Lecture 8 - Signals and Facial Expressions

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Readings:

- Picard *Affective Computing* Chapters 5 and 6
- Alan J. Fridlund The new ethology of human facial expressions in James A. Russell and Jose Miguel Fernandez-Dols The Psychology of Facial Expression, Chapt. 5, pages 103-129, Cambridge University Press, 1997.
- Allan J. Fridlund and Jose Miguel Fernandez-Dols What does facial expression mean? in James A. Russell and Jose Miguel Fernandez-Dols The Psychology of Facial Expression, Chapt. 1, pages 3-30, Cambridge University Press, 1997.

Properties of Emotional Signals

Signals from the body have:

- ▶ Response decay - exponential
- ▶ Repeated small strikes $>$ one big strike
- ▶ Influenced by temperament and personality
- ▶ Non-linear (but may be locally linear)
- ▶ Time invariant
- ▶ Activation and Saturation Thresholds
- ▶ Internal feedback loops
- ▶ Mood influenced

Emotion Recognition

Non-invasive

- sounds
- gestures
- facial expresions
- mouse/keyboard/screen interactions
- mobile device sensors

Invasive:

- blood pressure
- hormone levels
- neurotransmitter levels

Also:

- combinations of gestures
- context

Invasive Sensors

▶ Electromyogram (EMG): muscle contraction

▶ Blood volume pressure (BVP): blood flow

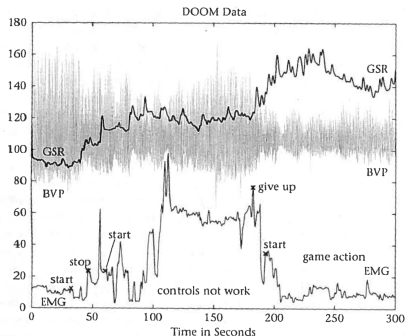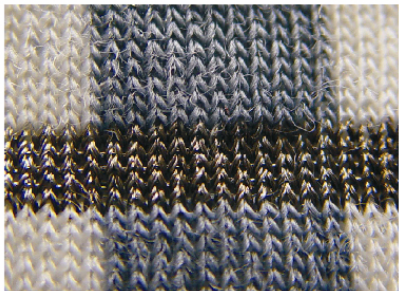▶ electrodermal activity (EDA) or Galvanic Skin Response (GSR): skin conductivity

▶ Respiration Rate

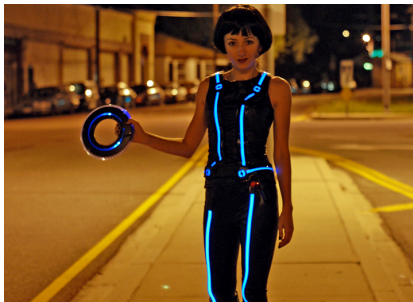# Invasive Sensors

- Electromyogram (EMG): muscle contraction

- Blood volume pressure (BVP): blood flow

- electrodermal activity (EDA) or Galvanic Skin Response (GSR): skin conductivity

- Respiration Rate

Video game player signals with faulty controller

Smart Textile Knits from CSIRO

Source   Color-amplified (x100)

https://www.youtube.com/watch?v=EhZXDgG9oSk

Table 6.1

Summary of human vocal effects most commonly associated with the emotions indicated. Descriptions are given relative to neutral speech. (Adapted with permission from Murray and Arnott (1993), Table 1. Copyright 1993 Acoustical Society of America.)

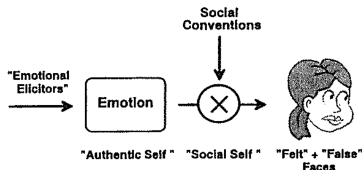|	Fear	Anger	Sadness	Happiness	Disgust
Speech rate	much faster	slightly faster	slightly slower	faster or slower	very much slower
Pitch average	very much higher	very much higher	slightly lower	much higher	very much lower
Pitch range	much wider	much wider	slightly narrower	much wider	slightly wider
Intensity	normal	higher	lower	higher	lower
Voice quality	irregular voicing	breathy chest tone	resonant	breathy blaring	grumbled chest tone
Pitch changes	normal	abrupt on stressed syllables	downward inflections	smooth upward inflections	wide downward terminal inflections
Articulation	precise	tense	slurring	normal	normal

Facial Expression Program

Figure 5.1. The Emotions View of facial expression.

James A. Russell *The Psychology of Facial Expression*,
Chapt. 5

- Happiness (Joy)
- Surprise
- Anger
- Sadness
- Fear
- Disgust
- Contempt
- Shame

- Ekman's facial expression "program"
- 6 "basic" universal emotions
- uncontrollable
- maskable

Facial Expression Program
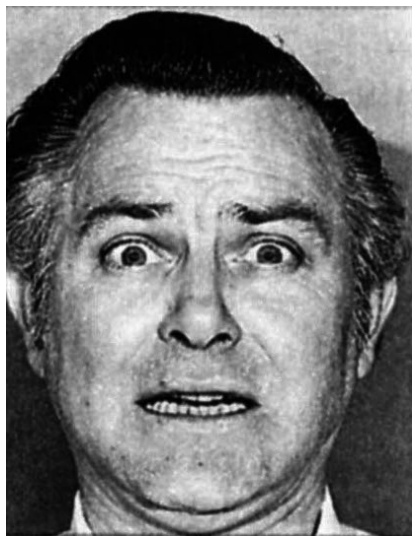

- ▶ Happiness
- ▶ Surprise
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Facial Expression Program

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Behavioral Ecology View

Table 5.2. *Emotions and Behavioral Ecology interpretations of common human facial displays*

Emotions view ["facial expressions of emotion"]	Behavioral Ecology view [signification of intent]
"Felt" ("Duchenne") smile (Expression of happiness)	Readiness to play or affiliate ("Let's play [keep playing]," or "Let's be friends")
"False" smile (Feigned happiness)	Readiness to appease ("Whatever you say," or "I give in")
"Sad" face	Recruitment of succor ("Take care of me," or "Hold me")
"Anger" face	Readiness to attack ("Back off or I'll attack")
"Leaked" anger (Inhibited anger)	Conflict about attacking ("I want to attack and I don't want to attack")
"Fear" face	Readiness to submit or escape ("Don't hurt me!")
"Contentment" face	Readiness to continue current interaction ("Everything [you're doing] is just fine")
"Contempt" face	Declaration of superiority ("I can't even bother with you")
"Poker" face (Suppressed emotion)	Declaration of neutrality ("I'm taking no position [on what you're doing or saying]")
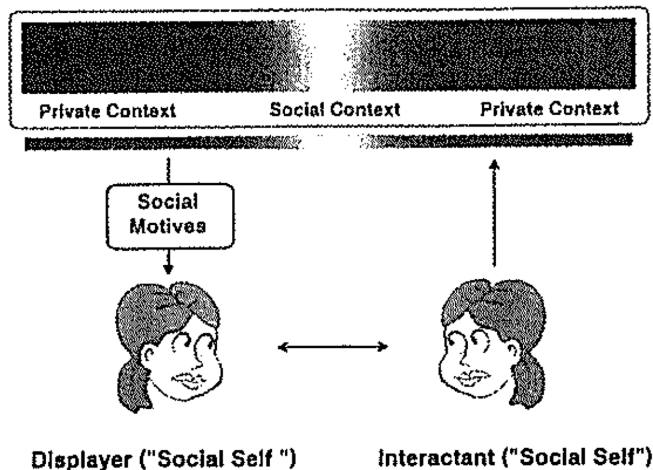
Figure 5.2. The Behavioral Ecology View of facial displays

James A. Russell *The Psychology of Facial Expression*, Chapt. 5

Behavioral Ecology View

Evolution dictates five requirements for facial expressions:

1. displays provide *reliable, graded, mututally beneficial signals of contingent future action*
2. displays would not *betray information detrimental to the displayer*
3. survivors of conflict would include both displayers and recognizers
4. *costs and benefits of signaling* [...] *would vary with the momentary social context and the animal's intentions within it*
5. co-evolution of signaling and vigilance: *"social tools" that aid the negotiation of social encounters*

The emotions view:

- *neglects the costs of automatic expression*
- *omits the recipient's co-evolutionary role in the origin and persistence of display*
- *erroneously presumes that infant faces are "authentic" and that maturation breed dissimulative faces*

The emotions view:

- *fails to account for the poor relationship between emotions and facial displays*

Justine Dufour-Lapointe (Sochi Gold Medallist 2014). Emotion?

The emotions view:

- ▶ *holds erroneously that the existence of "facial expressions of emotion" is demonstrated by the dual neurological control of facial expressions*

Stroke lesion makes "fake" smile impossible, but "real" smile unaffected

Two types of emotion are controlled by different brain areas: is this evidence for a two-factor model of emotions?

Compare with aphasia of speech: "constructed" vs "habitual"

Behavioral Ecology View

The emotions view:

- *neglects the sociality that is implicit when displayers are alone*
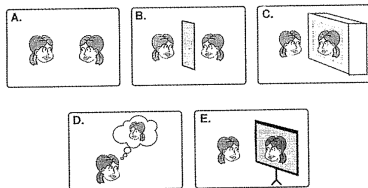
Figure 5.3. Disguised sociality in common methods of eliciting "emotional" facial expressions.

- Facial expressions occur when displayers are alone: support for emotions view?

- Emotions program view: B-E are non-social...

- *when we are alone we often treat ourselves as interactants*
- *we often act as if others are present when they are not*
- *we often imagine that others are present when they are not*
- *we often forecast interaction and deploy displays appropriately*
    - Kraut and Johnston: bowling study
- *we often treat nonhumans and animate and inanimate objects as interactants*
    - Media Equation

Facial Expression Analysis: Problem Space

▶ **Level of description**: FACS/emotions/context

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Table 11.1. FACS action units (AU). AUs with "*" indicate that the criteria have changed for this AU, that is, AU 25, 26, and 27 are now coded according to criteria of intensity (25A-E), and AU 41, 42, and 43 are now coded according to criteria of intensity.

Upper Face Action Units					
AU 1	AU 2	AU 4	AU 5	AU 6	AU 7
Inner Brow Raiser	Outer Brow Raiser	Brow Lowerer	Upper Lid Raiser	Cheek Raiser	Lid Tightener
*AU 41	*AU 42	*AU 43	AU 44	AU 45	AU 46
Lid Droop	Slit	Eyes Closed	Squint	Blink	Wink
Lower Face Action Units					
AU 9	AU 10	AU 11	AU 12	AU 13	AU 14
Nose Wrinkler	Upper Lip Raiser	Nasolabial Deepener	Lip Corner Puller	Cheek Puffer	Dimpler
AU 15	AU 16	AU 17	AU 18	AU 20	AU 22
Lip Corner	Lower Lip	Chin	Lip	Lip	Lip

▶ **Level of description**: FACS/emotions/context

Table 11.3. Some examples of combination of FACS action units.

AU 1+2	AU 1+4	AU 4+5	AU 1+2+4	AU 1+2+5
AU 1+6	AU 6+7	AU 1+2+5+6+7	AU 23+24	AU 9+17
AU 9+25	AU 9+17+23+24	AU 10+17	AU 10+25	AU 10+15+17
AU 12+25	AU 12+26	AU 15+17	AU 17+23+24	AU 20+25

- **Level of description**: FACS/emotions/context
- **Individual differences**

Facial Expression Analysis: Problem Space

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- ▶ **Transitions between expressions** Simple and co-articulatory effects

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- **Databases**
- **Relation to other facial/non-facial behaviour** Gestures, vocal intonation, etc...

Facial Expressions - Surveys and Software

- Ciprian Adrian Corneanu, Marc Oliu Simon, Jeffrey F. Cohn and Sergio Escalera Guerrero Survey on RGB, 3D, Thermal, and Multimodal Approaches for Facial Expression Recognition: History, Trends, and Affect-Related Applications IEEE Transactions on Pattern Analysis and Machine Intelligence (Volume: 38, Issue: 8, Aug. 1 2016)

- Evangelos Sariyanidi, Hatice Gunes, and Andrea Cavallaro Automatic Analysis of Facial Affect: A Survey of Registration, Representation, and Recognition. IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 37, No. 6, June 2015

- Li, S., and Deng, W. (2020). Deep facial expression recognition: A survey. IEEE transactions on affective computing.

- https://github.com/TadasBaltrusaitis/OpenFace

Next:

- Affect Control Theory
- Bayesian Affect Control Theory
- Student Presentations