

MACHINE LEARNING FOR ARTISTS: ADDITIONAL LECTURE (WEEK SIX)

THE EXPRESSION OF EMOTIONS AS A CLASSIFICATION PROBLEM

Many artists, philosophers, and scientists have tried to understand the language of emotional expression.

A painter who conducted research on the human face was Charles Le Brun (1619-1690).

This is a portrait of Le Brun by another painter, Nicolas de Largilliere.



Le Brun was an artist and a teacher.

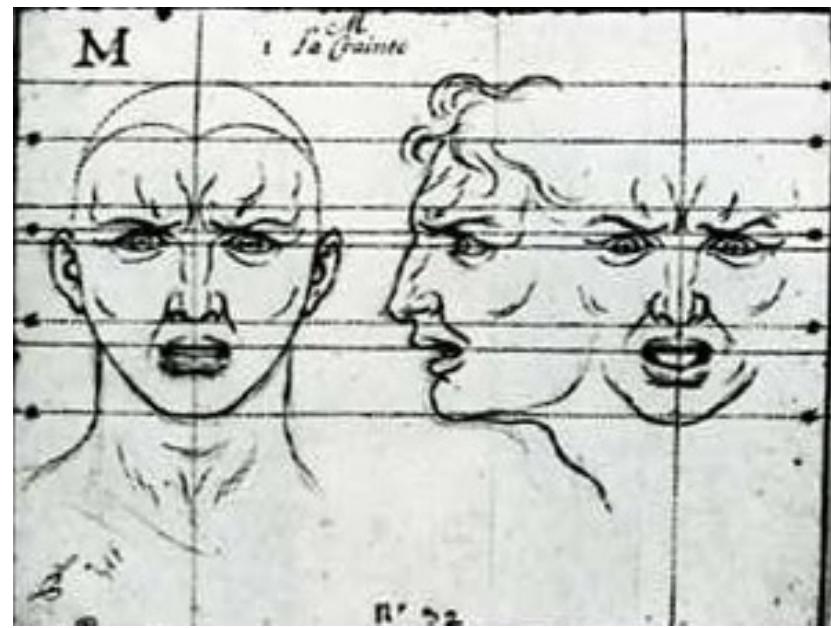
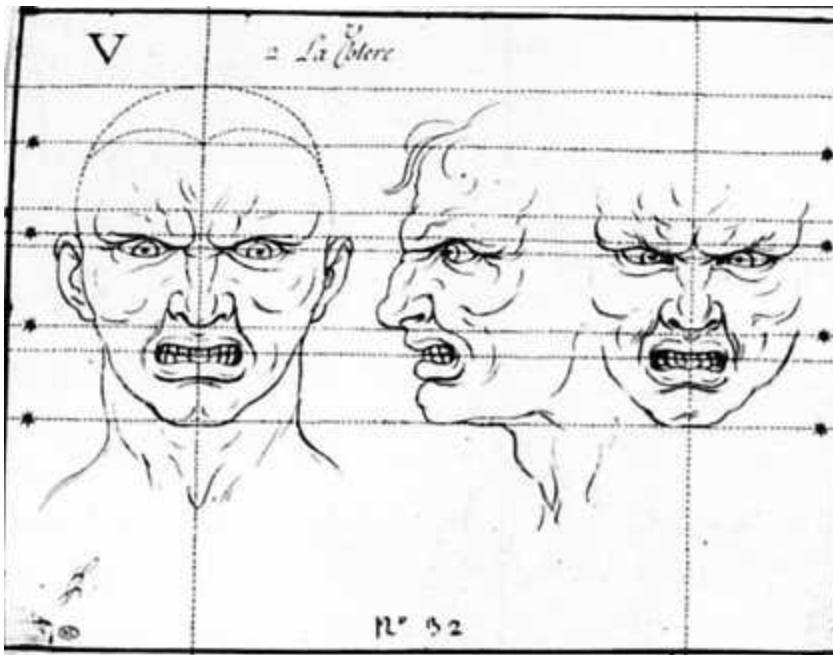
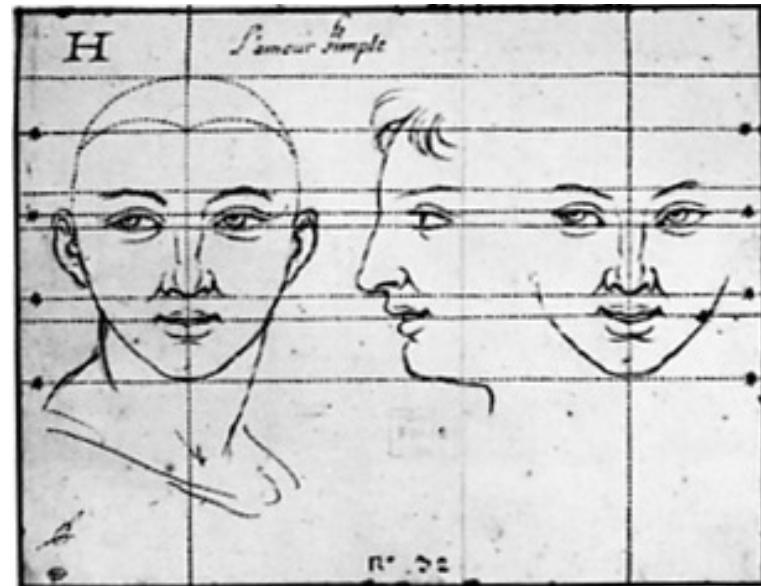
He aimed to help painters draw faces that would clearly express different emotions.

He developed a system for this purpose.

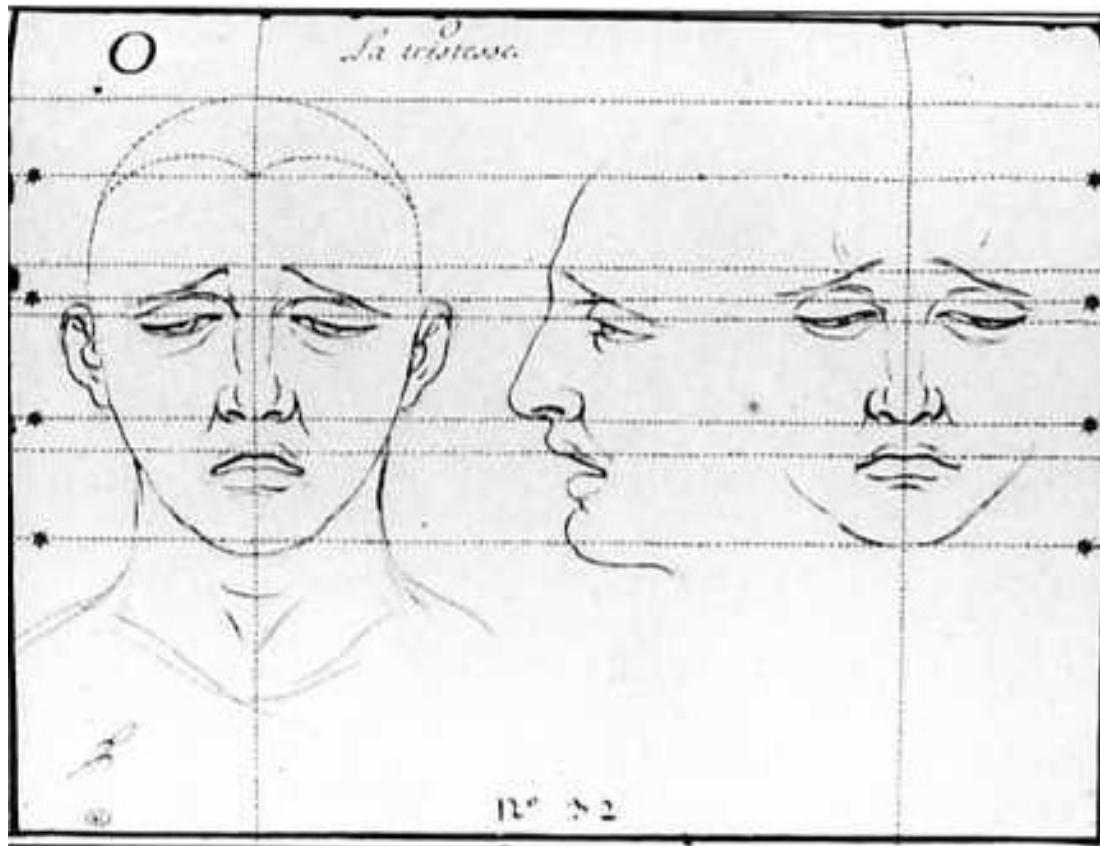


Emotions according to Le Brun (clockwise):

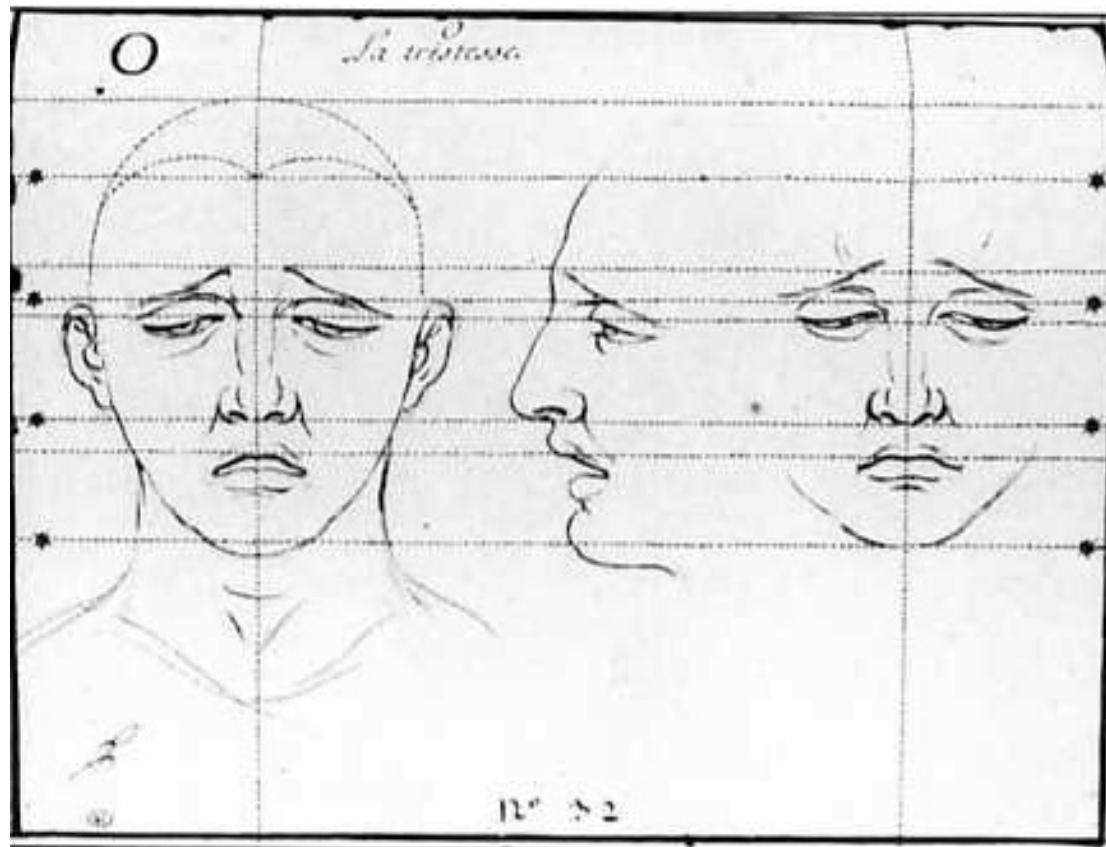
- simple love,
- fear,
- anger.



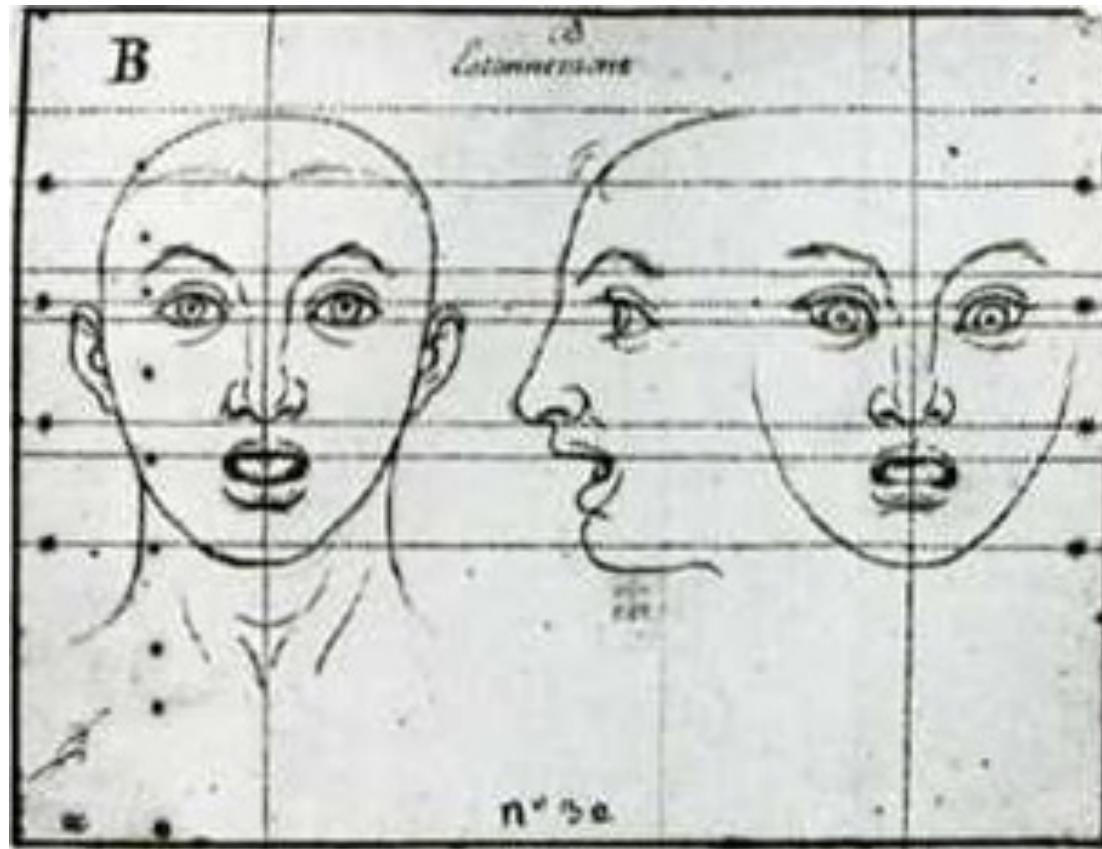
Which emotion do you think this is?



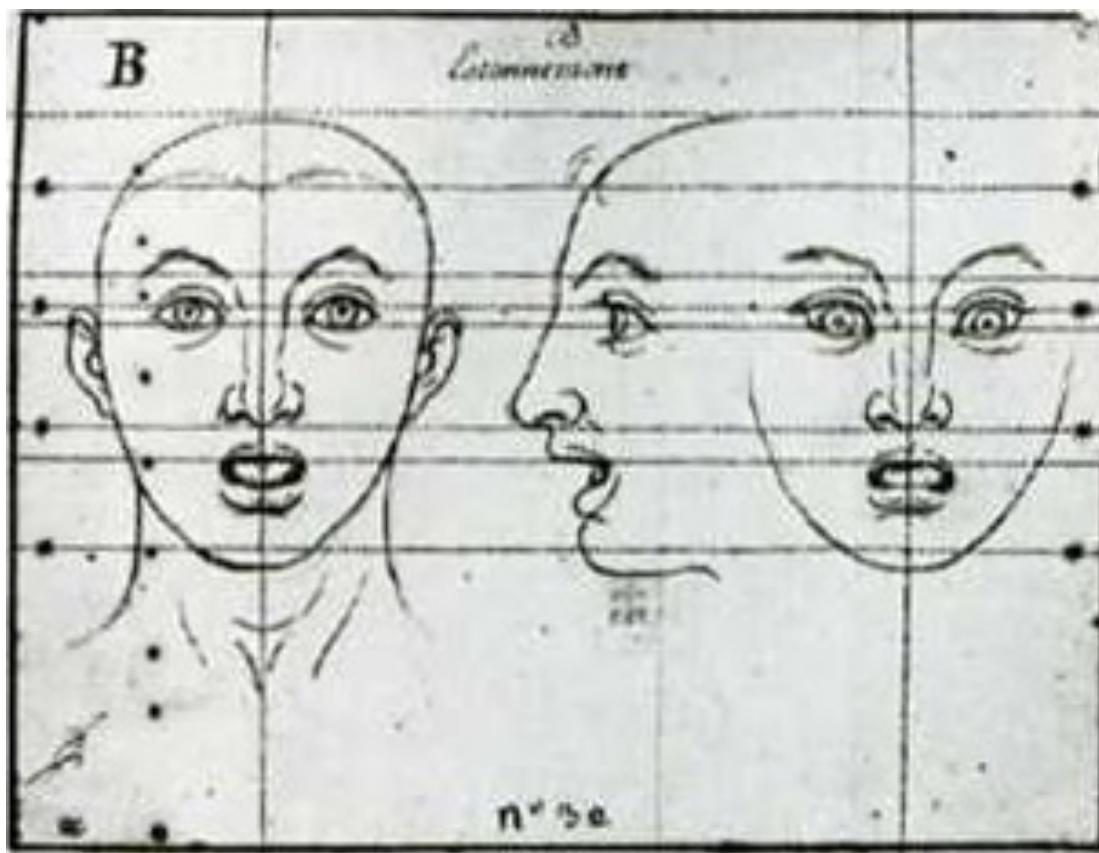
SADNESS



What about this one?



SURPRISE



And this one?



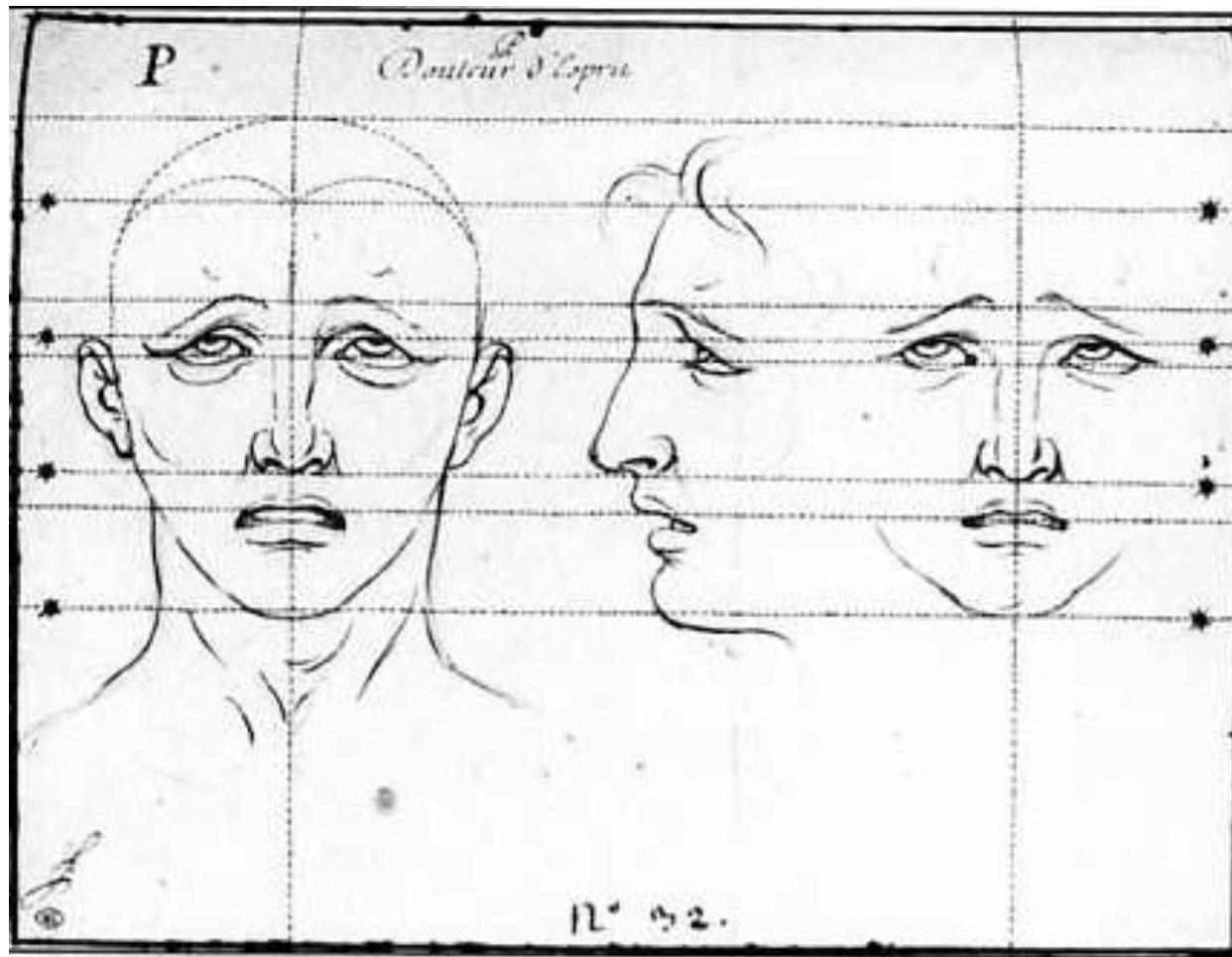
ADMIRATION
MIXED WITH
ASTONISHMENT



Le Brun's approach could be described as a classification problem.

He wanted to find the **features** of a face that ensure an accurate **classification** of the face as belonging to a particular emotion.

Which parts of the face are most important in displaying emotions?

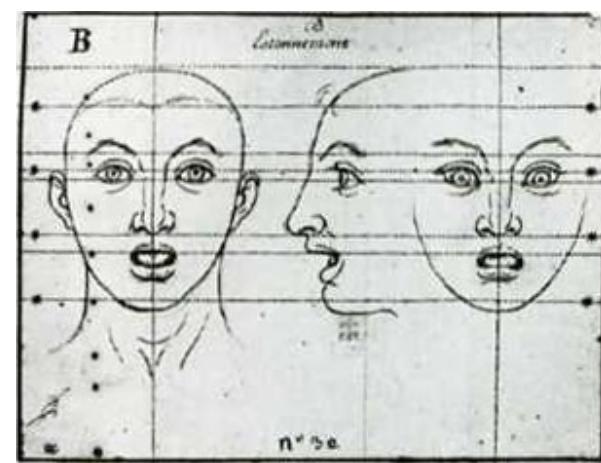
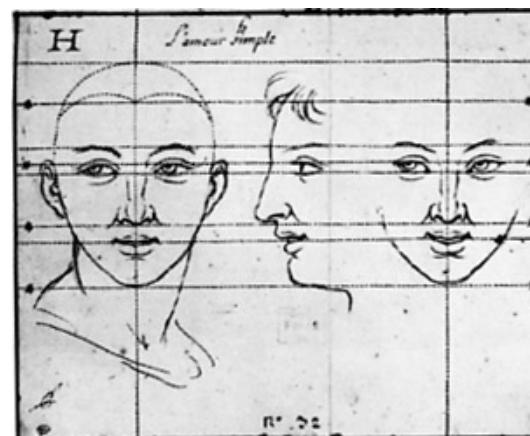
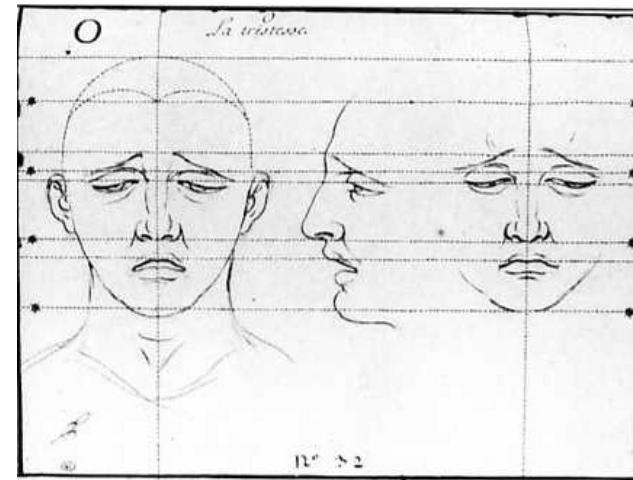


Which parts of the face are most important in displaying emotions?

For Le Brun, it is the eyes and (especially) the eyebrows.



An important feature is whether the eyebrow slopes upward or is arched in the middle.



O

Mouvement Singulier
Qui n'appartient qu'à l'espèce de l'homme.



A

Le Brun's painting of Louis XIV.



When the angle of the axis of the eyebrows rises up towards the forehead, this suggests a movement up towards the soul.



Le Brun's *The Penitent Magdalene*



Le Brun, *The Persian Queens*



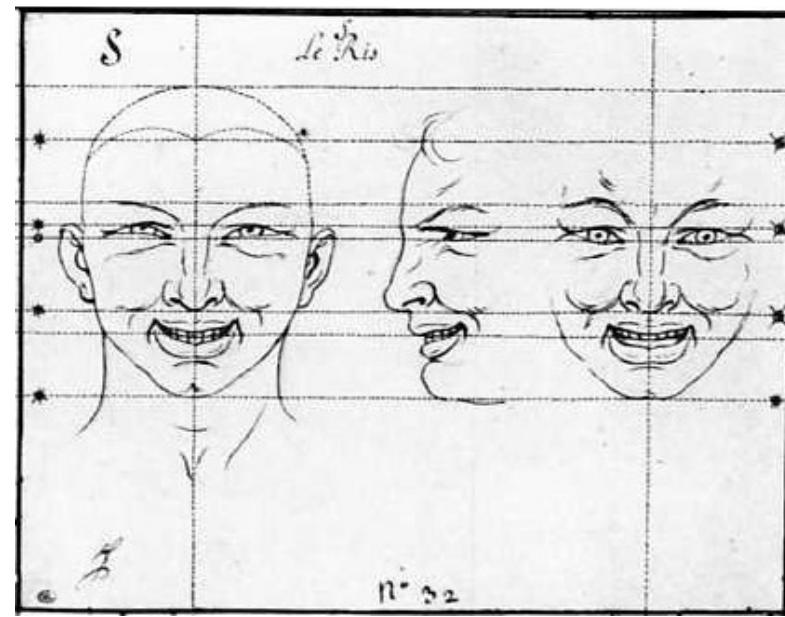
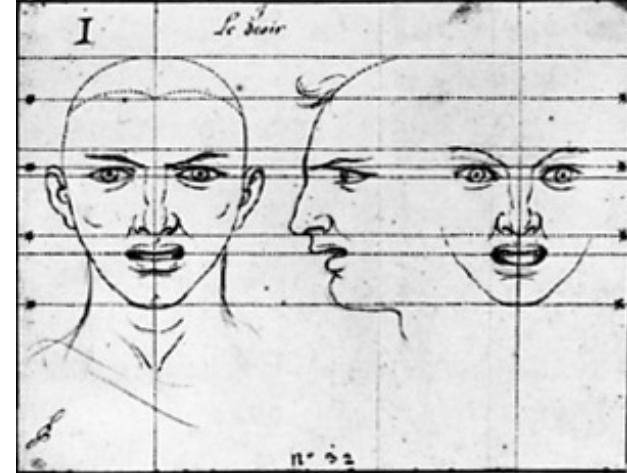
If the angle descends down towards the nose/mouth, the expression has a more animal quality.

Here are desire, scorn, fear and terror.



La Crainte

Fig. 18





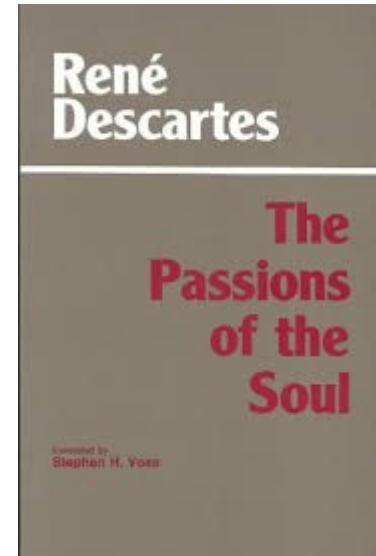
Fright



Anger

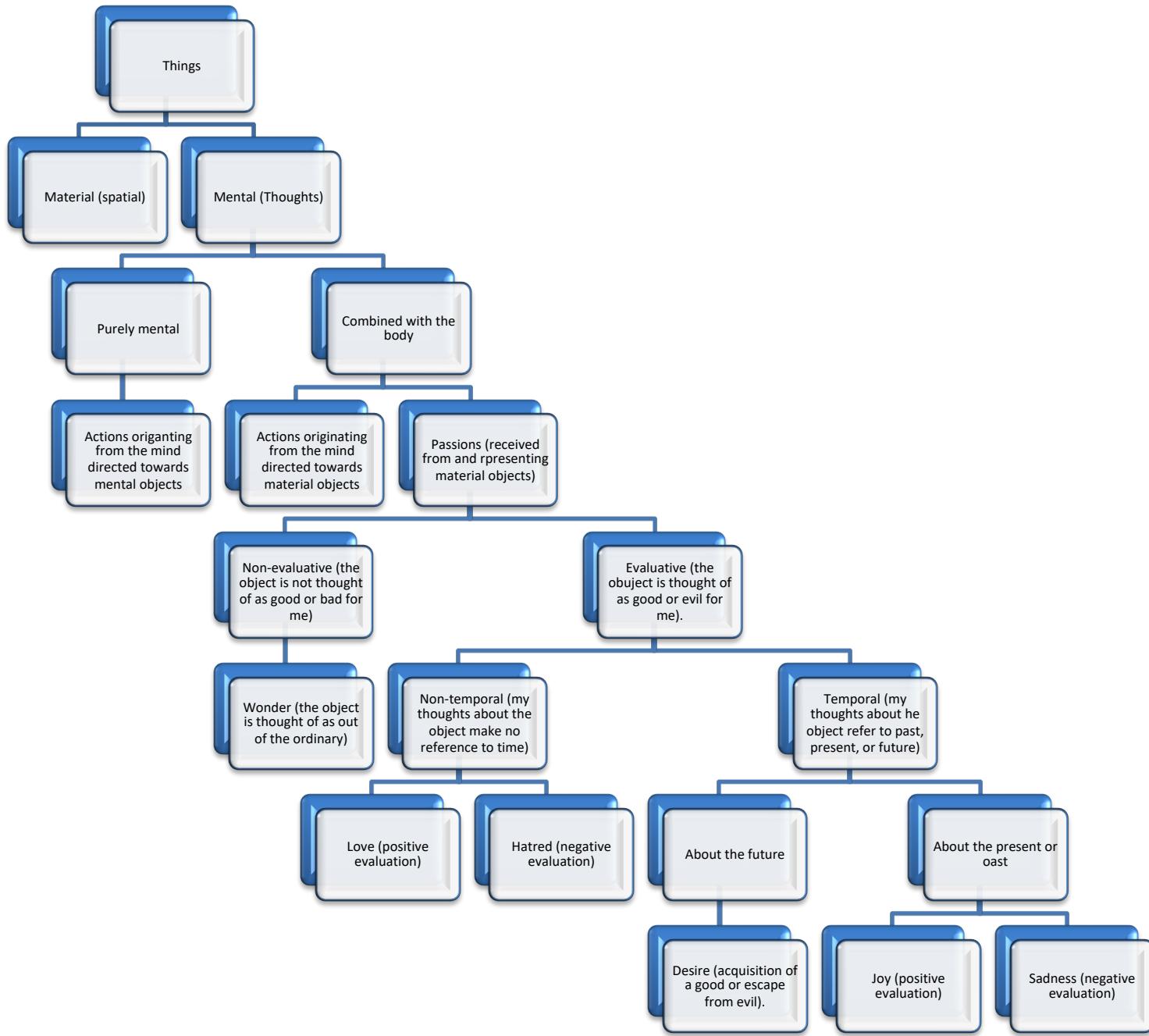


Le Brun was strongly influenced by a study of emotions written by the philosopher and scientist Rene Descartes.



When teaching students how to paint, Le Brun used a classification of the emotions developed by Descartes.





Hierarchy of passions (Descartes)

All passions of the soul for Descartes reduce **to six basic passions** (Article 69):

1. Wonder
2. Love
3. Hatred
4. Desire
5. Joy
6. Sadness

Hierarchy of passions (Descartes)

Other passions are either mixtures or species of these six basic passions.

Descartes aimed to produce a list of the main passions, which can be clearly and sharply defined.

Other passions can then be defined by reference to these main ones.

For instance, greed is love for the possession of money combined with the desire for money and other emotions (Article 82).

On the other hand, Descartes claimed that a father's love for his children is pure and involves no mixture with desire. (Article 82)

There are two species of love for Descartes, love for good things and love for beautiful things ("delight"). (Article 85).

The Classical Episteme

Le Brun and Descartes lived in a period of the history of Western knowledge (approximately 17th-18th centuries) that has been described as a **classical episteme**.

An episteme is a system of knowledge that characterizes many different branches or disciplines in a historical period.

The term “episteme” was introduced by 20th century philosopher and historian Michel Foucault in his book *The Order of Things*.

One important feature of the classical episteme was an obsession with **order** and **classification**.

Classical order

Classical knowledge consists in the arrangement of our ideas regarding a given topic from the simple and primitive to the complex.

- starting from what is simplest and easiest to know...
- then moving to what is progressively more complex.

Complex items are mixtures or species of basic ones.

Classical order

In the classical episteme, to know is to **distinguish** and to **relate**.

The “order of reality” is “to be found in the structure of the elements into which things and their resemblances can be analyzed. These elements are related not by vague and ambiguous resemblances but by **strict identities and differences (presence or absence of particular properties)**. On the basis of these identities and differences, elements can be **arranged in series** (e.g., from the simplest to the most complex) in terms of **precise criteria**.”

Gary Gutting, *Michel Foucault's Archaeology of Scientific Reason* (Cambridge, 2012), p. 146.

Exhaustive ordering

This order was to be attained by making a **complete (comprehensive) review** of all aspects of the problem being addressed, so that nothing is left out.

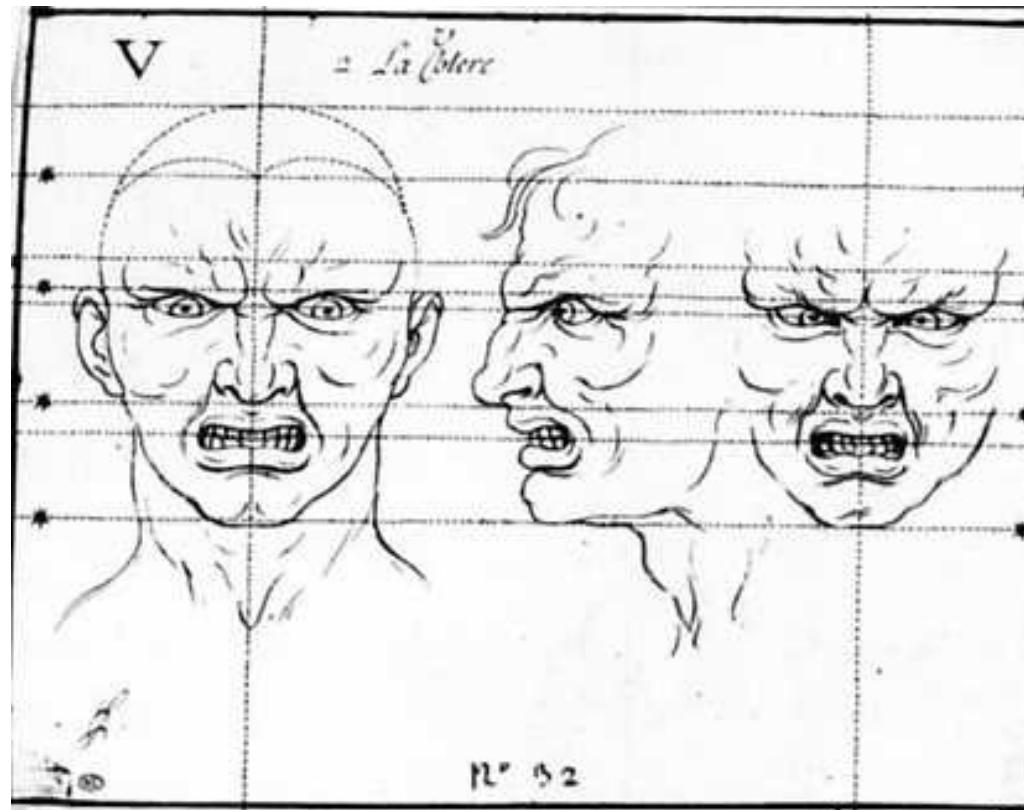
Descartes recognized, however, that there are many passions that might lie outside of his system. The number of passions is indefinite. He nonetheless claimed that his system includes all the main passions (Article 68).

This idea of exhaustive ordering was at the heart of early modern science:

“The sciences always carry within themselves the project, however remote it may be, of an exhaustive ordering of the world.”

Foucault, The Order of Things, p. 74.

The classical conception of knowledge was at the basis of Descartes' theory of the emotions and Le Brun's application of this theory to the art of painting.



Classical ideas of knowledge remained influential even after the 18th century, although the nature of scientific knowledge was altered.

New forms of knowledge (and power) since the 19th century were mainly organized around the collection and processing of **data about populations**.

Statistics was one of the key disciplines in modern forms of knowledge.

Modern artists and scientists aimed to understand the relation between the inner world of the mind and the outer expressions of the body.

We can think of this as the **creation of a dataset about large populations**.

Johann Kaspar Lavater (1741-1801) produced sketches of the facial expressions of the insane.



The insane were confined in large institutions (asylums).

Lavater often drew sketches of those inmates.

1. Sanguine



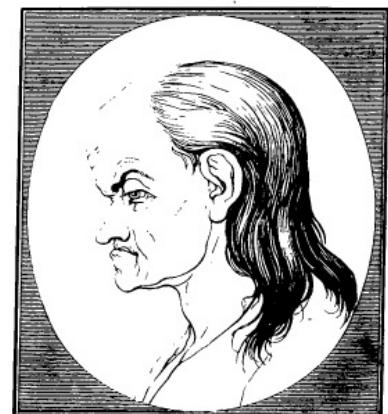
2. Phlegmatick



3. Cholerick



4. Melancholy.



19th century research on the creation of datasets of emotional expression benefited from two technological advances.

1. Photography
2. Electricity

1. photography

Why is it difficult to study (e)motions?

Charles Darwin wrote:

"The study of Expression is difficult, owing to the movements being often **extremely slight**, and of a **fleeting nature**. A difference may be clearly perceived, and yet it may be impossible... to state in what the difference consists."

19th century researchers used photography to capture slight and fleeting changes in the face, making it **possible to describe differences** that could not have been captured otherwise.

For this reason, **photography was considered a more "objective" medium.**



2. Electricity

- Emotional expression depends on the action of muscles.
- Researchers used electric shocks to produce muscle motions.
- This approach helped them to identify the combinations of muscle motions that express different emotions.

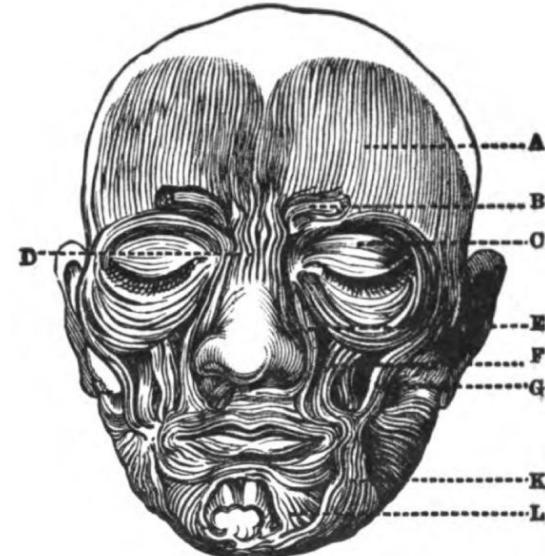


FIG. 1.—Diagram of the muscles of the face, from Sir C. Bell.

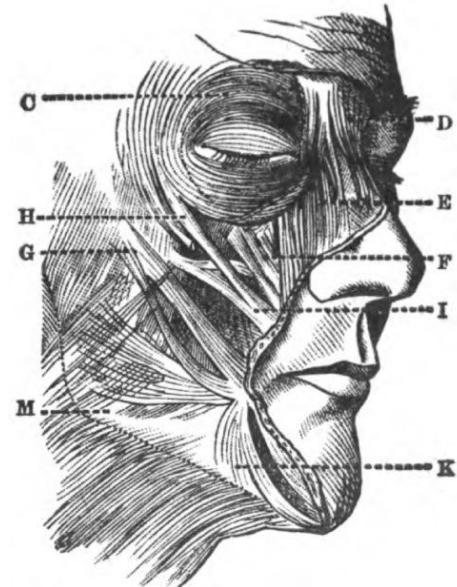


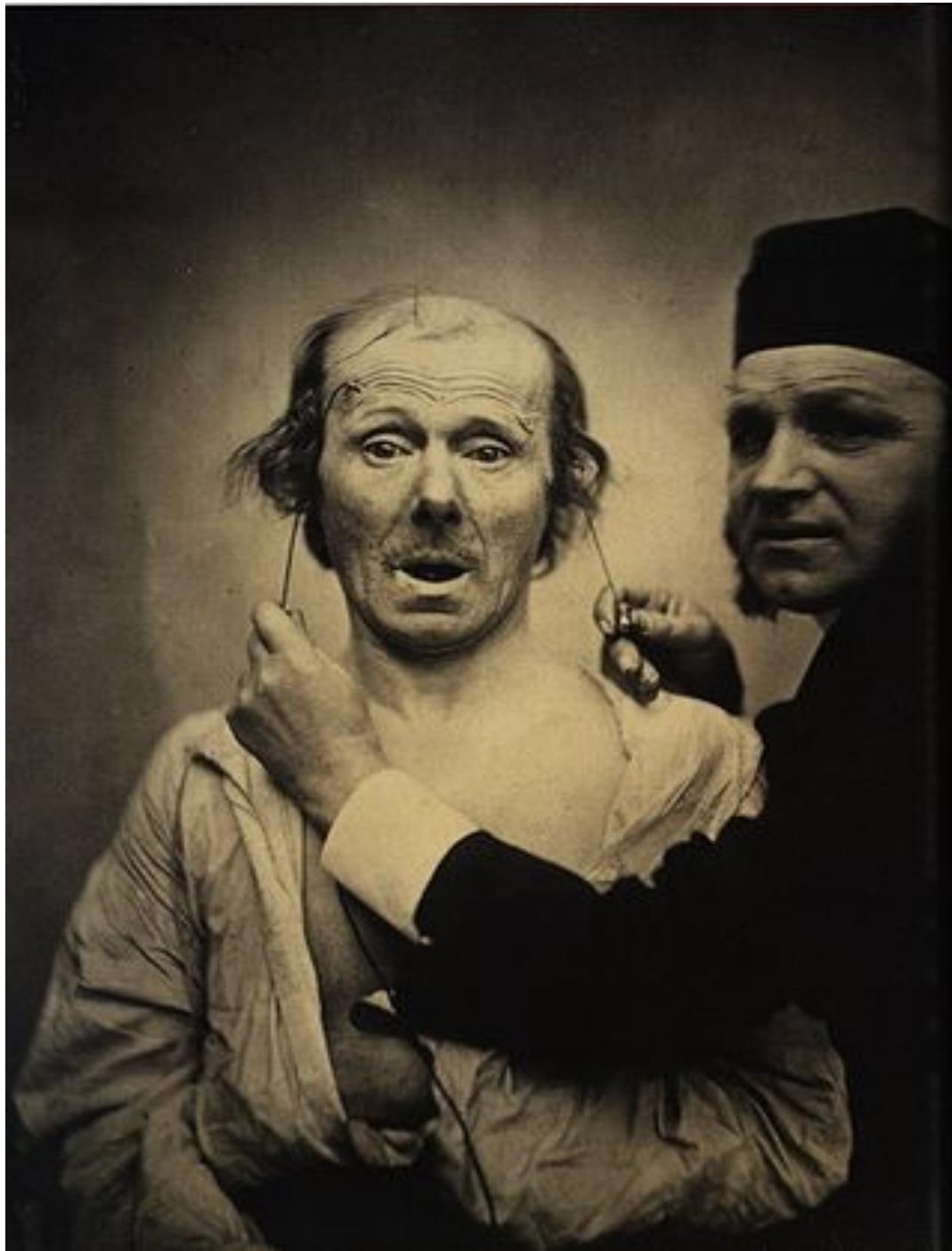
FIG. 2.—Diagram from Henle.

Guillaume-Benjamin Duchenne (1862) *The Mechanism of Human Facial Expression*



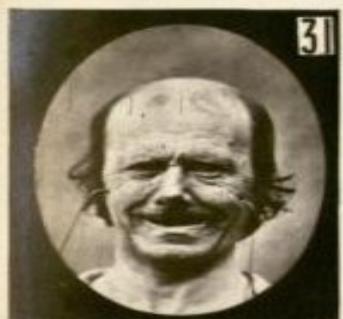
- Duchenne's research involved first stimulating one single muscle.
- He then "combined these isolated muscle contractions in all the variations possible, by making the different muscles contract, two by two and three by three"
- The approach has a classical aspect: trying to isolate simple or basic elements which can be combined to form more complex emotions











Duchenne believed that his work had both scientific and artistic value.

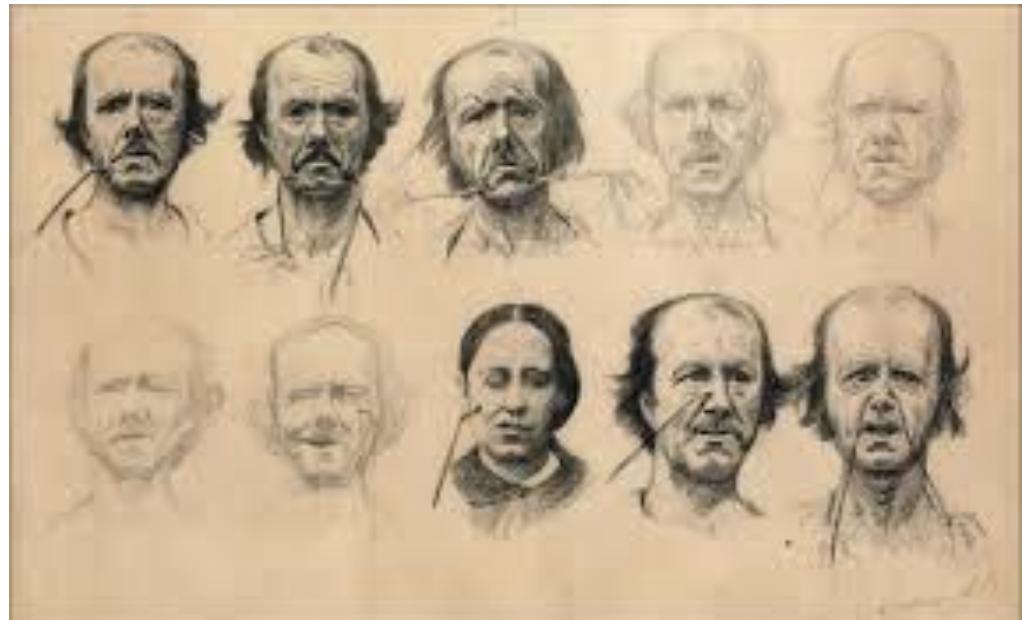


Fig. 75



Fig. 76





Scientist Charles Darwin admired Duchenne's work:

“No one has more carefully studied the contraction of each separate muscle, and the consequent furrows produced on the skin.

He has also, and this is a very important service, shown which muscles are least under the separate control of the will.”

Darwin,
The expression of the emotions in man and animals

- Darwin's methodology for the study of emotion in the 1860s:
 - He showed people photographs of facial expressions to test whether or not those people could recognize the emotions in those photographs.
 - These are photographs of sadness used by Darwin in his research.

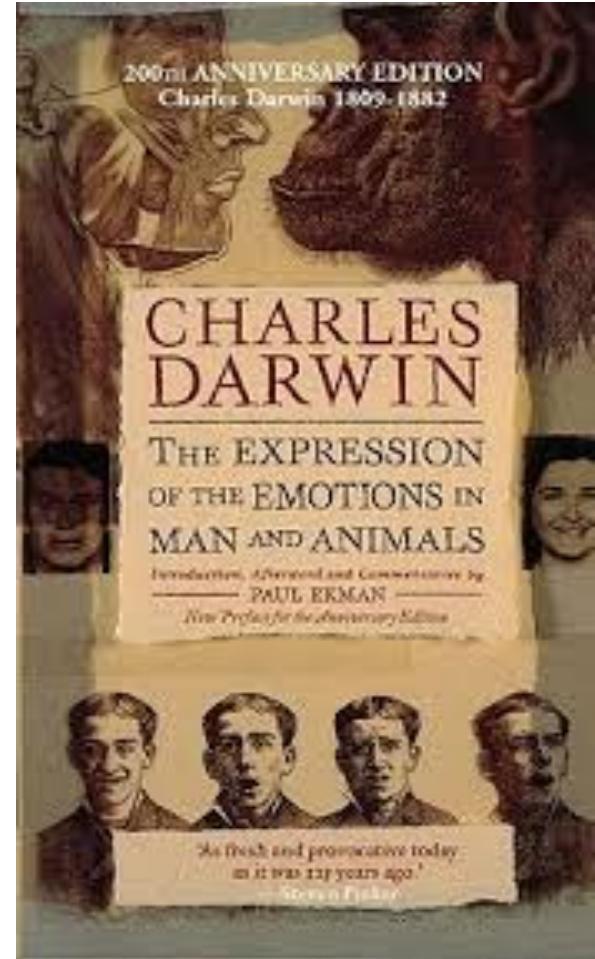


Darwin concluded that emotions are universal, i.e., they occur in all human cultures.

“...the young and the old of widely different races, both with man and animals, express the same state of mind by the same movements.”

He claimed that it is possible to produce a comprehensive ordering of all emotions.

Darwin published his results in the book *The Expression of the Emotions in Man and Animals* (1872).



Here is a short review of Darwin's work on emotions, which summarizes his ideas and gives examples:

<http://people.wku.edu/charles.smith/wallace/S220.htm>

Darwin's entire book is available online:

<http://www.gutenberg.org/files/1227/1227-h/1227-h.htm>

- Darwin's work has influenced recent work about emotional expression.
- Psychologist Paul Ekman showed people in different cultures photographs of certain facial expressions.
- People were asked to label those expressions.





fear

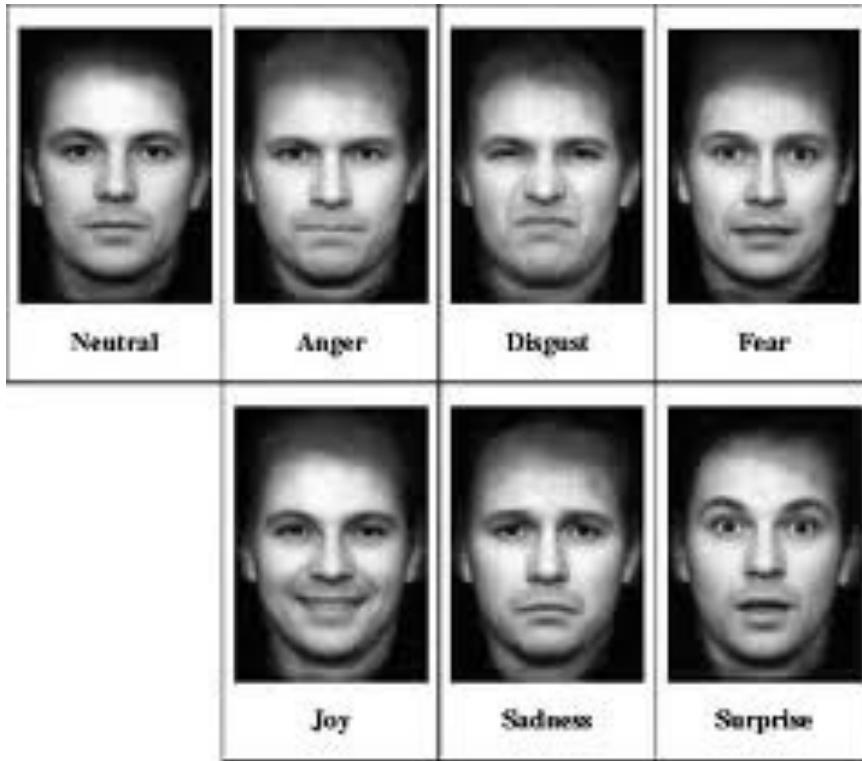
- ① eyebrows raised and pulled together
- ② raised upper eyelids
- ③ tensed lower eyelids
- ④ lips slightly stretched horizontally back to ears



happiness

A real smile always includes:

- ① crow's feet wrinkles
- ② pushed up cheeks
- ③ movement from muscle that orbits the eye



- Most people, even those from different cultures, chose the same labels for the same expressions.
- Conclusion: Certain expressions represent the same emotions in all cultures.

Ekman believed in the possibility that all emotions could be known in a classical way:

starting from a small number of simple emotions

whose combinations or variations generate more complex emotions,

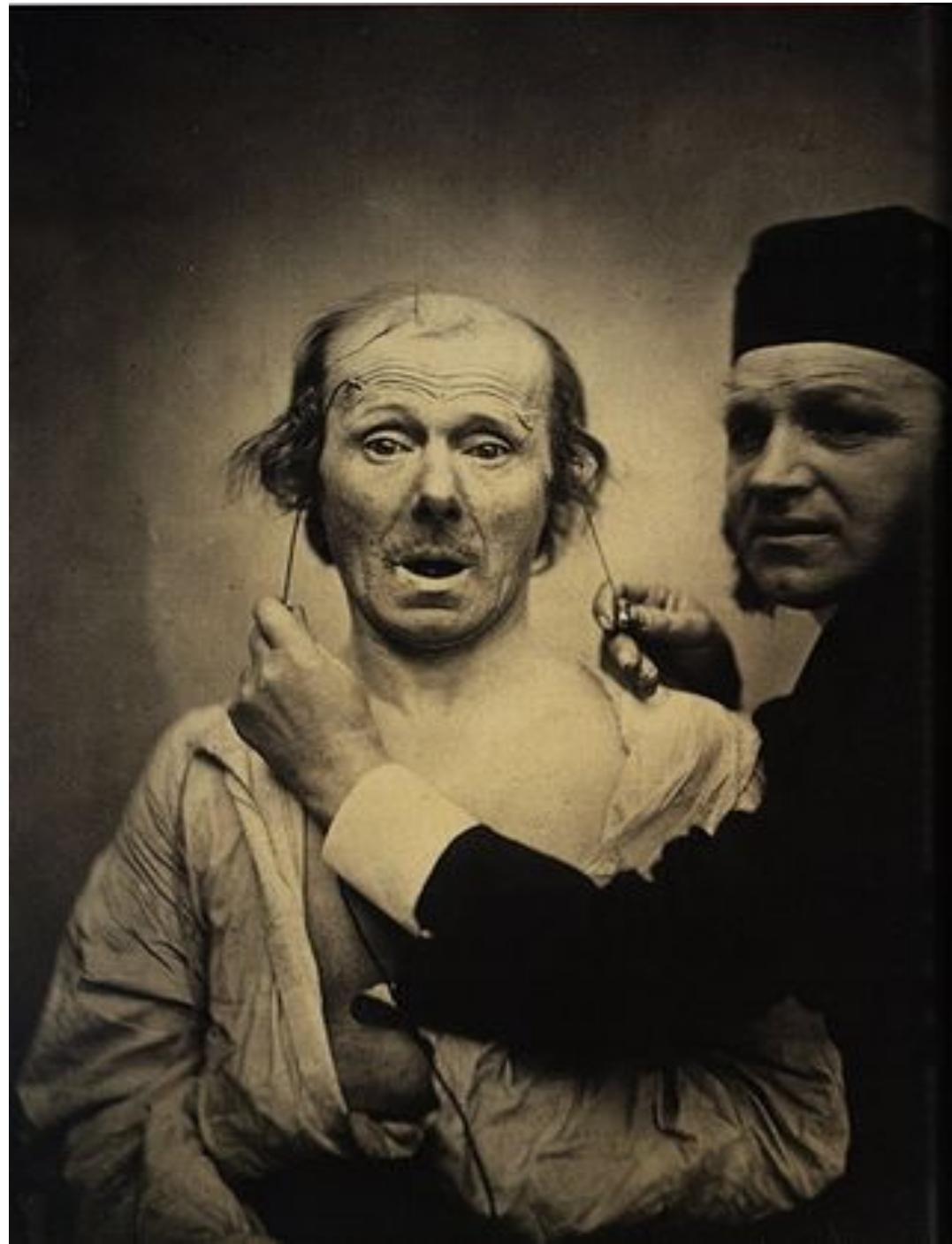
forming a comprehensive ordering.



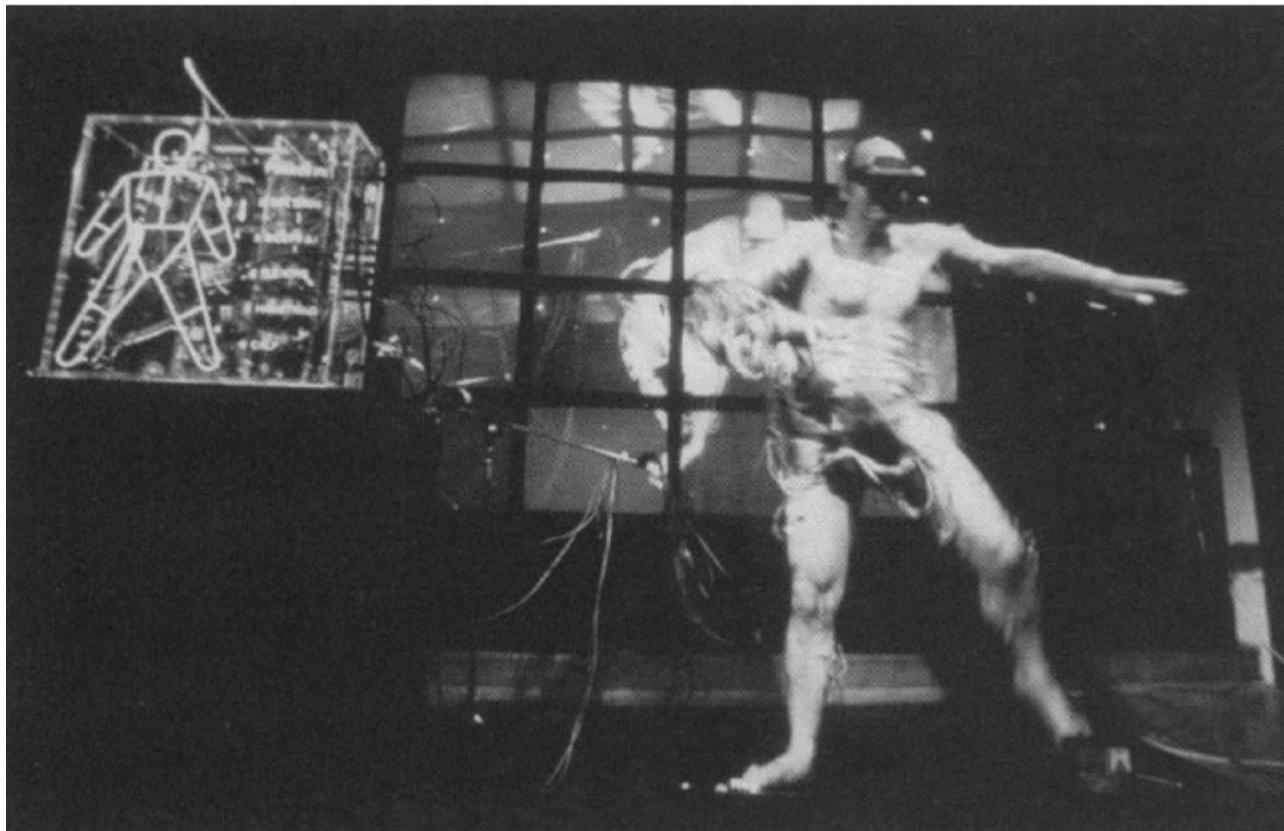
- Articles by Ekman about the expression of emotion:

<http://www.paulekman.com/wp-content/uploads/2013/07/Basic-Emotions.pdf>

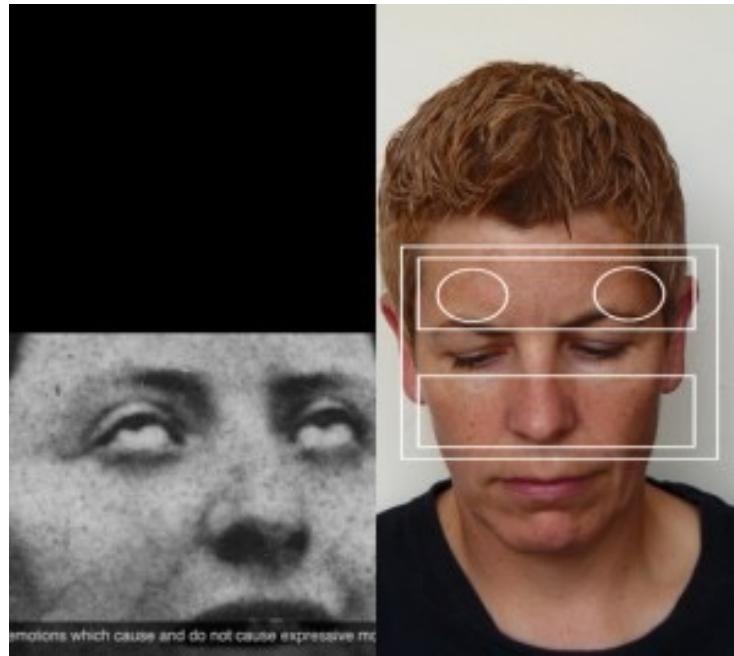
Other media artists have made reference to the history of research about emotions.



Performance artist Stelarc allowed people to control his body motions remotely, via the internet, by electric means.



Michele Barker and Anna Munster **Duchenne's smile (2009)**



Artwork: Reface [Portrait Sequencer] by Golan Levin and Zachary Lieberman, 2007.





The “installation records and dynamically remixes brief video slices of its viewers' mouths, eyes and brows. *Reface* uses face-tracking techniques to allow automatic alignment and segmentation of its participants' faces.”

<http://www.flong.com/projects/reface/>

Reface video documentation.

<https://vimeo.com/2355887>



Affective computing or Emotion Analytics is now a growing trend in the integration of design, computing, and business.

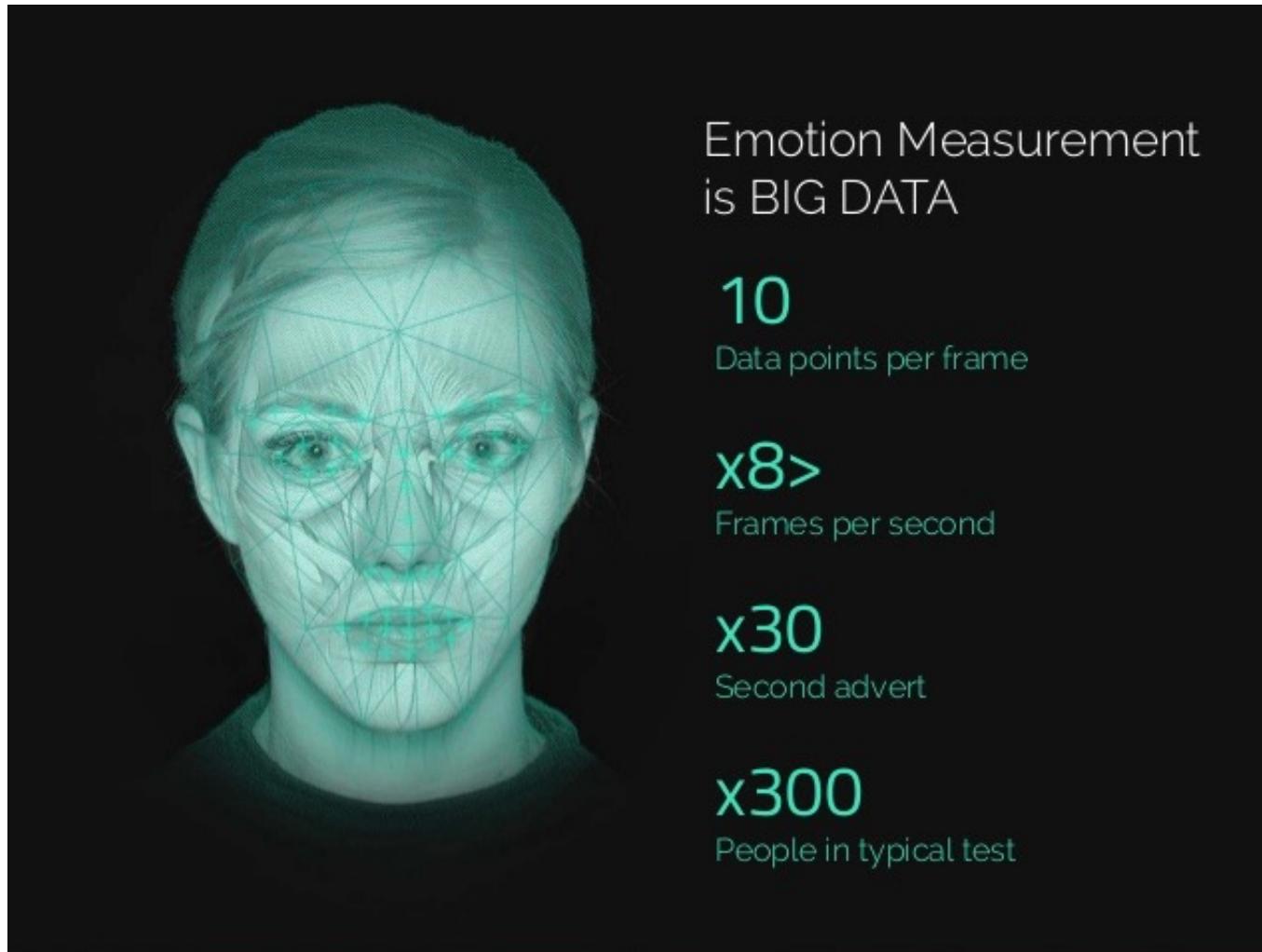
It depends on a classical conception of the knowledge of emotion.



AFFECTIVE COMPUTING

The Power of Emotion Analytics

The aim is the measurement of emotion.



Emotion Measurement
is BIG DATA

10

Data points per frame

x8>

Frames per second

x30

Second advert

x300

People in typical test

- Researchers aim to develop software that can detect the emotion of a person based on her/his facial expression and then respond appropriately.



It is helpful to have a set of basic emotions, such as surprise or anger, that the computer can be trained to identify.



Neutral:
Happiness:
Surprise:
Sadness:



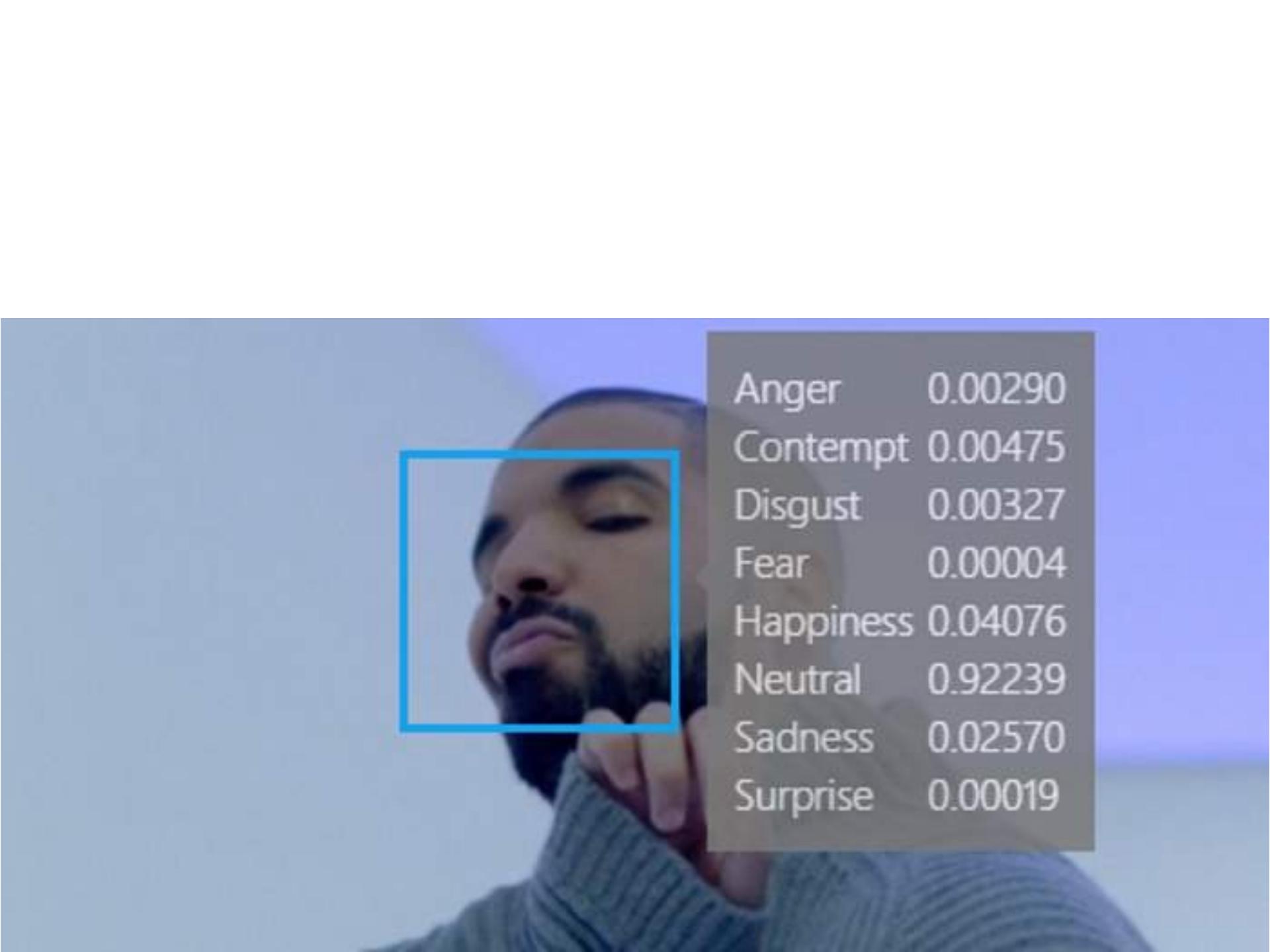
Anger:
Disgust:
Fear:
Contempt:



Get started for free at [projectoxford.ai](#)

Anger	0.65333
Contempt	0.01938
Disgust	0.28630
Fear	0.00234
Happiness	0.00201
Neutral	0.03473
Sadness	0.00070
Surprise	0.00121





Anger 0.00290
Contempt 0.00475
Disgust 0.00327
Fear 0.00004
Happiness 0.04076
Neutral 0.92239
Sadness 0.02570
Surprise 0.00019

- The field of Affective Computing was pioneered by scholar Rosalind W. Picard.



“Computers are beginning to acquire the ability to express and recognize affect, and may soon be given the ability to ‘have emotions’...

Affective computers should not only provide better performance in assisting humans, but also might enhance computers’ abilities to make decisions.”

Rosalind Picard, “Affective Computing”,
<https://affect.media.mit.edu/pdfs/95.picard.pdf>

- Some authors have criticized Picard's approach for treating emotion as **measurable information**.
- This **information-processing model** has been criticized for ignoring many cultural aspects of emotion.
- Perhaps these aspects can be better understood using ideas and methods from anthropology.

Boehner, Kirsten; DePaula, Rogerio; Dourish, Paul; Sengers, Phoebe (2007). "How emotion is made and measured". *International Journal of Human-Computer Studies*. **65** (4): 275–291.

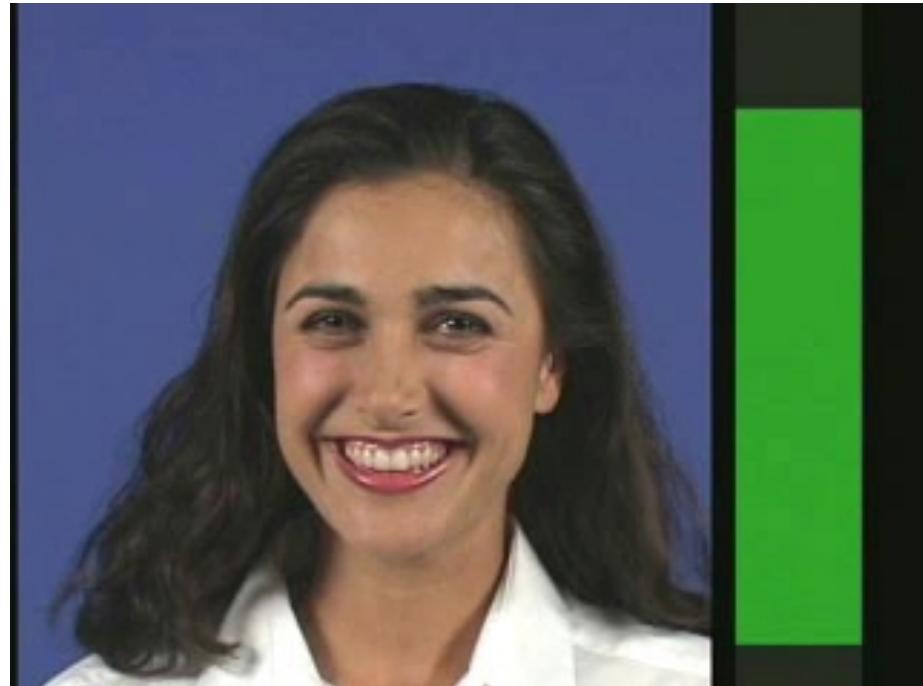
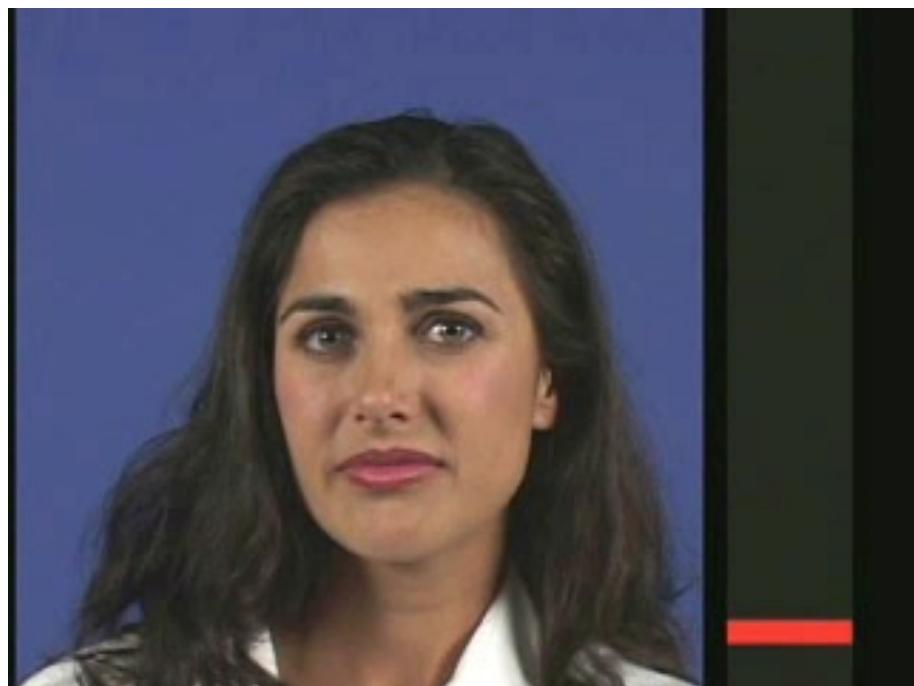
<https://www.sciencedirect.com/science/article/pii/S1071581906001844?via%3Dihub>

Another important and very urgent topic is the potential use of affective computing for surveillance and control.

- The expression of emotion is not only a biological feature of human beings.
- It has social (political, economic, cultural) aspects.
- New deep learning algorithms will attempt to interpret the emotions expressed by human faces.
- The conclusions can be used, for instance, for commercial purposes.
- These are potentially important questions for artists to explore and perhaps criticize.

Cheese, Christian Moller (video installation, 2003)

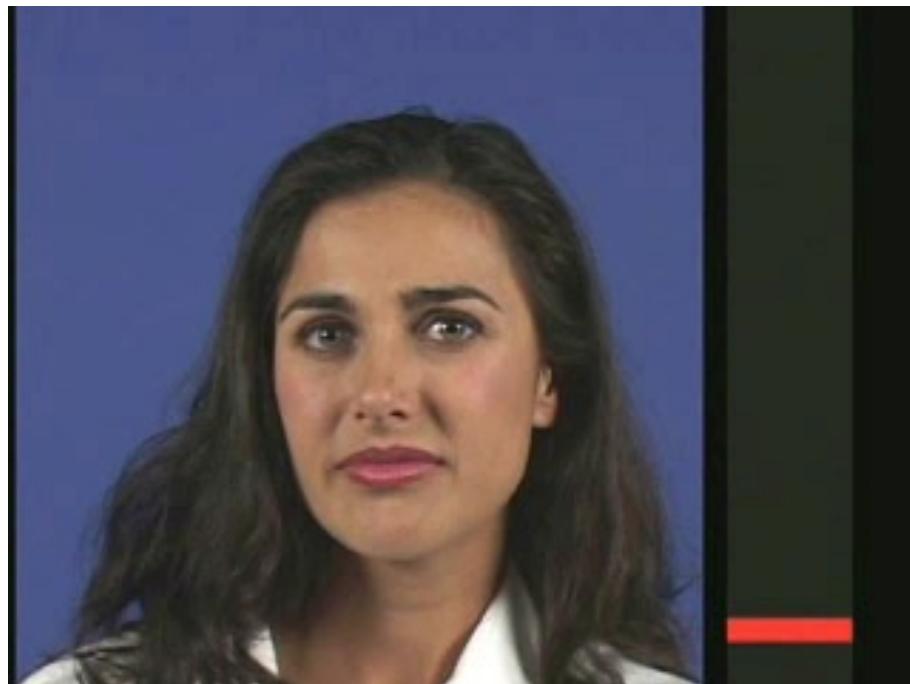
“...six actresses to hold a smile for as long as they could, up to one and half hours. Each ongoing smile is scrutinized by an emotion recognition system, and whenever the display of happiness fell below a certain threshold, an alarm alerted them to show more sincerity”



This work also shows the social pressures that certain people are under to display certain emotions.

If it is true that women are more subjected to these pressures than men, then there is a strong gender-bias here.

This artwork raises questions about the social aspects of the expression of emotion.



Smile, by Tomas Laurenzo

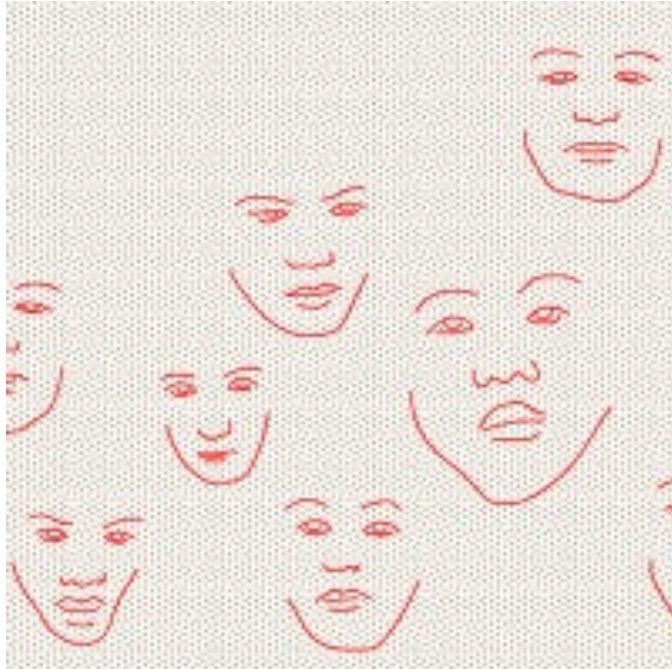


The visitor is invited to smile in order to see images of human-made destruction.

<https://laurenzo.net/smile>



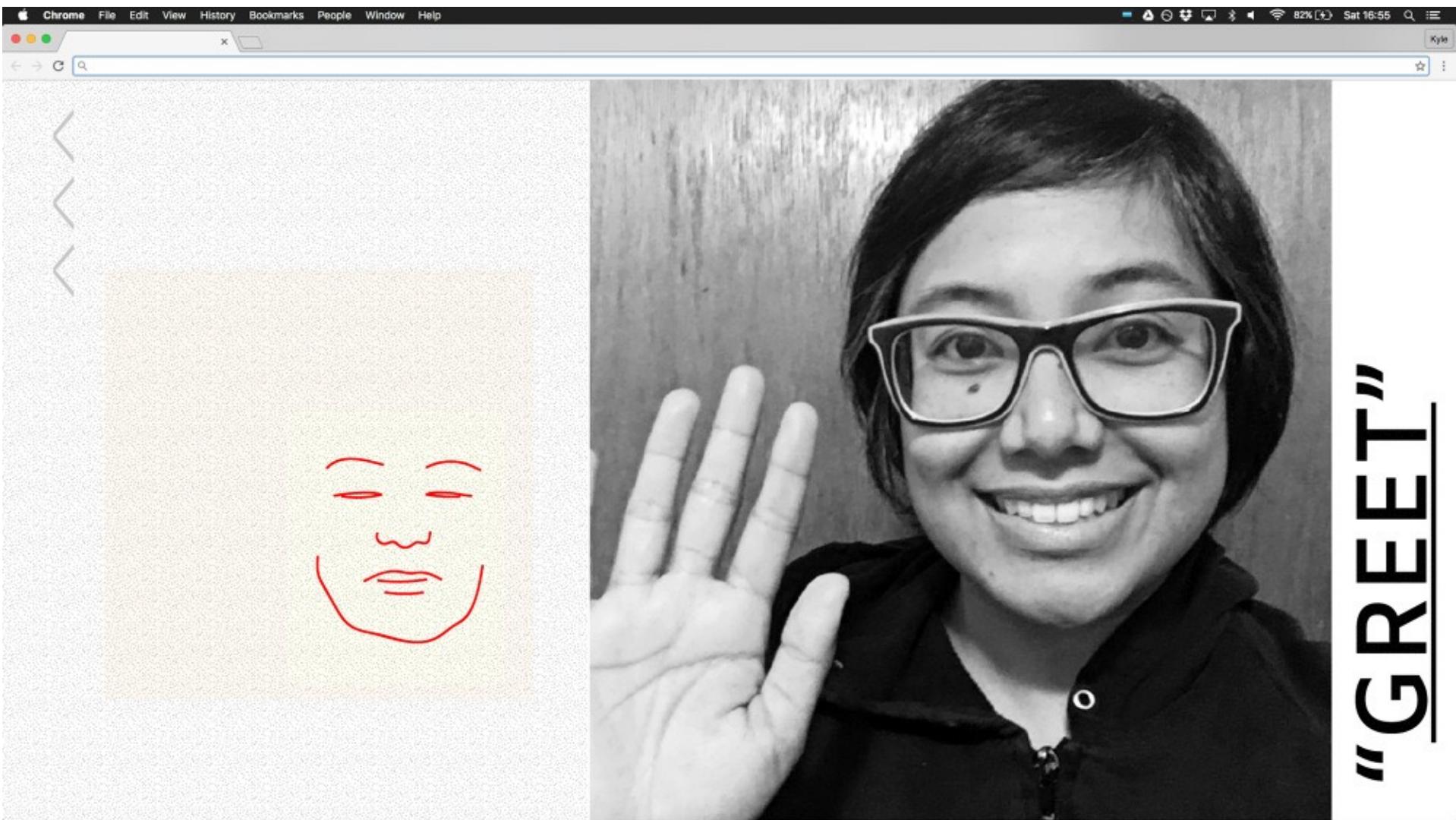
The work **How We Act Together** (2016), by Lauren McCarthy and Kyle McDonald, explores social and computational aspects of emotions.



Documentation of the work.

https://www.youtube.com/watch?time_continue=3&v=SPjt kUs1rvA

<http://lauren-mccarthy.com/How-We-Act-Together>



“GREET”