

Guide

Facial Action Coding System (FACS)

Facial expressions reveal more than people realize. This guide explains how FACS turns those expressions into objective, reproducible data, and how automated analysis makes it accessible for your research.

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From observation to data

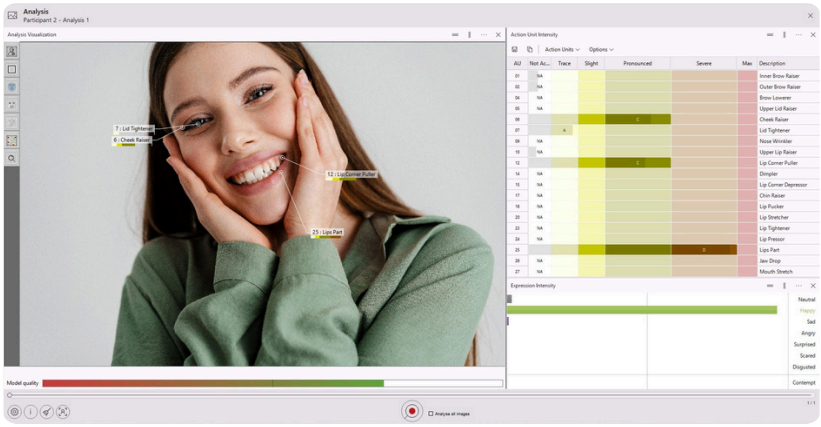
The face is full of information.
FACS makes it measurable.

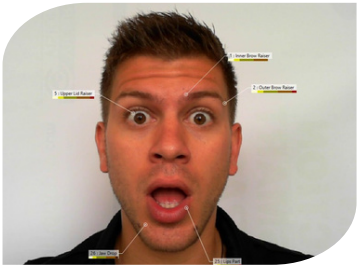
What the face reveals

The face is one of the most complex communication systems in nature. It signals emotion, intent, and cognition, often faster than conscious thought. The information is there. The question is how to measure it consistently.

That is exactly what the Facial Action Coding System (FACS) was built for. Developed from the pioneering work of Carl-Herman Hjortsjö and later refined by Paul Ekman and Wallace Friesen, FACS translates the movements of individual facial muscles into objective, quantifiable data.

This guide covers the foundations of FACS, how it is applied in research, and how FaceReader brings automated FACS analysis within reach for laboratories worldwide.





What is FACS ?

FACS does not label emotions. It describes muscle movements, objectively and without interpretation.

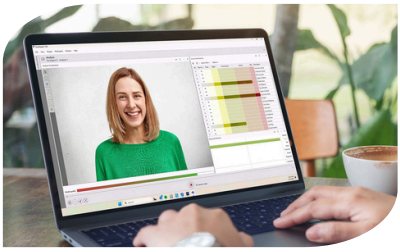
The anatomical foundation

Unlike self-report, FACS captures what the face does in the moment, not what participants remember or choose to share afterwards.

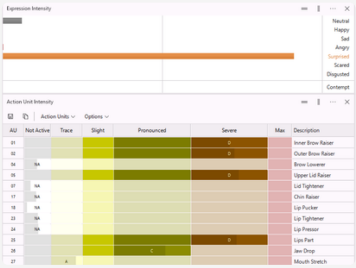
The system works by decomposing every expression into its component muscle movements, called Action Units (AUs). Rather than coding "this person looks surprised," a FACS coder or automated tool identifies which specific muscles moved, to what degree, and in what combination.

Twenty-eight main Action Units cover the face. Each maps to a defined muscle or muscle group. Each is scored on a five-point intensity scale from A (trace, barely visible) to E (maximum, the most extreme form of the movement).

This level of precision matters. Two expressions that look alike at first glance can involve different muscle combinations. FACS catches that difference. It also captures brief, subtle movements that are easy to miss by eye.



FACS does not interpret, it describes. Because AU coding is independent of any emotion label, researchers can choose the interpretation that fits their research question: basic emotions, custom expressions, or none at all.



Action Units and their combinations

Every expression is a combination. FACS identifies which ones.

The vocabulary of the face

A single Action Unit can be informative, but its meaning often becomes clearer in combination with others. AU1, the inner brow raiser, can mean many things on its own. Pair it with AU4 (brow lowerer) and AU15 (lip corner depressor), and the picture sharpens: this combination is typically associated with sadness rather than uncertainty.

FaceReader reads both sides of the face independently because symmetry itself carries information. Asymmetry can be informative, for example in contempt, which typically appears on one side of the face.

Emotions and their Action Unit combinations

The table below lists the Action Unit combinations most commonly associated with each emotion.

Emotion	Action Units	Description
Happiness	6 + 12	Cheek Raiser, Lip Corner Puller
Sadness	1 + 4 + 15	Inner Brow Raiser, Brow Lowerer, Lip Corner Depressor
Surprise	1 + 2 + 5 + 26	Inner Brow Raiser, Outer Brow Raiser, Upper Lid Raiser, Jaw Drop
Fear	1 + 2 + 4 + 5 + 7 + 20 + 26	Inner Brow Raiser, Outer Brow Raiser, Brow Lowerer, Upper Lid Raiser, Lid Tightener, Lip Stretcher, Jaw Drop
Anger	4 + 5 + 7 + 23	Brow Lowerer, Upper Lid Raiser, Lid Tightener, Lip Tightener
Disgust	9 + 15 + 17	Nose Wrinkler, Lip Corner Depressor, Chin Raiser
Contempt	12 + 14 (unilateral)	Lip Corner Puller, Dimpler

Prototypical Action Unit combinations according to EMFACS (Friesen & Ekman, 1983). Simplified for illustration. Contempt is not one of Ekman's original six basic emotions.



Three ways to score FACS

Manual, automated, or combined. The method you choose shapes what your research can deliver.

Finding the right fit for your research

Manual FACS coding is scientifically robust. It is also extraordinarily time-consuming, becoming proficient takes hundreds of hours, and coding a single session can take many times longer than the session itself. For small, controlled studies, that investment is feasible. For anything at scale, it creates a significant bottleneck.

Automated FACS analysis addresses that directly. Tools like FaceReader detect and classify Action Units frame by frame, consistently and without fatigue. The data is exportable, statistically ready, and produced at a fraction of the time cost of manual coding. Note that automated Action Unit detection works best with frontal, well-lit recordings. Accuracy can decrease with head rotation, partial occlusion (such as glasses or hands) and very subtle movements.
FaceReader's Action Unit detection reached an average accuracy of 92% on 213 annotated images. Read the validation white paper for all results.

Observational coding software like The Observer offers a third approach. It supports manual workflows when researcher-guided coding is needed, and allows FACS data to be combined with other data streams.

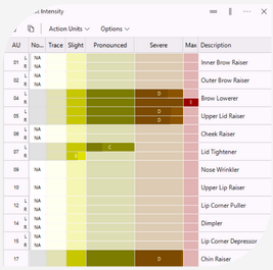
That said, the three methods are not mutually exclusive. Automated software handles large volumes reliably. Manual coding remains the gold standard for complex or ambiguous expressions. Observational coding software bridges both, allowing researchers to combine FACS output with behavioral observations and external data sources.



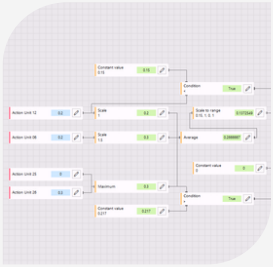
The right scoring method depends on what your study requires. If you are working with a small number of participants and need the highest possible level of detail, manual coding gives you that control. If your dataset is large, your timeline is real, or consistency across coders is a concern, automated analysis is the more practical choice.

Automated FACS analysis with FaceReader

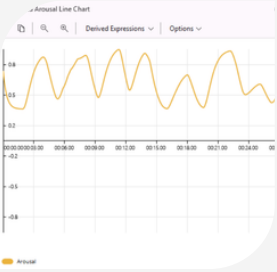
FaceReader brings FACS into your workflow without the manual overhead, making consistent, scalable facial expression analysis available to any lab.



FaceReader classifies 20 Action Units from video, frame by frame, analyzing both sides of the face separately and capturing asymmetries that matter. Intensity is reported on a five-point scale. Data exports as numerical values, compatible with standard analysis environments, and ready for further statistical processing.



The custom expressions function allows researchers to define combinations of Action Units that correspond to the specific states their research requires, whether that is pain, cognitive load, confusion, or a positive state like awe. The system recognizes what you define. Your research questions do not have to fit a pre-set emotional menu.



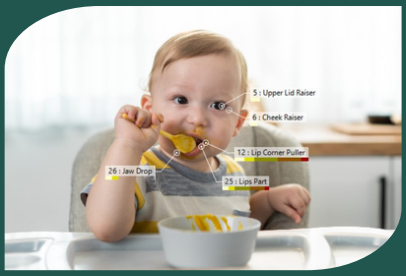
Arousal is also calculated within FaceReader, based on the activation of 20 AUs. It indicates whether a participant is in an active or inactive state, providing a continuous measure that complements discrete emotion classification.
This matters in studies where engagement, alertness, or stress are the variables of interest.

Special applications

Two research contexts where facial coding reveals what other methods miss.

Facial coding in early-life research

Infants cannot provide verbal feedback. That makes facial expressions particularly important as a research signal in early-life studies.



Baby FACS, developed by H. Oster, is an adaptation of the standard FACS for use with infants and young children. It accounts for the anatomical and developmental differences between infant and adult facial musculature. Baby FaceReader extends this to automated analysis, classifying facial expressions in infants aged six to 24 months.

Research applications include infant responses to taste and sensory stimuli, early emotion development, cognitive processing, and parent-child interaction. In pain research, Baby FACS provides objective data where self-report is not an option.

Distinguishing genuine smiles from social smiles

AU12, the lip corner puller, can mean many things on its own. Paired with AU6, the cheek raiser, it forms what is known as the Duchenne smile, named after the 19th-century researcher Guillaume Duchenne.

This combination is often associated with felt enjoyment and appears less often in polite smiles. FACS reliably captures whether AU6 is present, giving researchers a precise basis for studying different types of smiles.

Who uses FACS and for what?

From the clinic to the consumer lab: FACS across research contexts

Facial coding captures responses as they happen, sometimes before reflection occurs.
That is why it shows up across fields as different as developmental psychology, consumer behavior, and user experience.





Academic psychology

- Emotion regulation studies
- Social interaction research
- Micro-expression analysis

Neuroscience

- Cognitive load measurement
- Affective response mapping
- Arousal and alertness analysis





UX and human factors

- Interface interaction studies
- Operator stress and fatigue
- Real-time engagement data

Consumer behavior

- Product and packaging response
- Advertising effectiveness
- In-store environment testing





Child development

- Early emotion development
- Parent-child interaction
- Sensory response in infants

Autism research

- Social responsiveness coding
- Emotional signaling studies
- Naturalistic interaction data



Clinical research

- Pain assessment in patients
- Alzheimer & Parkinson studies
- Non-verbal response analysis

Across all these contexts, the underlying question is the same: how do you measure emotional responses reliably? Where self-report is not possible, facial coding offers a way in.

The studies in the next chapter show what that looks like in practice.

FACS in practice

These studies show what FACS-based facial expression analysis looks like in practice, across research contexts where objective emotional data made a measurable difference. What would your data show?

Brand authenticity and ad performance



Does brand authenticity affect how people respond to ads? Researchers used FaceReader to measure facial expressions during commercials, revealing that perceived authenticity shapes emotional response in measurable ways. Custom expressions made the difference visible.

Read →

Outdoor activities and emotions in preschoolers



Researchers used FaceReader to measure basic emotional states in preschoolers before and after outdoor activity sessions. FACS-based facial coding revealed significant reductions in sadness and disgust, and increased arousal and valence.

Read →

Facial coding in geriatric dental care



Can automated facial coding detect emotions in care-dependent older adults who cannot communicate verbally? Researchers used FaceReader to analyze Action Units in 50 patients, demonstrating its potential for non-invasive clinical assessment.

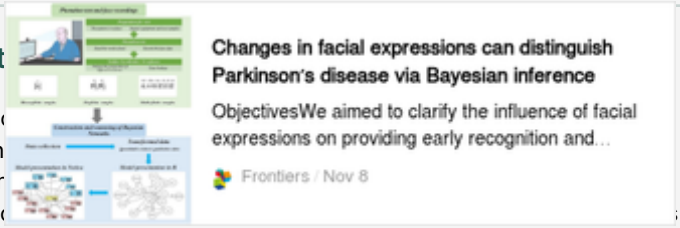
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Where to go from here

A few good places to start, depending on where you are.

See what



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website. Some images are zoomed in on the area of interest to explicitly show what muscle movement corresponds to each specific Action Unit. Worth a look if you want to see what the building blocks of facial expression actually look like in practice.

View the AUs →

Ready to take the next step?

If you have a specific research question and want to understand whether FACS-based analysis fits your design, the Noldus team works directly with researchers on exactly that.

Let's talk →

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