blinking. When the eye is irritated by a foreign body, such as grit or a fly, we blink to remove it. This is a *reflex, and there is also reflex closing of the eyes to prevent damage when we sneeze; but everyday blinking is not a reflex activity. A reflex needs an initiating signal; but if, for example, the eyes had to dry up to initiate blink signals, the blink would follow the beginnings of damage, due to the eyes drying, but it would be too late to protect the delicate corneas with a film of tears.

Normal blinking is given by signals initiating in the brain, probably from the *basal ganglia. Rather surprisingly, the rate of blinking is a useful index of general attention, as it tends to increase markedly when anticipating *stress, and it falls below the normal rate during periods of high concentration. This is possibly related to its early use in conditions such as hunting, when the eye needs to be cleared and the fluid on the cornea smoothed out for maximum visual acuity. During a prolonged task, however, the eyes need to remain open for long periods. Blinking can then be so reduced that damage may result as the eyes dry. This is a hazard in some occupations: draughtsmen, for example, are apt to suffer from inflammation of the eyes, and over time from clinical problems with their corneas if they continue to concentrate for prolonged periods without blinking.

It is interesting that the rate of blinking is similarly affected by non-visual tasks. Most curiously, we are not normally aware of blinking, though the eyes are closed every few seconds. One might have thought that blinking would occur in one eye at a time so that we are not intermittently blinded, but it turns out that this seldom matters, as blinking is normally inhibited just prior to important anticipated events. It has been suggested that people having unusually high blink rates may be unsuitable as pilots, or be dangerous drivers, but experiments have shown that high individual blink rates are not a significant hazard for skills where short-term prediction of dangerous events is possible. RLG

Ponder, E., and Kennedy, W. P. (1928). 'On the act of blinking'. *Quarterly Journal of Experimental Physiology*, 18.

Poulton, E. C. and Gregory, R. L. (1952). 'Blinking during visual tracking'. *Quarterly Journal of Experimental Psychology*, 4.

blushing. Uncontrollable reddening of the cheeks, and sometimes the ears and neck, is associated with embarrassment and guilt. Charles *Darwin made the most interesting suggestion: that blushing is a warning that the individual who is blushing is not to be trusted, as he or she has violated the mores of the group or has committed some crime. This notion that blushing is a visible warning sign that an individual is not to be trusted Darwin puts forward in *Expression of the Emotions in Man and Animals* (1872). Part of his evidence is that children before the age of understanding social rules do not blush, for 'the mental powers of infants are not yet sufficiently developed to allow of their blushing. Hence, also, it is that idiots rarely blush.' Blushing (and also weeping and sobbing) is found only in man and not in other primates, who are generally supposed (in spite of some recent contrary evidence) not to have cognitive understanding of social mores or their violation. This is not to say that only humans have social mores, only that we alone appreciate and evaluate them, and act on our assessments of social situations, and monitor our successes and failures and the appropriateness of our behaviour in situations that had no precedence earlier in evolution. It seems that only humans have the understanding to be embarrassed—and so to blush.

For Darwin 'blushing is the most peculiar and the most human of all expressions'. He goes on to suggest a psychosomatic origin: 'we cannot cause a blush by any physical means. . . . It is the mind which must be affected.' But this is not the *conscious* mind, for (writing nearly twenty years before Sigmund *Freud was born) Darwin points out that blushing is not under control and that, further: 'Blushing is not only involuntary; but the wish to restrain it, by leading to self-attention, actually increases the tendency.' That it is an innate sign of mental states is confirmed by blushing in blind people.

Women blush more than men. Darwin wished to discover how far down the body blushes extend, so he adopted the ingenious notion of asking his medical friends 'who necessarily had frequent opportunities for observation'. His friend Sir James Paget (1814–99, who wrote the standard texts, *Lectures on Surgical Pathology* and *Clinical Lectures*) reported that: 'with women who blush intensely on the face, ears, nape of the neck, the blush does not commonly extend any lower down the body'. He never saw an instance in which it extended below the upper part of the chest. Darwin considers whether it is the exposure of the face to temperature changes that makes the capillaries specially labile; but decides, rather, that the face is intimately associated with the brain and that the blushing is primarily facial, at least in English women, because of the 'attention of the mind having been directed more

frequently and earnestly to the face than any other part of the body'.

What we would now call the psychosomatic basis of blushing was pondered in astonishing depth by Darwin, as he considered that its mental effects may be *reversible*. He refers to the observation that when patients are given nitrite of amyl they blush in the same restricted regions as with embarrassment. 'The patients are at first pleasantly stimulated but, as the flushing increases, they become confused and bewildered. One woman to whom the vapour had been administered asserted that, as soon as she grew hot, she grew *muddled*.' Although all this was said well over a century ago there is little to add now, apart from its detailed physiology, to Darwin's comments on blushing. RLG

body language. The traditional theory of body language, originating with *Wundt in 1921, is that it is quite separate from verbal language in terms of both form and function. This theory holds that verbal language in the form of words and sentences is used primarily to convey factual or semantic information about the world whereas body language, in the form of facial expression, eye gaze, posture, gesture, head movement, and foot movement, is used to convey information about emotional states and to communicate information about interpersonal attitudes, crucial to the formation and maintenance of interpersonal relationships. Verbal language articulates thought; body language, on the other hand, communicates emotion and especially about relationships. Intuitively this latter proposition makes some sense. One advantage of interpersonal matters being dealt with non-verbally, is that the expression of such attitudes can be kept vague and flexible. According to Michael Argyle (1972), 'People need not reveal clearly nor commit themselves to what they think about each other.' Once we start using language to communicate our attitudes to another person then we are publicly committed to what we have said and therefore accountable. 'You said that you loved me' would be a perfectly reasonable retort. 'You acted like you loved me, there was just something momentary in your eyes' is much weaker somehow. Clearly body language has some advantages when it comes to the communication of emotion and interpersonal attitudes.

The anthropologist Gregory Bateson (1968) highlighted another possible advantage of using body language to communicate interpersonal attitudes when he wrote that 'It seems that the discourse of nonverbal communication is precisely concerned with matters of relationship. . . . From an adaptive point of view, it is therefore important that this discourse be carried on by techniques which are relatively unconscious and only imperfectly subject to voluntary control.' He implied that it was unconscious body language that was primarily involved in these 'matters of relationship'. We can all say 'I love you', some rather too easily; it is quite a different matter to fake love non-verbally, or so Gregory Bateson seemed to think.

This is the traditional theory of body language, partly based on reasoning of the sort that we have just outlined but partly based on a set of core studies by Mehrabian in the 1960s and Argyle in the 1970s, which compare the impact of body language to verbal language in the communication of interpersonal attitudes. The problem with these seminal studies is that they are all flawed in one way or another (see Beattie 2003). They all apparently demonstrate that, in the communication of interpersonal attitudes, body language is much more powerful than verbal language, with the facial channel alone estimated to be more than five times as powerful as the verbal channel. These studies were all based around a simple paradigm, the construction of consistent or inconsistent verbal language/body language combinations that were rated by participants. But the problem with these studies is that they underestimate the power of language in the expression of interpersonal attitudes. Mehrabian restricted his analysis to individual words such as 'honey', 'maybe', and 'brute'. But the problem is that no one talks in individual words in the real world if they can help it. Michael Argyle used sentences in his studies but these were extremely explicit and therefore rather unreal sentences, which failed to take into account the great subtlety of language for the communication of interpersonal attitudes in everyday life. So how might verbal language be used to convey interpersonal attitudes? Opening up a conversation, the use of first names, compliments, disclosure, reciprocated disclosure, the asking of personal questions, verbal engagement, shared perspectives, the sharing of childhood memories, offers of help, offers of support are all likely to play some vital role in such communication. Language is almost certainly as crucial to conveying interpersonal attitudes as body language and classic studies, which suggest otherwise, are themselves fundamentally flawed.

But some psychologists have argued that the other half of the traditional theory about language and body language is also incorrect, namely that half which states that only verbal language conveys factual or semantic information. Wundt, the originator of the traditional theory, wrote in 1921 that 'the primary cause of natural gestures does not lie in the motivation to communicate a concept, but rather in the expression of an emotion'. But consider the following extract produced when a participant was narrating a cartoon story:

'she [chases him out again]'
Hand, gripping an object, swings from left to right.

McNeill (1992) pointed out that the speech conveys pursuit and repetition but does not indicate the weapon (an

umbrella)—the iconic gesture (the spontaneous hand movement accompanying the speech) conveys this. McNeill emphasized that the sentence is well formed and not in need of repair and that the gesture (whose start point and end point are indicated by the square brackets) is perfectly temporally coordinated with the speech, and therefore the speech and gesture are generated by the brain at exactly the same time. Gesture and speech, McNeill concluded, cooperate to present 'a single cognitive representation' and to get the complete message you need both speech and gesture. This division of meaning between speech and iconic gesture generalizes across different languages. In fact, differences in iconic gesture use in different cultures are relatively trivial compared to the underlying similarities in their use. There are also striking similarities in the form of iconic gestures used to represent core semantic dimensions in different languages (see Beattie 2003).

Other psychologists have recognized that iconic gestures are common in speech but claim that they are too 'imprecise and unreliable' to be of any value in the communication of meaning (Krauss, Morrel-Samuels, and Colasante 1991) on the basis that individuals find it quite difficult to match gestures with the speech they accompany. However, Beattie and Shovelton (1999, 2001) argued that this is the wrong way of investigating the possible communicational function of these gestures. They maintained that if gestures are designed to communicate then they should provide critical information about the semantic domain to be encoded, the world out there or that part of it involved in the experiment, rather than about the accompanying speech.

Beattie and Shovelton video recorded participants narrating cartoon stories and then played just the speech segments or the gesture–speech combinations to another set of participants who were questioned about the original stories. They demonstrated that participants who received gesture–speech combinations recalled significantly more information than those who heard only the speech (60 per cent more specific information, 10 per cent in terms of overall message). The extra information included the speed and direction of the action, whether or not the action involved rotation or upward movement, and the relative position, size, and shape of the people and objects depicted, among other things. This research suggests that the iconic gestures that accompany talk are highly communicative and convey particular semantic aspects of a message. The fact that people gesture on the telephone (but less frequently on the telephone or on an intercom than in face-to-face communication, see Cohen and Harrison 1973) does not disprove this theory. People gesture when they speak, but the brain mechanisms that mediate gesturing are far older than mechanical artefacts like the telephone—on the telephone they simply cannot inhibit this natural and primitive form of communication.

In conclusion, body language is not separate functionally from verbal language in the way that Wundt, the founder of modern psychology, thought. They both work together to communicate interpersonal relationships and both work together to convey semantic information. However, although some forms of body language like iconic gesture do communicate semantic information they do so in a different fashion from verbal language. Speakers spontaneously create images for the listener with their hands, but unlike verbal language, they do not use a pre-selected lexicon of individual items to do this. It has been argued that in some forms of body language one can see the unconstrained human mind in action, working alongside verbal language to communicate meaning in its own unique way, in everyday talk. GB/HKS

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