of that specific behavior. The child's response is not attributed to detection of a fear signal but is an interpretation drawing heavily on contextual information (especially the presence of a snake) as well as the mother's nonverbal expressions and instrumental actions. Psychological constructionists would add that the snake-in-the-grass story illustrates a prototypical fear event that is unlike many other fear events, and such stories loom large in theorists' thinking, but that in reality fear events are a heterogeneous lot, with a variety of specific behaviors and nonverbal expressions.

How to Progress in the Study of Nonverbal Expressions and Emotion?

Nonverbal expressions (actions commonly taken to express emotions) have been seen as a testing ground for the different theories of emotion, but the evidence has not declared a winner.[1] At the same time, the three programs we have considered so far have all inspired research that provides part of the answer to the question of how nonverbal expressions arise and how they are perceived. Further, the dialectic between competing programs has been a source of progress with respect to both methods of investigation and empirical facts uncovered. Although the authors of this chapter work within different research programs, we agree that no research program currently provides a fully satisfactory account of the available evidence. We are starting to see proponents of one program addressing issues raised by other programs (e.g., Cowen, Sauter, Tracy & Keltner, 2019; Griffiths, 2008; Keltner & Haidt, 1999, Lange, Dalege, Borsboom, van Kleef & Fischer, 2020; Moors, 2017; Scarantino, 2015; Scherer & Moors, 2018). As they evolve, the programs are bending toward each other. In this rest of this chapter, we outline some of this progress.

We find encouraging the emergence of areas of convergence across the three programs. Propositions emphasized in one program – such as the role of evolution through natural selection – are assumed by the other two programs. Other claims made in one program have come to be accepted by at least some researchers traditionally associated with other programs. For example, most theorists in each program now assume that emotion episodes include a heterogeneous variety of components (even if not necessarily the same components) including an appraisal process. Some theorists believe that the descriptive study of the folk representation of emotion

[1] The outcome of the debate among theories also has implications for applied work. We have not touched on the use of nonverbal expressions in applied settings, such as lie detection, but we do not underestimate the importance of the theoretical assumptions made in such applications (see Denault et al., 2019)

episodes needs to be differentiated from their prescriptive study. Some distinguish signs from signals. Some acknowledge that production and perception must be distinguished and that one cannot be directly inferred from the other. Some agree that we should not presume that folk categories such as emotion, anger, fear, and so on necessarily provide prescriptive scientific categories but of course they might. We next elaborate on these areas of convergence.

Going Beyond the Nature – Nurture Dichotomy

Evolution and culture must both be included in a complete account of the production and perception of nonverbal expressions. All human activity ultimately relies on structures honed through natural selection, and so all theories in psychology must be consistent with what is known about evolution and genetics. Epigenetics, plasticity, and learning are also fundamental to human biology, and so all theories in this domain must also acknowledge these processes. In turn, what is acquired during ontogeny can be specific to a particular society's culture. We hope that any account that excludes nature or nurture is finally and totally behind us.

Both nature and nurture need to be taken into account. An example may be the in-group advantage: there is a closer match between what is perceived in a nonverbal expression and what the expresser means to convey when the perceiver and expresser are members of the same group (Elfenbein, 2017; Elfenbein & Ambady, 2002). Different degrees of matching may occur for different nonverbal expressions, different societies, or both. One possibility is that some nonverbal expressions vary across cultures in the way accents vary within a language; the result is small differences in perception based on whether the expresser is from the same group as the expresser (in-group) or not (out-group). Another possibility is that some expressions vary in the

way that dialects vary from each other and from an original language; the result is greater cultural differences in perception but still some mutual intelligibility. Still another possibility is that some nonverbal expressions vary in the way that one language varies from another; the result is expressions that are mutually unintelligible. One example of the last possibility is nonverbal vocalizations of triumph, which have been found to be reliably recognized within, but not across, cultural boundaries, although vocalizations of triumph from different cultures share low-level acoustic features, such as having high and variable pitch (Sauter, Eisner, Calder, & Scott, 2010; Sauter, Eisner, Ekman, & Scott, 2010). Another example is a certain tongue protrusion, which is a culture-specific signal of a culture-specific emotion, roughly translated as shame (Shweder, 2003).

Rather than simply operating as two forces opposing each other, biological and cultural factors *interact*. Such interactions open the door to exciting research. Some genes vary between populations and can affect culture via psychological predispositions to cultural learning by, for example, biasing transmission of information towards some cultural variants of a behavior over others (Boyd & Richerson, 1985; Dressler, Balieiro, Ribeiro, & dos Santos, 2009; Kim et al., 2011). On the other hand, cultural practices can also affect a group's gene pool; a well-known example is the low prevalence of the genotype for lactose intolerance in cultural groups that have historically kept dairy cattle (Bersaglieri et al., 2004). In short, over time, changes in culture can lead to genetic changes; and genetic differences can influence culture. The person we study and theorize about is the product of forces that have interacted repeatedly throughout human phylogeny.

Degrees of Preparedness

Consistent with the interaction of nature with nurture, theorists within each program acknowledge a continuum of preparedness and learning. At one extreme are unconditioned reflexes: some nonverbal expressions can be elicited by unconditioned stimuli, such as wincing at a looming object rapidly approaching, or flailing at the sudden loss of support, or a blink in reaction to air puffs to the eye. (It is a separate (and open) question whether or not these expressions are accompanied by changes in other emotion components.) At the other extreme would be nonverbal expressions that are unique to a cultural group and that are extremely difficult to learn, such as a calm demeanor while walking across burning coals. But most nonverbal expressions are between these extremes. Humans enter the world prepared to acquire some practices more easily than others. We are also biologically prepared to learn some associations more rapidly and easily than others. Primates, including humans, are prepared to link particular stimuli to particular behaviors, such as learning a "fear response" to snakes and smiling at a caregiver early in ontogeny (Cook & Mineka, 1990; Öhman & Mineka, 2003; Wörmann, Holodynski, Kartner & Keller, 2014). In humans, these kinds of prepared reactions are also reflected in some pathologies: phobias tend to be of animals rather than other objectively dangerous objects such as guns and cars (Hoehl & Pauen, 2017).

A telling example of the interplay between nature and nurture is laughter. Laughter in response to tickling likely evolved in the context of rough-and-tumble play across species (Dezecache & Dunbar, 2012; Panksepp, 2007). An early form of this can be seen in humans within the first few months of life, human babies laugh when tickled and in other forms of social play (Sroufe & Waters, 1976). This response is found across cultures (Sauter, Eisner, Ekman, & Scott, 2015;

Sauter, Eisner, Ekman, et al., 2010) and across species (Davila Ross, Owren, & Zimmermann, 2009; Knutson, Burgdorf, & Panksepp, 1998). However, nurture subsequently shapes laughter: Tickling doesn't always elicit laughter or enjoyment; depending on context, especially the social relationship of those involved, tickling can elicit strong protest. A laugh can be social bonding with one person when directed at another in mockery. The social relationship also shapes the sound of laughter: Listeners can infer whether individuals in brief decontextualized instances of co-laughter are friends or strangers (Bryant et al., 2016). Laughter is also influenced by culture-specific forces, resulting in laughter sounding subtly different across cultural groups (Sauter, 2013; Sauter & Scott, 2007).

Expressions as signals, signs, and direct influencers

Research programs are also converging on the idea that different nonverbal expressions may have different origins – some may be signals, others may be signs, and others may have an effect without communicating information. Even nonverbal expressions produced as signals need not signal emotion nor signal information automatically. For example, nonverbal expressions can signal intentions produced strategically, as suggested in Fridlund's (1994) behavioral ecology account. Examples would include a smile produced to indicate willingness to cooperate or a frown produced to indicate readiness to attack (but without indicating that either cooperation or attack is inevitable). As evolved mechanisms, these nonverbal signals need not be deliberately or consciously produced. Instead, in their social interactions, humans, as deeply social animals, rely on evolved mechanisms that include nonverbal signals. Some nonverbal signals are strategically deployed social tools aimed at a specific audience, but others might be deployed to influence anyone who happens to be available. They evolved in order to signal to the audience one's

projected contingent plans and goals. A smile foretells friendly interaction or collusion if the observer cooperates (and might be used even if the expresser feels bad about the interaction). A furrowed brow can convey a willingness to attack if the observer fails to retreat (and might be used even if the expresser feels extremely threatened). Such signaling thus allows expresser and observer to coordinate their behaviors, often to the benefit of both. On this account, signaling is strategic; signaling an inevitable attack would hold no advantage, and a surprise attack without warning would be more beneficial for the expresser (and more detrimental for an opponent), and those who could deliver such attacks without giving off warning signs might have enhanced reproductive fitness.

All research programs at this stage accept that some nonverbal expressions may be produced as signs, that is, simply as behaviors "given off" (Goffman, 1959) without the function or intention of communicating. For example, facial expressions seen as fear signals might instead enhance sensory acquisition for the expresser by producing a larger visual field and increased air velocity (Susskind et al, 2008). All the same, signs allow an observer to infer something about the expresser. In such cases, some observers might infer an emotion (perhaps accurately, perhaps not), but others might infer something else entirely such as how the expresser appraises the situation or what the expresser is preparing to do.

A third possibility is that some nonverbal expressions are neither signals nor signs, but produced to influence the observer directly (Rendall & Owren, 2010). That is, some nonverbal expressions might influence relatively low-level processes such as attention or arousal, rather than leading to more complex information processing in the observer. If nothing else, a scream wakes you up

and gets your attention. We tend to yawn automatically when we see others yawn; yawn synchrony may regulate the sleep cycles of social groups (Provine, Hamernik, & Curchack, 1987). A retching sound might make observers feel nauseous and likely to retch themselves; and retching is indeed highly contagious. In some cases, the direct influence of nonverbal expressions need not rely on the sensory properties of the expressions alone, but on their ability to influence the recipient by virtue of its association with prior negative or positive experiences. A parent can, for instance, exploit social conditioning processes by pairing distinctive expressions with subsequent harsh punishment of a child, and in the future use the expression alone as a conditioned stimulus leading the child to expect harsh punishment and not misbehave as a result.

What is The Range of Perceived Information?

Whether signs, signals, or direct influences, the physical behavior -- nonverbal expressions -- can provide much potential information to an observer. Several questions thus arise: What further information, beyond the occurrence of the physical display, is perceived by the observer? And what is the process that the perceiver engages in? Evidence has yet to provide clear answers. Here, we use the term 'perception' to encompass information processing of any kind (e.g., detecting, interpreting, computing, inferring) without making assumptions as to its nature or whether the perception is accurate.

So, what further information does the observer perceive? The most common answer is that the observer perceives the expresser's emotion. Taking seriously the multi-componential nature of the emotion episode requires careful unpacking of this answer. For example, if the observer

perceives -- through whatever mechanism -- that the expresser is afraid, which, if any, of the components of fear is perceived? The observer might have inferred an appraisal, a subjective conscious experience, a physiological change, a motive for instrumental behavior, or some combination of these (Figure 1). For example, the observer who interprets an expression as one of "fear" could perceive that the expresser has appraised their situation as threatening, is subjectively experiencing fear, is physiologically aroused, wants to flee, or some combination of these. And all, some, or none of these perceptions may be accurate.

The need to unpack an emotion episode into its components is recognized from different theoretical perspectives. Ekman (1997, pp. 334–335) wrote: "… Facial expressions can provide, I think, each of these different types of information, but that is not a demonstrated fact within or across cultures. I think we use emotion words - anger, fear, disgust, sadness, and so on - as a shorthand, an abbreviated way to refer to the various events and processes that make up the phenomenon of emotion." This passage from Ekman echoes work done from a different theoretical perspective but with the same implication: "Although we often speak of fear as a thing, a more apt description may be a sequence of events. . . . [T]o know the meaning of the word *fear* is to know some such sequence. It is to know a *script* (Abelson, 1981) in which events unfold in a certain order. The script contains prototypical causes, beliefs, physiological reactions, feelings, facial expressions, actions, and consequences" (Fehr & Russell, 1984, p. 483).

The implication is that finding that an observer labels someone as afraid on the basis of a facial expression thus tells us less than it might at first appear. As Ekman (1997, p. 334) put it, "We do

not know which information domains those actually engaged in [an interaction] actually derive from each others' expressions. It could be only one [type of information] or all of them." When asked, observers do report perceiving multiple components from nonverbal expressions, as well as further information. Perceivers ascribe beliefs, desires, and intentions (Frijda, Kuipers, & ter Schure, 1989) to expressers (Frijda & Tscherkassof, 1997), and appraisals potentially unrelated to emotions are inferred about a situation from a nonverbal expression (e.g., Laukka & Elfenbein, 2012). Furthermore, the expressers' social intentions can be reliably perceived when measured as the extent to which observers agree on ascribing statements such as *Please hold me and comfort me* to facial expressions typically linked to sadness (Parkinson, 2005; Yik & Russell, 1999). Finally, observers can infer arousal, reflecting the extent to which the expresser is energized, as well as the extent to which the expresser feels good or bad (Russell, 1997).

Because an observer can ascribe qualitatively different types of information to a nonverbal expression, further questions arise. One question is what kind, if any, background knowledge is needed for the perception of different features; observers are not always correct, and some individuals might be better than others in extracting useful information. The next question is whether some types of information are privileged over others -- more automatic, faster, more consensual, and so on. There is variability in how much agreement is found between perceivers for the different components. One study found greater agreement for judgements of the expresser's subjective feelings than for behavioral intention or action requests (Horstmann, 2003). Observers have also been found to agree more, both with each other and with theoretical predictions, when making judgments from nonverbal expressions about emotion words (*fear*) and appraisals (*I am in a dangerous situation*), as compared to social messages (*Don't hurt me! I*

give up) or beliefs, desires, and intentions (*I feel like getting out*) (Scherer & Grandjean, 2008). On the other hand, the studies just mentioned were of observers in a small sample of cultures, and observers with different cultural backgrounds may make different inferences. For example, Crivelli, Russell, Jarillo and Fernandez-Dols (2016) found that for a group of Trobrianders in Papua New Guinea, motive/action statements (e.g., wants social interaction vs doesn't want social interaction) dominated over an emotion interpretation of facial expressions.

A few caveats should be noted in relation to the summary of the literature on perception that we have just sketched. First, what observers report when directly asked does not necessarily allow us to infer what they perceive spontaneously. Second, observers' judgments are influenced by many other factors as well, such as whether an expression is perceived as being genuine. Third, response format has been found to influence the kinds and patterns of responses that observers give. For example, DiGirolamo and Russell (2017) found that observers can agree on a made-up nonsense word as the emotion conveyed by a type of facial expression when the response format asks them to select one word from a short list. The study of the perception of nonverbal expressions needs to include more open response formats to gain a richer picture of observers' spontaneous interpretations. Fourth, the typical nonverbal expressions used in such studies may be rare in the society studied, and more ecologically valid samples of stimuli are needed. It will also be important to include studies of spontaneous, ecologically valid social interactions to establish the social consequences of nonverbal expressions in live settings.

Can we please have more interdisciplinary research?

Contemporary theory on emotion has benefited from insights integrating disciplines in the sciences and humanities. To cite just two examples: An ecological perspective told us about how and when nonverbal expressions occur in the real world in human and non-human animals (Eibl-Eibesfeld, 1989). For example, the "eyebrow flash" is a universal signal that occurs during social interaction, with its specific features depending on specific features of the interaction and on what other nonverbal behavior accompanies it (Grammer et al., 1988).

Research in communication science suggests that some nonverbal expressions, including facial movements, are part of paralanguage. Paralanguage is the use of nonverbal material as a part of speech. Humans produce nonverbal expressions as part of talking, and these nonverbal expressions are inserted in the proper syntactic place to aid communication. Chovil (1991) offered a taxonomy for paralanguage in which facial movements are a part. An example is inserting a scrunched nose into a sentence in place of the words "that stinks." More generally, people use pantomime in order to get an audience to infer certain cognitive, emotional, or motivational states. We humans augment our conversations with paralanguage in which we mime the actions and states we are talking about, or the listener mimes to communicate back to the speaker an understanding of or empathy with what was said (Bavelas & Chovil, 1997; Scherer & Bänziger, 2010). Studying nonverbal expressions from the point of view of communication science thus reveals some to be understandable only as part of language.

Another contribution comes from linguistics. Fernández-Dols (2017) drew on the linguistic distinction between semantics and pragmatics to suggest an account of nonverbal communication. The search for the one emotion conveyed by a nonverbal expression is like a

narrowly semantic approach to language, according to which there is an encoded meaning for any expression which is preserved in all contexts. Fernández-Dols advocated adding a pragmatic approach that emphasizes the context-dependent use of a nonverbal expression. For example, on a narrowly semantic view, a smile has a fixed meaning, roughly: "I am happy." And the questions are whether the smile is true or false and whether the observer is correct or incorrect in decoding it. On the pragmatic view, in contrast, a smile leads the observer to understand that the expresser – depending on context -- acknowledges the observer's presence, provides a polite greeting, flirts, accepts or offers an invitation, conveys a willingness to proceed, provides an apology, understands the joke, invites collusion, or admits defeat. And the question is whether the interaction proceeds as the expresser intended. This insight from linguistics, as with insights from other disciplines, is paving the way to a more integrated view of how humans produce and perceive nonverbal expressions (Scarantino, 2017).

Future progress depends on multidisciplinary research. Human beings are, in some ways, like all other living creatures; in some ways, like other mammals; and in some ways, like other primates. Each human being is, in some ways, like all other human beings. But evolution through natural selection includes not only common descent, resulting in commonalities, but also descent with modification, resulting in variability (Darwin, 1871). Through plasticity, epigenetics, and learning, each human being differs from others who live in different geographical, historical, economic, or socio-political systems or who grow up in a different culture or speak a different language. Each human being also differs from even those with whom they share all those background features. The pursuit of universalism of human nature must therefore be balanced with an understanding of human diversity. Multidisciplinary research teams in cognitive science

have documented both universality and diversity in social categorization, odor and color perception, mental representations, and so on. Research on nonverbal expression similarly points to the need for explanations that include both universality and diversity.

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Figure 1. Components of emotion episodes.