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Nonverbal Communication

Judith A. Hall,[1] Terrence G. Horgan,[2] and Nora A. Murphy[3]

[1]Department of Psychology, Northeastern University, Boston, Massachusetts 02115, USA; email: j.hall@northeastern.edu

[2]Department of Psychology, University of Michigan, Flint, Michigan 48502, USA; email: thorgan@umflint.edu

[3]Department of Psychology, Loyola Marymount University, Los Angeles, California 90045, USA; email: nora.murphy@lmu.edu

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Abstract

The field of nonverbal communication (NVC) has a long history involving many cue modalities, including face, voice, body, touch, and interpersonal space; different levels of analysis, including normative, group, and individual differences; and many substantive themes that cross from psychology into other disciplines. In this review, we focus on NVC as it pertains to individuals and social interaction. We concentrate specifically on (*a*) the meanings and correlates of cues that are enacted (sent) by encoders and (*b*) the perception of nonverbal cues and the accuracy of such perception. Frameworks are presented for conceptualizing and understanding the process of sending and receiving nonverbal cues. Measurement issues are discussed, and theoretical issues and new developments are covered briefly. Although our review is primarily oriented within social and personality psychology, the interdisciplinary nature of NVC is evident in the growing body of research on NVC across many areas of scientific inquiry.

Contents

INTRODUCTION

Nonverbal communication (NVC) is the common denominator in social life; there is hardly any domain of social experience that is not connected to it. NVC is defined as behavior of the face, body, or voice minus the linguistic content, in other words, everything but the words. The study of human NVC is wide-ranging and includes inquiry into the following domains: evolutionary origins; developmental processes; physiological and neurological processes; intra- and interpersonal usages, correlates, antecedents, and consequences; group differences (e.g., culture, gender); the accuracy with which people are able to use NVC to convey intended meanings; and the accuracy with which people are able to understand the meanings of others' nonverbal cues.

Nonverbal communication (NVC): nonlinguistic, informative aspects of behavior and appearance, including head and body features or movements, touch, interpersonal distance, and paralanguage

Nonverbal cues: aspects of appearance or nonverbal behavior to which a perceiver may respond or from which they may draw an inference

Encoding: the enactment, expression, or sending of nonverbal cues

However, it is not quite correct to define NVC as everything but the words. The complex relationship between nonverbal and verbal behavior impacts the thought and language processes of a sender (the person sending or encoding nonverbal information) and the inferences drawn by a perceiver (the person receiving the sender's nonverbal information). Nonverbal and verbal channels often have to be considered together to understand conveyed meanings. In fact, a large body of research shows that hand gestures produced during speech are, along with the words, part of an integrated speech production system (Goldin-Meadow & Alibali 2013). Nevertheless, although a complete understanding of NVC should take verbal behavior into account, this review focuses only on cues in the nonverbal modality.

Although it is essential to connect NVC to its intended or inferred meaning, we concur with the often-stated warning that there is no dictionary of nonverbal cue meanings, because contextual factors involving encoders' intentions, their other verbal and nonverbal behaviors, other people (who they are and their behavior), and the setting will all affect meaning. Some discrete gestures (often called emblems) do have meanings that are consensually understood within a given cultural group; examples in North American culture include crossing the fingers for good luck or extending the middle finger toward someone as an insult. However, gestures that have distinct meanings comprise only a tiny part of the entire repertoire of NVC.

An important theoretical distinction can be drawn between the terms NVC and nonverbal behavior (NVB) (Wiener et al. 1972). Terms corresponding to this distinction are signal versus sign or, equivalently, cues that are given versus given off (Goffman 1959). The term signal represents behaviors that are part of a consensually understood messaging system that is engaged with

interpersonal intent, while sign denotes behaviors that may be informative but unintended and not communicative in that sense. While valid analytically, this distinction often founders because of the difficulty of establishing intentionality (e.g., is a yawning sender telling me she is bored, or is she simply tired?) and because of uncertainty over whether the parties are actually sharing a code in the linguistic sense. Researchers have come to use the terms NVC and NVB interchangeably much of the time, as we do in this review.

Although we focus on research in psychology, the study of NVC is truly interdisciplinary. NVC is a standard topic in the field of communication studies and in journals in this field (e.g., *Human Communication Research*), and it has longstanding roots in anthropology, ethology, and sociology. NVC is routinely studied in the applied fields of medicine, business, mental health, criminal justice, education, and law. Computer scientists study NVC for programming avatars and robots. NVC is a topic in all subdisciplines within psychology. The interdisciplinarity of the field is revealed in the fact that the 1,000 most-cited studies on visible nonverbal cues were published in 297 different journals, many of them outside the field of psychology (Plusquellec & Denault 2018).

The NVC field is not unified within a single theoretical framework. Theories span many perspectives: biological or evolutionary (Ekman 2017, Puts et al. 2014), social or communicative (Fridlund 2017), sociopolitical (Burgoon & Dunbar 2006), functional (Patterson 1982), and dyadic or process (Patterson 2018). The breadth of topics that relate to NVC is quite wide, in accordance with its many functions, which include displaying affect (such as anxiety or happiness), revealing attitudes (such as interest, prejudice, or intimacy), regulating interaction (such as taking turns or directing attention), managing impressions (such as by presenting oneself as competent or brave), revealing physical and mental conditions (such as pain or mental disorders), and exerting interpersonal control (as in displaying dominance).

The NVC field is advancing rapidly. Technological advances such as automatic measurement, brain imaging, and affective computing offer new possibilities for research. In addition, due to the calls for more measurement of actual social behavior, as opposed to self-reports and measures of nonsocial behaviors such as reaction times (Agnew et al. 2010), there is renewed interest in NVC as a compelling behavioral window into psychological processes. Finally, broad thematic trends in psychology promote interest in NVC. One is interest in nonconscious processes (implicit, automatic cognitions and behavior). One active domain in this regard is the study of stereotyping, prejudice, and discrimination, where NVC can be studied as a manifestation of denied or implicit attitudes (e.g., Richeson & Shelton 2005). Another theme that deeply involves NVC is the study of emotions and their behavioral correlates, particularly facial expressions. The quantity of NVC research is now sufficient to support several handbooks (e.g., Hall & Knapp 2013, Harrigan et al. 2005, Manusov & Patterson 2006, Matsumoto et al. 2016), as well as numerous monographs (e.g., McNeill 2016, Todorov 2017), edited volumes (e.g., Fernández-Dols & Russell 2017, Hall et al. 2016, Kostić & Chadee 2015), textbooks (e.g., Burgoon et al. 2016, Knapp et al. 2014) and meta-analyses (e.g., Bond & DePaulo 2006, Hall et al. 2015, Schlegel et al. 2017a) and two dedicated journals (*Journal of Nonverbal Behavior* and *Gesture*).

There are many ways to organize a review of the NVC literature. One is to summarize findings relating to a specific modality of NVC, such as the smile (Abel 2002) or behavioral mimicry (Chartrand & Lakin 2013, Vicaria & Dickens 2016). Another approach would be to review multiple kinds of NVC as they relate to a particular topic, such as emotion (Bänziger et al. 2014, Cohn et al. 2007), psychological immediacy (Witt et al. 2006), or gender (Hall & Gunnery 2013). Another important distinction that can be an organizing framework is between normative or group effects (Elfenbein & Ambady 2002) and individual differences (Hall et al. 2009a).

This review focuses on, first, behavior that is encoded (sent, enacted, or otherwise revealed) and, second, behavior that is decoded by perceivers, which includes both the inferences drawn

by perceivers and the accuracy of those inferences. We acknowledge that such a division can sometimes be arbitrary because the operational definition of what a cue means might be based on how its recipients decode it or its impact on them. The distinction between encoding and decoding is, therefore, heuristic. These two foci, as well as some of the others listed above, come together in our discussion of applications of Brunswik's (1956) lens model, which affords insight into how a criterion variable (e.g., an emotion, truth versus lie, or a personality trait) is manifested in nonverbal cues; how, in turn, the cues are interpreted by perceivers; and how accurate those perceivers are in judging the given criterion based on the available cues.

Decoding: inferences drawn by perceivers about others' encoded nonverbal behaviors or appearance

There are many topics that we can only briefly cover, or cannot cover at all, in this review. Readers wanting to go deeper into NVC should consult the works cited above, as well as recent *Annual Review of Psychology* articles that cover specific NVC topics (Blake & Shiffrar 2007, Chartrand & Lakin 2013, Goldin-Meadow & Alibali 2013, Jack & Schyns 2017, Todorov et al. 2015).

ENCODING: THE CUES THAT ARE SENT

Senders encode vast amounts of information along visual, auditory, olfactory, and tactile channels of communication, including who they are; their emotional, cognitive, and attitudinal states; and the nature of their interactions with others (Hall & Knapp 2013, Matsumoto et al. 2016). Sender cues may be spontaneous or deliberate (posed), and informative to the senders themselves (e.g., facial feedback via neurological or cognitive processes), the perceivers, both the senders and the perceivers, or no one. The informational value of each sender cue may be reinforced, contradicted, augmented, minimized, or not impacted at all by other sender cues or contextual factors that accompany it.

As noted above, distinguishing whether an encoded cue is a sign or a signal has proved problematic because the encoder's awareness (spontaneous and nonconscious at one extreme and deliberately planned at the other) is hard to determine. While challenging to study, this is not a trivial distinction and it also applies to the study of decoding NVC (Ambady 2010). In fact, it is not possible to fully understand NVC without considering this continuum.

Figure 1 serves as a framework for reviewing recent findings pertaining to nonverbal encoding. The horizontal axis shows that encoding covers a continuum anchored by static and dynamic cues, and the vertical axis covers a continuum anchored by nonconscious and conscious encoding processes. Representative examples of encoded information are shown within the resulting quadrants. The focus in this review is on quadrants 1 and 2; quadrants 3 and 4 are covered to a lesser extent. Our initial focus is primarily on the potential informational value of encoded quadrant 1 cues—that is, cues that are transmitted more or less nonconsciously to perceivers and appear to be relatively static to them (e.g., a sender's age). In this context, static does not always mean not moving; for example, a sender's gait may appear to be relatively the same over time to perceivers, unless the terrain (from dry to icy) or condition of the sender (injury) changes suddenly.[1] Static refers to encoded behavior that is relatively typical for a specific type of sender (e.g., a child with autism) across different contexts. These cues may thus serve as potential markers of senders' attributes (e.g., biological sex, personality, clinical conditions).

The center circle depicts how proximal time factors (e.g., situational factors impacting the behavior) and distal time factors (i.e., the process begins in the past; e.g., a sender's developmental

[1] Our use of the terms static and dynamic is, therefore, different from the way in which researchers often describe NVC stimuli that are shown to perceivers, where static literally means not moving (i.e., a photograph) while dynamic means moving (as in a video) (Schlegel et al. 2017a).

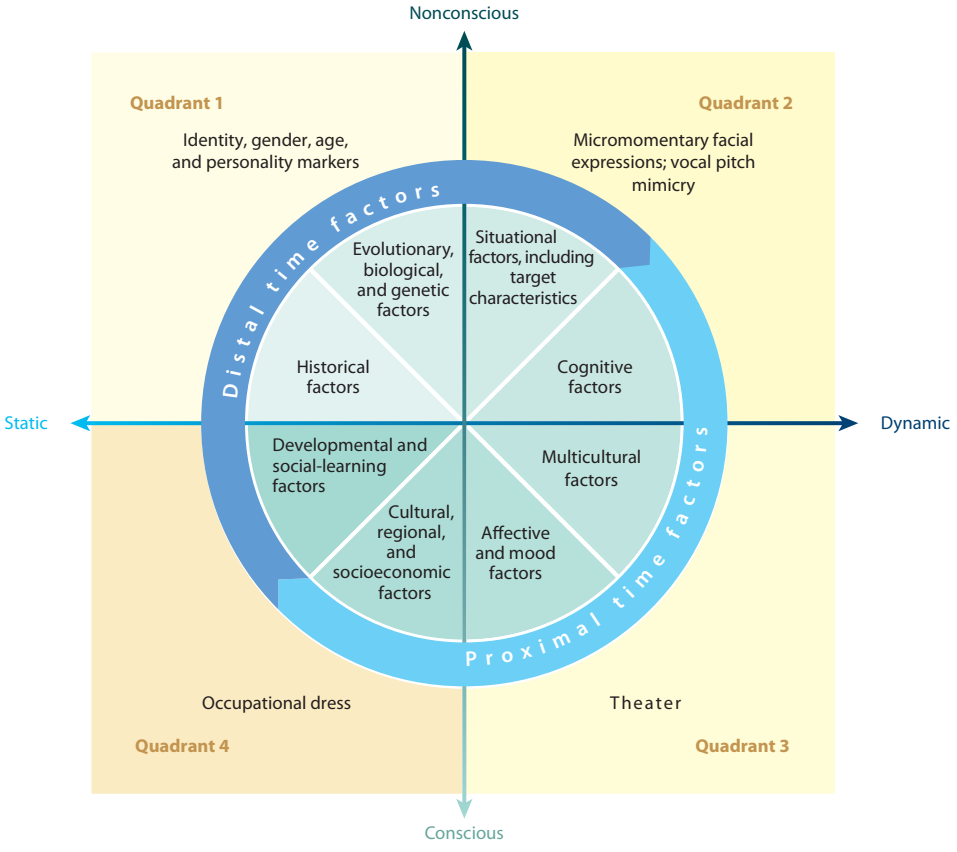

Figure 1

A framework for reviewing recent findings pertaining to nonverbal encoding. The horizontal axis shows that encoding covers a continuum anchored by static and dynamic cues, and the vertical axis covers a continuum anchored by nonconscious and conscious encoding processes. Static refers to encoded behavior that is relatively typical for a sender across different contexts. Representative examples of encoded information are shown within the resulting quadrants. The center circle depicts how proximal (e.g., situational factors) and distal (i.e., the process begins in the past; e.g., a sender's developmental history) time factors may impact the relative location of specific cues—and thus their potential informational value to perceivers—along the two axes.

history) may impact the relative location of specific cues—and thus their potential informational value to perceivers—along the two axes. Eye-tracking technology has uncovered differences in how older and younger senders use their eyes to process emotional facial expressions, with older individuals fixating more on the lower face regions (Chaby et al. 2017). This gaze pattern represents a potential marker of older age that unfolds over a long duration of time (i.e., it is a distal factor) and is not likely to be under the conscious control of senders (quadrant 1). Infants' pupils, in contrast, automatically dilate more in response to larger versus smaller depictions of pupils (a proximal factor), suggesting a possible mechanism of arousal contagion (Fawcett et al. 2016) (quadrant 2). In theater, senders may deliberately change their voice to portray a particular character (Cartei & Reby 2012) (quadrant 3); in this case, adopting a role for a specific character would represent a proximal factor, whereas the actor's ability to convey a character's voice is a distal factor (practice). With respect to quadrant 4, senders in a work environment may consciously choose to don a new

role-specific, company-specific uniform (a proximal time factor; e.g., a waiter at a restaurant), and others may adorn themselves in a manner that reflects longstanding, perhaps culturally specific, traditions (a distal time factor; e.g., the robe worn by leaders of different religions). Below, we are able to describe only some of the most recent work, given the large literature on each topic covered.

Cues That Are Seen

Social categorization is a fundamental aspect of human cognition. The potential informational value of various sender cues is thus an important line of basic research within the domain of nonverbal encoding. It also is important to both traditional (e.g., psychiatric diagnoses) and emerging (e.g., biometrics and human–robot interactions) domains. During interactions, senders nonconsciously encode information about themselves that is more or less static (e.g., markers), such as their identity, biological sex, psychological and developmental problems, and social and personality attributes. These markers likely emerge as a consequence of genetic, biological, developmental, and learning factors, among others. In this section, we discuss illustrative cues that are visible to an actual or potential perceiver and that have potential informational value as markers for social categorization. The potential value of cues is stressed because the meaning of any cue or set of cues is probabilistic at best and may hinge on a host of other encoded cues, sender characteristics, perceiver qualities, and contextual and situational factors, as stated above. This aspect of nonverbal encoding is covered in the section titled Cues That Are Heard.

Individual identity. Senders' unique identities can be communicated via a number of nonverbal channels, including their gait (Takemura et al. 2018), the iris of the eye (Sibai et al. 2011), and body odor (Rodriguez-Lujan et al. 2013). For example, Rodriguez-Lujan et al. (2013) provided evidence that hand odor may serve as a biomarker of identity. However, much of this research is situated in the computer science domain of biometrics; its generalizability to everyday person identification among humans is therefore unclear.

Biological sex and gender. Some encoded cues signal senders' biological sex or gender. Mutic et al. (2015) did not find that armpit odor was a marker of a sender's gender, but differences in bodily expressiveness or restlessness, gait, gazing, and the voice have been found to distinguish women from men. The faces, voices, and hands of women tend to be more expressive than men's; men tend to have more restless feet and legs than women; and men's arms and legs tend to be more open. During interactions, women tend to gaze, touch, and smile more at others than do men, and they stand closer to others, as well, unless the topic is threatening or alienating in nature (Hall & Gunnery 2013, LaFrance et al. 2003). The gait patterns of men and women are different in both young and older adults, largely due to differences in their average heights and body shapes (Cho et al. 2004, Ko et al. 2011). A number of vocal differences exist, as well; for example, men have louder voices, use filled pauses and interruptions more often, and show more speech dysfluencies (Knapp et al. 2014). Yet in terms of the voice, major markers of gender appear to be timbre and pitch (Pernet & Belin 2012); for example, men tend to have a lower vocal pitch than women.

Psychological and developmental problems. Disturbances across a number of nonverbal channels may signal physiologically based health problems, neurologically based developmental deficits, psychological conditions, and changes in mental status among senders in several of the quadrants shown in **Figure 1**.

Many diagnostic markers are situated within quadrant 1. Greater pitch variability and range appear to be two biomarkers of autism in children (Bonneh et al. 2011), whereas less pitch variability

may be a biomarker of schizotypal personality disorder in adults (Dickey et al. 2012). Atypical gaze patterns, eye movements, facial expressiveness, hand gestures (e.g., flapping), and pupil activity represent potential markers for anxiety, depression, autism, or schizophrenia (Benson et al. 2016, Loveland et al. 1994, Martineau et al. 2011, Reed et al. 2007, Trevisan et al. 2016, Wieser et al. 2010, Yirmiya et al. 1989). Children with autism display facial expressions that appear more neutral, ambiguous, or mechanical (Loveland et al. 1994, Yirmiya et al. 1989), and they show less facial expressivity when distressed (Esposito et al. 2011). Such differences may be due to deficits that children with autism have in common with alexithymic individuals (Trevisan et al. 2016). At present, the evidence is mixed regarding whether gaze aversion is a potential marker of autism (Adrien et al. 1993, Moriuchi et al. 2017).

Paralanguage: vocal behavior that occurs with or substitutes for words, including fundamental frequency; amplitude; rate; pitch contour; and sighs, cries, and other non-word sounds

Other nonverbal cues may be more dynamic in nature because they are sent either nonconsciously (quadrant 2) or consciously (quadrant 3) in response to specific situational factors. In terms of gaze, Wieser et al. (2010) observed that socially anxious people gazed less (compared to non–socially anxious people) at a male avatar that was facing them from a distance in a virtual reality setup, a pattern that is also demonstrated by socially anxious people in potentially confrontational interactions with real people (Knapp et al. 2014). Reed et al. (2007) noted that depressed adults appear to actively suppress felt happiness with their facial muscles.

In terms of quadrant 4, senders may more or less consciously provide cues to their personality problems via dress and by how they design, decorate, and use the various spaces (including virtual) that they own (Eftekhar et al. 2014, Vazire et al. 2008). Vazire et al. (2008) noted that flashy clothes were one of the features associated with narcissists. With respect to Facebook usage, neurotic individuals post more pictures, and their albums contain more pictures (Eftekhar et al. 2014).

Social and personality attributes. Senders often convey, nonconsciously or consciously, social and personality attributes about themselves across a number of nonverbal channels, including their faces and gestures. Evidence that people's social and personality attributes are revealed in their faces is growing; for example, Ellis et al. (2008) proposed that higher levels of androgens in males (and females) lead not only to more masculinity in their physical features (e.g., more hair, greater muscularity), but also to a greater propensity for violent behavior due to androgens' other effects on their developing brains. In terms of gestures, Kraus & Keltner (2009) observed that senders from higher–socioeconomic status (SES) backgrounds used more cues of disengagement (doodling) during dyadic interactions, whereas those from lower-SES backgrounds were observed using more cues of engagement (head nodding, laughter). These are only two examples of the many social and personality attributes that have been associated with facial morphology and nonverbal expression (Nestler & Back 2013, Rule & Alaei 2016). While studies of judgment accuracy (see the section titled Decoding: The Perceiver's Nonverbal Communication Experience) confirm the importance of nonverbal cues in the expression of such attributes, researchers have not fully documented what those cues are.

Cues That Are Heard

A sender's vocal cues (paralanguage) and words often parallel each other in meaning. Nonetheless, paralanguage may disambiguate, clarify (e.g., rising pitch at sentence's end to indicate a question versus a declarative statement), or contradict (e.g., sarcasm) spoken words. Vocal cues can convey additional information (e.g., about the sender's emotion state) or add information independent of words altogether (e.g., laughing without speaking). Vocal cues may also regulate conversations, as with turn requesting, maintaining, yielding, and denying, and thus can best be understood within

the context of a face-to-face interaction. To illustrate, a sender's vocal cues may signal that they want another person to speak (e.g., by using a lower pitch, pause, drawl, or questioning tone at the end of a sentence or filler trail-offs such as "ah" and "you know").

How proximally driven factors within the inner circle of **Figure 1** primarily impact the dynamic aspects of senders' vocal qualities in general and their pitch in particular (the number of vocal vibration cycles per second of the vocal folds, technically fundamental frequency) along the two axes is reviewed in this section. Dynamic, in this context, means that the encoded cues occur in response to specific target qualities and particular sender states, as opposed to occurring across many targets and contexts in general.

Target qualities. Senders' vocal cues may consciously or nonconsciously shift in response to the situation that the sender is in (e.g., talking more softly when entering a library; quadrant 3) as well as in response to other people (i.e., targets) who are in that situation with the sender. Infant-directed speech and what has been called elderspeak (Kemper 1994) represent two examples of the latter that might be situated in quadrants 2 and 3, respectively. When adults and children speak to babies, changes in their timbre, pitch (higher), and speech rate (slower) have been observed, and they also tend to use shorter and simpler sentences, more extreme vowels, and exaggerated emotional tones (Kuhl et al. 1997, Piazza et al. 2017, Saint-Georges et al. 2013). Although variability in infant-directed speech has been documented, it has been observed in many cultures, suggesting that it may be an evolved solution to an adaptive problem (e.g., Broesch & Bryant 2017, Narayan & McDermott 2016, Sulpizio et al. 2018). The informational value of infant-directed speech has been examined; for example, Zangl & Mills (2007) found that infants show greater event-related potentials (ERPs) to familiar and unfamiliar words spoken in infant-directed speech than to words spoken in adult-directed speech.

With elderspeak, senders use some of the same vocal cues associated with infant-directed talk—shorter sentences, slower speech, and higher pitch—when addressing the elderly (Kemper 1994). Elderspeak can be perceived as patronizing and may negatively impact elderly patients' receptiveness to treatment (Ryan et al. 1995, Williams & Herman 2011). Less patronizing speech directed toward more positively viewed elderly individuals, as well as the belief that elderspeak is more appropriate for certain types of older clients, suggests the possible role of conscious processes in the decision to switch to elderspeak (Lombardi et al. 2014, Thimm et al. 1998).

Senders' cognitive factors. Changes in senders' nonverbal cues that are more or less nonconscious in nature provide clues to their cognitive activities (quadrant 2). This has been well documented with respect to the use of gestures in learning and language production (Goldin-Meadow & Alibali 2013). Perceivers may be able to infer what kind of manipulable object (e.g., scissors) senders are thinking about by observing their gestures, as some gestures seem tied to the semantic properties of words (Pine et al. 2010). Doherty-Sneddon et al. (2013) noted that gaze aversion appears to be a strategy used by typically developing individuals, as well as those with autism and Williams syndrome, to reduce cognitive load when they are thinking about listeners' questions. Examples of more distally based cognitive factors include the relationship between pupil dilation and senders' memory. Senders' pupils dilate more when they are looking at items that they have seen before (relative to new items), even when they are instructed to pretend that they have never seen the items before (Heaver & Hutton 2011, Otero et al. 2011).

Senders' speech and vocal pitch also may change in response to conscious and nonconscious thought processes. Regarding conscious processes (quadrant 3), LaBov (1966) observed that people deliberately adjust their speech patterns to match those of the class of people that they aspire to be part of. Singers attend to their own vocal cues to produce desired sounds, such as a head voice

or falsetto. Male actors may use a higher-pitched voice when depicting gay characters, perhaps consciously altering their voice to fit stereotypic expectations of gay males (Cartei & Reby 2012). In terms of nonconscious processes (quadrant 2), senders' pitch may automatically change when speaking to another person with a sad versus a neutral facial expression, especially if they are experiencing greater empathy (Karthikeyan & Ramachandra 2016).

Motivation. Paralanguage provides information to perceivers about senders' motivations, including those that are controlling or romantic in nature. The examples in this section represent dynamic, nonconscious encoding processes (quadrant 2). By examining ERPs, Zougkou et al. (2017) noted that listeners appear to quickly (within 200 ms) distinguish between motivational (e.g., controlling tone) and nonmotivational speech, leading to greater attunement to the former. Senders' vocal pitch may signal their mating strategy as well as their attraction to or desire for intimacy with another person (O'Connor et al. 2011). When speaking to members of another sex that they find attractive, women may adopt a higher pitch (Fraccaro et al. 2011), whereas men may use a sing-song pitch whereby they strike a balance between signaling their masculinity and signaling too much of it (Leongómez et al. 2014).

Mating. Senders' body types and vocal pitches may nonconsciously communicate information about their sexual orientation, sexual maturity, or fitness from an evolutionary perspective (quadrant 1) (Baeck et al. 2011, Fitzgerald et al. 2016, Horgan et al. 2016, Skorska et al. 2015). For instance, gay males' pitch is higher than heterosexual males' pitch but still lower than that of heterosexual women (Baeck et al. 2011). In terms of fitness, men with higher shoulder-to-hip ratios have lower-pitched voices, which women find attractive, and women with lower waist-to-hip ratios have higher-pitched voices, which men find attractive (Hughes et al. 2004). Men's upper body strength can also be reliably detected from their voices alone, suggesting that men's vocal qualities contain information pertaining to their fitness (Sell et al. 2010). Communication about the fitness of senders may extend to same-sex rivals; a deeper voice among men, for instance, may communicate their ability to intimidate other men (Puts et al. 2016). Importantly, extreme values do not perforce signal greater sender fitness or attractiveness. Although men prefer higher-pitched female voices, presumably because they signal women's fertility (Apicella & Feinberg 2009), too high a pitch is less attractive to men, perhaps because of its association with sexual immaturity (Borkowska & Pawlowski 2011).

However, proximal factors may nonconsciously and temporarily alter a sender's typical pitch (quadrant 2). As an example, women's voices are subject to hormonal processes that coincide with their menstrual cycles, including changes to their pitch. Whether these changes in pitch are related to fertility detection is debatable. Although studies have shown that women's pitch is higher prior to ovulation, which men seem to find more attractive, it is not clear if that change is a reliable indicator of their time of peak fertility (Bryant & Haselton 2008, Fischer et al. 2011).

Status. Senders' voices and vocal pitches may be used to project and negotiate status relations in interpersonal contexts, including in mixed-gender dyads, in group settings, and during interviewee–interviewer interactions (Cheng et al. 2016, Hall et al. 2005, Ko et al. 2014, Leongómez et al. 2017, Zhang et al. 2018). Ko et al. (2014) found that, when participants were assigned to a more powerful role in a negotiation, they tended to use a higher, less variable pitch and were more variable in their loudness than were their less powerful counterparts. In a group setting, however, senders who initially used a deepening pitch were more likely to emerge as higher-ranking members (Cheng et al. 2016). Leongómez et al. (2017) observed that males and females who were low in self-perceived dominance increased their pitch more in the presence of

a dominant interviewer than in the presence of a typical interviewer, and less pitch variability was observed in those higher in self-perceived dominance. These results suggest that changes in pitch and loudness may serve as more or less nonconscious vocal signals of senders' actual or desired rank in a specific setting (quadrants 1 and 2).

Affective and mood states. Vocal cues are tied to the current affective states of senders (Bänziger et al. 2014, Knapp et al. 2014). Perceivers and listeners have been shown to pick up on the following cues: higher pitch and greater pitch range, more loudness, and faster speech rate for joy or elation; lower pitch, reduced loudness, slower rate, and longer pauses for sadness; and higher pitch, voice tremor, and various speech dysfluencies (e.g., stutter, incoherent sounds, repetition) for anxiety. Using information concerning pitch, sound pressure level, timbre, and length of pauses between words, Dasgupta (2017) observed that faster talking in a shrill and louder voice was associated with an agitated emotional state.

Obviously, senders' affective states may change quickly due to situational factors. Although mood states tend to be longer lasting than affective states, they, too, have a dynamic quality. Mundt et al. (2007), for example, found that changes in depressed patients' pitch (which was detected over the phone) indicated their positive response to therapeutic interventions.

Socioeconomic, regional, and cultural factors. In each quadrant of **Figure 1**, senders' vocal qualities may be influenced by socioeconomic, regional, and cultural factors. In terms of the more static, nonconscious qualities of speech, Brown & Lambert (1976) observed differences in the vocal qualities of blue- versus white-collar French Canadian workers. Accents may provide cues to which region of the same country a sender is from (e.g., southern and northern France) (Aubanel & Nguyen 2010). Such vocal differences may serve as potential markers of a sender's background.

Other pitch differences might reflect the nonconscious or conscious adoption of cultural or gender rules over a lifetime (distal time factors). For example, Japanese women's pitch tends to be higher than Dutch women's, perhaps due to greater societal pressures to appear feminine in the former than the latter cultural setting (Van Bezooijen 1995) (quadrant 1 or 4). Upspeak or uptalk (using a rising pitch and uncertain tone at the end of a sentence, often assumed to reflect a less confident or dominant person) points to the possibility that vocal qualities serve as gender markers that are actively constructed by senders as a function of situational forces (Linneman 2012). For instance, Linneman (2012) noted that men's and women's use of uptalk differed when they were experiencing greater success on a television show (e.g., answering questions correctly on *Jeopardy*); specifically, men's use of uptalk dropped, whereas women's use of uptalk increased. This gender difference may be due to women feeling a greater need to apologize to others for their success than is the case with men (Linneman 2012) (quadrant 3).

Lastly, in terms of the more dynamic qualities of speech, as mentioned above, senders may deliberately change their speech patterns to match the class of people that they aspire to be part of (LaBov 1966) (quadrant 3), or they may nonconsciously mimic a speaker's tone of voice (Smith-Genthôs et al. 2015).

DECODING: THE PERCEIVER'S NONVERBAL COMMUNICATION EXPERIENCE

As outlined in the previous section, encoding refers to an individual's NVC that conveys or reveals information. The interpretation of that NVC is the decoding process. For instance, a perceiver might conclude that a conversation partner is anxious based on the partner's quivering voice and shaky hands. Such inferences may be accurate or inaccurate. One cannot avoid communicating nonverbally, because one's cues (or absence of cues) will be interpreted by others. Those cues may

or may not be conveyed intentionally, and they may or may not be interpreted correctly, but in any case, they will impact social relationships.

Many studies have investigated the relationship between NVC and formed impressions (e.g., Todorov 2017). For instance, having a smiling and relaxed face was associated with perceived extraversion (Naumann et al. 2009). Other terms besides decoding have been used to describe a perceiver's intake of nonverbal information, including nonverbal perception, nonverbal detection, and nonverbal sensitivity.

Regardless of terminology, NVC decoding may encompass both automatic and controlled cognitive components, in parallel with the sender's conscious and nonconscious factors described above and illustrated in **Figure 1**. In the first few seconds or even microseconds of a social interaction, the NVC message may be interpreted quickly and processed outside of conscious awareness with little or no cognitive control (Ambady 2010, Lakin 2006). Several studies document that less than 100 ms of exposure to a face is enough for perceivers to make trait judgments; for example, extraversion impressions were formed within the first 50 ms of being exposed to a face (Borkenau et al. 2009). The automaticity of NVC is also demonstrated in studies of behavioral mimicry, where social interaction partners may imitate one another's specific nonverbal behaviors outside of conscious awareness (Chartrand & Lakin 2013). Conscious awareness and cognitive resources may change a decoded message over time. For instance, first impressions based on sender photographs were modified after a live interaction between senders and perceivers that occurred 1 month later (Gunaydin et al. 2017). Even so, much of the immediate decoding process may happen on a nonconscious level.

Just as various sender states, such as mood and status, contribute to nonverbal encoding, the same factors also relate to a perceiver's decoding process. Various components that may influence NVC processes between a sender and perceiver include the expression channel and features of the interaction itself (e.g., perceiver orientation either within or outside observance of an interaction, interaction length, acquaintanceship between perceiver and sender). Perceiver qualities such as emotional state, personality traits, and demographic attributes may also influence NVC and subsequent impressions. Just as a sender's encoded message is influenced by the factors described in **Figure 1**, perceiver impressions of a sender may be quite different depending on the interplay of these same components in the perceiver.

The role of NVC in impression formation is acknowledged, either implicitly or explicitly, in many social cognitive models of person perception, including the ecological theory of social perception (Zebrowitz & Collins 1997), the systems model of dyadic nonverbal interaction (Patterson 2018), the Realistic Accuracy Model (Funder 1999), the Social Accuracy Model (Biesanz 2010), the social cue integration framework (Zaki 2013), the Social Relations Model (Back & Kenny 2010), the Truth and Bias model of human judgment (West & Kenny 2011), and the Brunswik lens model, which we discuss in the next section. Although the models range in scope and applicability in terms of specific person perception processes and components, NVC is an integral component of all models.

Brunswik Lens Model

The Brunswik (1956) lens model is a common theoretical and methodological framework used to study NVC, particularly in relation to studying interpersonal judgments (Nestler & Back 2013). As illustrated in **Figure 2**, the Brunswik lens model includes three components: (*a*) a measured construct in a sender (such as a personality trait), (*b*) the sender's NVB, and (*c*) the perceiver's impression of the sender on the construct. Cue validity, the pathway between the first and second components, indicates whether a specific NVB (e.g., fidgeting) is a valid cue to the sender's

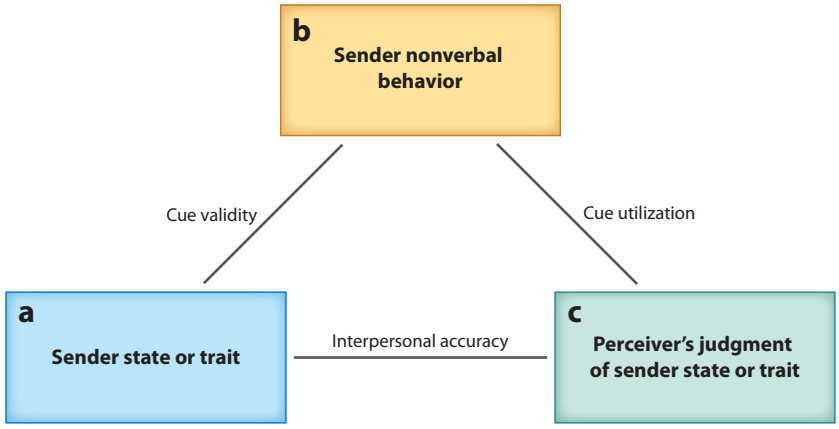

Figure 2

Interpersonal perception and interpersonal accuracy in a modified Brunswik (1956) lens model. (*a*) Sender state or trait refers to a measured construct in a target, such as a mood state or personality trait. (*b*) Sender nonverbal behavior is the sender's expressed nonverbal behavior. (*c*) Perceiver's judgment refers to a perceiver's impression of the sender's state or trait. Cue validity is the correspondence between the sender's nonverbal behavior and the sender's state or trait. Cue utilization is the correspondence between the sender's nonverbal behavior and a perceiver's impression of the sender. Interpersonal accuracy is the correspondence between the sender's state or trait and the perceiver's judgment of the sender (i.e., whether the perceiver's judgment was an accurate impression of the sender's measured state or trait).

measured construct (criterion). Cue utilization, the pathway between the second and third components, reflects how the perceiver's impression may be shaped by specific NVB expressed by the sender. Finally, interpersonal accuracy (IPA), the pathway between the first and third components, indicates whether the perceiver's impression of the sender is accurate at a statistically significant level and how strong the effect is [Brunswik (1956) used the term achievement for this pathway]. The lens model can also be used to examine other pathways between criterion, cues, and outcomes, such as that between extraversion and likeability (Back et al. 2011).

The Brunswik lens model framework has been used to investigate NVC and person perception for many personality and social characteristics (e.g., Borkenau et al. 2004, Naumann et al. 2009). For example, Reynolds & Gifford (2001) investigated NVC and judgments of intelligence using a lens model framework. Senders were videotaped reading a script; perceivers then judged senders' intelligence levels from video clips, and external raters coded senders' NVB. Measured intelligence was correlated with speaking more words and speaking faster, illustrating cue validity. Perceived intelligence correlated with less halting speech and more words spoken, illustrating cue utilization. Finally, IPA was achieved between senders' perceived and measured intelligence ($r = 0.38$). Another lens model study demonstrated accuracy in judging self-esteem (Hirschmüller et al. 2018). In that study, nonverbal expressiveness and vocal warmth were associated with both measured self-esteem (cue validity) and judged self-esteem (cue utilizations).

Interpersonal accuracy (IPA): the accuracy with which perceivers can decode the meaning of nonverbal behaviors

The broad impact of the Brunswik lens model is demonstrated in two meta-analyses of lens model studies, which included 29 studies (Kaufmann & Anthanasou 2009) and 86 articles (Karelaia & Hogarth 2008), respectively. Both meta-analyses confirmed that perceivers can be interpersonally accurate at statistically significant above-chance levels across a range of domains, confirming many results not based on lens model methodology (Hall et al. 2008, 2016b). Some argue that the lens model does not provide a theoretical basis as to which cues or constructs are measured (Zebrowitz & Collins 1997). Thus, any given lens model study potentially results in a list of

correlations between cues and a measured construct, with little guidance in how to interpret the constellation of those particular cues. However, the Brunswik lens model continues to be a valuable heuristic framework within which to investigate NVC and social perception.

Measurement of Interpersonal Accuracy

Many of the social-cognitive models of person perception mentioned above explicitly involve the question of accuracy in person perception: Did the perceiver accurately decode the sender's messages? The study of IPA refers to a perceiver's ability to accurately decode senders' emotion states, personality traits, or other social characteristics. The list of traits, states, and characteristics studied in the IPA field is potentially endless, but researchers have focused on recognizing emotions; judging personality; distinguishing lies from truth; and, less often, identifying group memberships (such as religion), sexual orientation, physical states, psychopathology, relationship or kinship status, and dominance or social status, to name a few (Hall et al. 2016b). Most IPA studies involve zero-acquaintanceship paradigms, where individuals form first impressions of strangers (Kenny & West 2008). The research described below concerns stranger judgments, although IPA based on NVC is clearly relevant to, and has been measured in, interactions between acquainted pairs (e.g., friends or romantic partners).

Interpersonal accuracy measures. The standard measures of IPA are those with established psychometric properties and demonstrated reliability and validity. A typical standard test of IPA in emotion recognition involves a perceiver making judgments about senders' discrete emotional expressions. For example, Schlegel et al. (2014) developed the Geneva Emotion Recognition Test (GERT) using short video clips (1–4 s) of actors expressing various emotions. The selected actor clips were culled from a corpus of videos and were chosen via rigorous reliability and validity procedures. Perceivers watch clips and judge which of 14 discrete emotions is being expressed in each. These perceiver judgments are then compared to the actors' intentions (the criterion for scoring accuracy). Another example is the Diagnostic Analysis of NonVerbal Accuracy 2–Adult Faces test (DANVA2-AF; Nowicki & Duke 2001), in which perceivers judge emotional expressions appearing in facial photographs.

Standard IPA measures extend beyond recognizing basic emotions; other standard IPA tests ask perceivers to judge various social situations and affective states. For example, in the Reading the Mind in the Eyes test, perceivers judge the emotional or mental state of a person based only on pictures of the eyes that have been cropped from facial photographs (Baron-Cohen et al. 2001). This measure has been used extensively to assess social functioning of various populations, including individuals with schizophrenia and autism spectrum disorder (Gökçen et al. 2016).

In contrast to standard IPA measures, nonstandard IPA tests are typically developed for a specific study or construct, and they may not have documented reliability or validity properties (Hall et al. 2008). For example, to test whether perceivers could distinguish between spontaneous and posed smiles, senders were videotaped under various conditions, and their smiles were judged by perceiver participants (Murphy et al. 2010). The perceivers' judgments were then scored on the IPA ability to discriminate between spontaneous and posed smiles; this IPA measure was developed for that particular study and has not been used again. Nonstandard IPA measures abound in the literature, and researchers have used nonstandard IPA measures to assess anything from accuracy in perceiving rapport between interaction partners (Bernieri et al. 1996) to mind-reading abilities (Realo et al. 2003).

Empathic accuracy is a term referring to the ability to accurately infer others' spontaneously experienced thoughts and feelings, typically after having a live interaction with the target person (Hodges et al. 2015, Ickes 2016). After the interaction, each party reviews the video, pausing it

whenever they remember having a particular thought or feeling. One or both of the dyad members view the video and infer the thoughts or feelings of their partner at those particular time points. Accuracy is the match between what the partner self-reported experiencing at that time and what the perceiver thinks their partner was experiencing then. Lower empathic accuracy (as well as lower performance on many other IPA measures) is associated with social adjustment problems and poor mental health, including depression (Gadassi et al. 2011), although authors caution that there are many moderators to empathic accuracy outcomes (Hodges et al. 2015).

Although the empathic accuracy paradigm can be applied to new perceivers watching a video, its hallmark feature is its in vivo, dyadic nature. Many other variations of the in vivo method have been used; for example, one person's ratings of a partner's emotions can be compared to the partner's self-ratings (Côté et al. 2011). When considering this method, authors need to acknowledge the full confounding of one person's perception with the other person's expression. Accurate judgment in a dyadic interaction is a joint outcome of the extent to which one person is perceptive in reading the other's cues and the extent to which the other person's cues afford accurate judgment (good information in the Realistic Accuracy Model; Funder 1999); it is therefore a dyadic score and not one that can be attributable to any one single individual. Disambiguation of sending from receiving is possible but requires additional features in the methodology, such as analysis of videotapes (Hall et al. 2006) or a round-robin design (Back & Kenny 2010).

Thin slices. Many IPA measures use a thin-slice methodology. The term thin slices refers to short excerpts of dynamic stimuli, such as a brief video or audio clip of sender behavior (Ambady 2010); sometimes, photo stimuli are also referred to as thin slices. NVB expressed within a thin slice may validly predict social outcomes, for instance, company profits predicted from perceivers' ratings of their CEOs' faces (Rule & Tskhay 2014). Determining causal (or noncausal) mechanisms in such prediction studies remains a challenge for researchers. Thin slices are also used in many IPA measures, most often to measure emotion judgments, but thin-slice methodology has also been used to demonstrate accuracy in perceiving many other characteristics. From a methodological perspective, thin slices reliably represent relative amounts of specific NVBs expressed during an interaction; that is, slices of a particular behavior were predictive of that same behavior in other slices (Murphy et al. 2015). While the validity and reliability of the thin-slice methodology may depend on the particular behavior and context from which the slice was extracted, studies of the thin-slice methodology suggest that thin slices may reliably and validly measure specific NVBs and predict a wide range of outcome variables (Murphy et al. 2015, 2018).

Additional Considerations in Understanding Interpersonal Accuracy

Other factors that may influence IPA include perceiver gender, perceiver motivation, and training. Research typically demonstrates that women tend to outperform men on an array of IPA measures, with the largest body of relevant research pertaining to the judgment of emotions. Some exceptions also depend on the specific measure or the qualities being judged. Gender differences in IPA may arise due to evolutionary, motivational, or gender socialization processes (Hall et al. 2016a).

IPA researchers have also investigated the effects of increased or decreased motivation on perceiver accuracy, with inconsistent results (Biesanz & Human 2010, Hall et al. 2009b). The effects of increased or decreased motivation on IPA are likely moderated by many factors, such as the specific IPA test (including its difficulty), relationship factors, and the content and valence of the motivational inducement (Schmid 2016).

As discussed above, both distal and proximal effects are no doubt operative. The same construct may even operate at both levels. To continue with motivation as an example, the motivation to be

accurate on a particular test during a particular test administration (a proximal time factor) may operate independently from lifetime motivation to be a good judge of other people. In turn, being a good judge may impact one's trait accuracy via repeated past experiences of careful attention to cues, efforts to get feedback on one's judgments, one's responses to feedback, and so forth. Over time, these experiences may result in better knowledge of the meanings of cues and better strategies for judgment (distal time factors). The motivational processes operating in a given testing occasion might be very different: Motivation that is activated during IPA testing could affect attentional processes (for example) but not how much knowledge one has accumulated about the meanings of nonverbal cues. Proximal and distal determinants of IPA could be independent or even interactive (e.g., a proximal influence such as high motivation in the moment might be operative only for individuals who already possess high trait or knowledge-based accuracy; K. Ogawa & J.A. Hall, unpublished manuscript). Research does show a positive relationship between knowledge about cues and performance on an audiovisual IPA test (e.g., Schlegel & Scherer 2018).

Training perceivers to improve their IPA is effective across clinical and nonclinical populations. A meta-analysis confirmed that a combination of feedback and practice helps improve IPA performance (Blanch-Hartigan et al. 2012). Improvements in emotion recognition have been found after training with a self-administered program of instruction, practice, and feedback that takes less than an hour (Schlegel et al. 2017b). In that research, the benefits of training lasted several weeks and also generalized across several different IPA tests. The ability to experimentally intervene in participants' IPA is a significant breakthrough in researchers' ability to design studies to determine the causal impact of IPA on social and personal outcomes.

In this review, we mostly consider correlates of IPA, but important questions remain about understanding mean levels of IPA. Authors commonly report that perceivers are accurate when what they are referring to is accuracy that is statistically significant above the guessing or chance level. Sometimes levels of accuracy are not impressively high even when they are statistically significant (for example, in lie detection; Bond & DePaulo 2006). Yet even levels barely above chance can be impressive if the stimuli are extremely brief or degraded. Furthermore, the various IPA measurement approaches and scoring methodologies create difficulties in comparing across tests or across types of accuracy (Hall et al. 2008). For example, emotion judgment tasks are typically scored as percent accuracy, while personality judgment tasks are often scored as correlation coefficients; furthermore, even tests scored as percent accuracy cannot be compared directly if the guessing level within the test (as determined by the number of response options) varies from test to test. Various statistical conversions allow comparisons between tests and scoring methods, but until there is widespread adoption of such calculations, readers may be left wondering how an accuracy score of $r = 0.38$ in judging intelligence compares to a 55% accuracy score in judging leadership ability.

IPA measures tend to be correlated with other favorable social traits. A meta-analysis of IPA and psychosocial variables showed that higher IPA significantly correlated with more conscientiousness, less neuroticism, and more tolerance (Hall et al. 2009a), among other traits. Also, a meta-analysis showed that IPA measures themselves tend to correlate with one another at only modest levels; given these modest effect sizes, there remain questions about what, precisely, is being measured in IPA tests (Schlegel et al. 2017a). More specifically, is IPA one underlying construct that unites accuracy in judging domains ranging from emotion recognition, to personality traits, to judgments of political orientation? Or are various IPA measures assessing distinct skills? To date, it appears that measures of emotion recognition form a more coherent latent construct than do tests measuring other content, perhaps due to better psychometric properties and more homogeneity of content in tests measuring emotion perception.

Furthermore, while we may know a lot about constructs related to IPA, there is no consistent tradition of exploring the predictive value of IPA. Correlational evidence suggests the likelihood

that IPA does impact social outcomes, although causality remains to be determined. Behavioral adaptability, which is the ability to adapt one's behaviors to the needs and preferences of an interaction partner, has been suggested as a possible mechanism to explain why IPA may relate to positive behavioral outcomes (Schmid Mast & Hall 2018).

FUTURE DIRECTIONS AND CONCLUSIONS

Technology

Technology has always been crucial to the development of the NVC field. Photography and, later, audio and video recording allowed researchers to capture behavior for analysis. Behaviors that have been difficult for human observers to code can now be supplemented by additional technologies; for example, eye tracking is used to document what parts of stimuli, or which stimuli, are attended to. The newest frontier in technology is automated and computer-assisted measurement. Because coding nonverbal behavior with human observers is laborious (even with the efficiencies resulting from the use of thin slices), computerized methods of measurement have great appeal. With computer assistance, coders can enter their observations with automatic time stamps, enabling easy measurement of both frequency and duration and allowing for exact coordination among behaviors over time, both within and between interactants. Some sophisticated methods such as machine learning still require human coders or strong normative knowledge for establishing the training parameters. Measurement that is entirely automated may eliminate human coders, but such tools present new challenges, including equipment costs, better extraction for some kinds of behavior than for others, the need for expert consultants, and constraints on the nature of the stimuli to be analyzed (e.g., camera or head angles, lighting, background noise) (Schmid Mast et al. 2015).

Aside from these pragmatic considerations, there are also theoretical issues involved in a choice of measurement methodology. Automated measurement has strong appeal for its accuracy and granularity, yet it does not necessarily serve the theoretical interests of researchers. That is because measuring a behavior is not the same as understanding its meaning or function. Human observers remain crucial for making both mid-level and high-level inferences. As an example, the automated system might quantify foot, hand, and finger movements (frequency, duration, acceleration, articulation, direction, location), while an observer might rate fidgetiness (a mid-level behavior impression made after watching all of these movements), and yet another observer might rate deceptiveness, anxiety, or impatience (a high-level impression that could be based on the inference of fidgetiness along with other cues). Researchers must decide what level of inference best serves their research goals: pure description, some integration, or a high degree of inference. With sufficient resources, one could measure behavior at all three levels.

Another interface of NVC with technology is in affective computing, the field concerned with computer systems that can detect and label human affective expressions or effectively simulate them, as in avatars, animations, and robots (Calvo et al. 2015, Daily et al. 2017). One particularly relevant strand of this research and technology development involves the animation and recognition of emotional expressions on the face (Bartlett et al. 2011, Krumhuber et al. 2012).

Neuroscience

How does nonverbal behavior reflect and impact the brain and peripheral nervous system? One area of study concerns empathy as it is manifested in neural activity, interpersonal judgment, and NVB (Christov-Moore & Iacoboni 2015, Klimecki & Singer 2013). One line of research shows that reacting to others' emotion cues can involve different neural pathways representing

emotional resonance (mirroring) and mental states attribution (mentalizing) (Doré et al. 2015, Zaki et al. 2009). Another developing line of research is in the study of neurological and physiological processes that co-occur between people in interaction (Babiloni & Astolfi 2014, Finset 2014). Understanding the interconnections between brain activity, including activation of mirror neurons, and interpersonal mimicry or synchrony, emotional contagion, interpersonal accuracy, and other interpersonal phenomena will continue to be an important goal.

General Conclusions

Despite a wealth of accumulated understanding of NVC, there are noticeable gaps in the literature. With regard to encoding NVC, a challenge is to go beyond simply studying cues in isolation to understand how cues operate in concert and over time, reflect meaning and intention, and exert their impact. With regard to IPA, little is definitely known about the antecedents of this ability, including the nature of the life experiences that might make a person more or less accurate, the relative contributions of accuracy motivation and declarative knowledge about the meanings and usages of NVC, and the role of interpersonal mimicry and other proximal (situational) factors in the judgment of others' emotion cues. As alluded to above, the IPA field consists overwhelmingly of correlational studies where causal mechanisms and causality itself have rarely been determined. Thus, although there are many results that can be seen as outcomes of having this ability (e.g., among clinicians and in workplaces and relationships), the causal nature of these pathways is not known, nor are the mediating behaviors that may account for such effects (Schmid Mast & Hall 2018).

We have come far, but controversies and mysteries (old and new) still enliven researchers. These include debate over universality versus cultural specificity of NVC (in both its occurrence and its meaning) and the balance of conscious and nonconscious processes in encoding and decoding. The study of the impact of social media and digital devices on people's NVC skills is in its infancy. Questions about how technology might affect rising generations could have profound implications for the processes described in **Figure 1** and for the NVC field as a whole.

The interdisciplinary nature of NVC makes it an exciting domain across many areas of psychology and other disciplines. We remain enthusiastic about the growing interest in NVC and its implications for social interaction, and we look forward to learning more as NVC research continues to expand.

SUMMARY POINTS

1. With roots in communication studies and psychology, the study of NVC is an interdisciplinary topic that is applicable across many domains, including medicine, business, and criminal justice, as well as everyday social life.
2. Nonverbal cues convey a wide range of interpersonal and social information, including individual identity, biological sex and gender, affect, interpersonal attitudes, and social and developmental attributes.
3. Many NVBs do not have fixed meanings, but instead must be interpreted in light of co-occurring verbal behavior, other nonverbal cues, and situational and social factors.
4. Individuals can accurately perceive a variety of social and personal attributes, such as personality and affective states, from nonverbal cues.
5. Both encoded NVC and IPA have many correlates, including personality traits, emotional states, social and other skills, social attributes, and interpersonal outcomes.

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