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REVIEWS

Review

Smiles as Multipurpose Social Signals

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The human smile is highly variable in both its form and the social contexts in which it is displayed. A social-functional account identifies three distinct smile expressions defined in terms of their effects on the perceiver: reward smiles reinforce desired behavior; affiliation smiles invite and maintain social bonds; and dominance smiles manage hierarchical relationships. Mathematical modeling uncovers the appearance of the smiles, and both human and Bayesian classifiers validate these distinctions. New findings link laughter to reward, affiliation, and dominance, and research suggests that these functions of smiles are recognized across cultures. Taken together, this evidence suggests that the smile can be productively investigated according to how it assists the smiler in meeting the challenges and opportunities inherent in human social living.

Why Study the Smile?

The human smile is a potent social tool. Smiles grab perceivers' attention [1,2], influence their brain activity [3–5], and affect their inferences about the person expressing the smile (the encoder; [5–7]). Extant research across topics as wide-ranging as close relationships [8], group decision making [9], and negotiation [10] demonstrates that smiles can also affect the behavior of the perceiver. For example, in the absence of further information, individuals are more likely to trust a smiling stranger [11–13] and select a less personally advantageous outcome when it is delivered with a smile [14,15].

Given the ubiquity of smiles in social interaction, as well as their power to regulate the behavior of observers, it is critical that affective and cognitive science be guided by a principled account of the form and function of this facial expression. The present review develops an integrative framework for advancing the science of smiles.

Current Approaches to Classifying Smiles

The contraction of a single muscle, the ***zygomaticus major*** (see Glossary), is sufficient to qualify a facial expression as a smile [16]. But although every smile includes this essential movement, the expression can vary along many other dimensions [17]. Perhaps more than any other facial display, smiles vary in temporal dynamics [11,18,19], accompanying emotional states [20,21], and corresponding contexts [22]. In light of this variability, a number of attempts have been made to partition the smile into theoretically productive categories, with some researchers proposing two [23], and others upwards of 50, distinct smile expressions [24].

One approach distinguishes between smiles that are due to (and accurately reflect) underlying positive affect – called true or genuine smiles – and those that do not – called false or fake smiles (see Box 1 for a historical overview [16]). The so-called **Duchenne marker** – the appearance of 'crow's feet' around the eyes – has been most often used as a morphological indicator of 'true'

Trends

Smiles are highly variable across a number of dimensions. Predominant approaches to smile categorization do not sufficiently explain this variability. Their ubiquity and social impact make smiles a critical topic for affective and cognitive science.

A social-functional analysis, categorizing smiles by how they resolve the challenges and opportunities required by social living, suggests three types of smiles: reward smiles that reinforce desired behavior; affiliation smiles that form and maintain social bonds; and dominance smiles that manage social hierarchies.

Recent evidence supports this typology: distinct morphological features communicate each functional intent and motivations to smile are predictably variable across culture based on factors related to the salient social tasks in a given culture.

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Box 1. Brief History of 'True' and 'False' Smiles

Where did the concept of a 'false' smile come from? Duchenne claimed that the contraction of the **orbicularis oculi**, creating 'crow's feet' in a smile 'does not obey the will; it is brought into play by a true feeling, by an agreeable emotion (Figure I). Its inertia, in smiling, unmasks a false friend' [25]. Subsequently, Ekman and Friesen, typically credited for re-popularizing Duchenne's early observations, theorized about two kinds of smiles that do not accompany positive emotion: (i) phony smiles that occur without any particular underlying feeling at all; and (ii) masking smiles that are produced intentionally in order to conceal negative emotions with the appearance of positivity [16]. The same researchers conducted empirical investigations of masking smiles: nursing students were filmed as they watched a pleasant video and then as they intentionally covered with smiles their reactions to a negative film showing amputations and burns [103]. 'True' smiles (of felt positive affect, i.e., Duchenne smiles) were defined as expressions that contained both zygomaticus major and orbicularis occuli activation, and masking smiles as expressions containing the contraction of zygomaticus major plus facial actions associated with any of five negative emotions. Masking smiles were more frequently displayed during the viewing of the negative film. Research using methods of electroencephalography also showed that, in both infants [55] and adults [104], the production of 'true' smiles – compared to other smiles containing zygomaticus major, but not orbicularis occuli activity – is accompanied by more left- than right-sided hemispheric activation, which is thought to be an indicator of positive affect.

Since publication of this seminal work, studies of 'true' and 'false' smiles have for the most part contrasted expressions elicited by amusing stimuli with smiles intentionally posed for a camera – often with no or unspecified instructions [14,105]. Thus, rather than 'true' and masking smiles, most studies focus on 'true' and 'phony' smiles, with an emphasis on the presence versus absence of the Duchenne marker (Figure I). In addition, perceivers' understanding of the smile meaning (i.e., critical dependent variable) has been limited largely to judgments of whether or not the smiler is experiencing genuine positive emotion [106]. Participants' judgments of other underlying states have thus been inadvertently underrepresented.

Figure I. Examples of Duchenne (left) and Non-Duchenne Smiles. Contraction of the orbicularis occuli is absent in the non-Duchenne expression (right).

Glossary

Autonomic nervous system (ANS): controls many relatively automatic biological processes (e.g., sweating). It is classically divided into two branches, the sympathetic (fight and flight) and parasympathetic (rest and digest) nervous system. ANS measures are frequently collected in emotion science largely because they are thought to be involved in emotion-related biological processes over which we have limited conscious control [126].

Duchenne marker: First documented by Guillaume-Benjamin Duchenne de Boulogne [25], the Duchenne marker refers to the visible 'crow's feet' around the eyes resulting from the contraction of the orbicularis oculi, or eye sphincter muscle.

Historical homogeneity: nation-level variable that quantifies the number of source countries that have contributed to a present-day population over the last 500 years [95]. Nations with high historical heterogeneity scores, like the US and Brazil, derived their populations from extensive and diverse long-history immigration trends, while homogeneous populations like those of Norway and Japan have been relatively stable.

Orbicularis oculi: muscle responsible for opening and closing the eyelids, the orbicularis oculi is under both voluntary and involuntary control [127].

Social-functional theories of emotion: inspired by ethological and evolutionary approaches to psychology, social-functional theories of emotion argue that emotions – and associated facial expressions, body states, etc. – aid the individual in solving social challenges and opportunities. These challenges and opportunities occur at many levels of analysis, including within dyads and groups [42,43].

Zygomaticus major: connecting the check bone with the corners of the mouth, contraction of the zygomaticus major pulls the corners of the lips up and back [127], and is considered a necessary muscle in smile production.

smiles. Several classic studies have demonstrated that this feature is present when a smile spontaneously occurs during states of happiness and that it is lacking when a smile is encoded deliberately, especially in attempts to mask negative feelings [16,25].