MAS630: Affective Computing

PLEASE FILL OUT INDEX CARD & HAND IN BEFORE YOU LEAVE TODAY:

NAME **Probability taking class for credit**

Email

Program of study & Year in it

Research (thesis) advisor

Why are you interested in affective computing? What topics do you most want to see us cover this semester?

MAS630: Affective Computing

http://courses.media.mit.edu/2015fall/mas630

Rosalind Picard, Sc.D., Professor

Introductions: Who is here…?

Course Logistics

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First ideas about projects due in two weeks!

MIT COUHES – Sept 24 & Oct 27 deadlines

Week 1: Overview

Terminology: Affect, emotions, moods, feelings, expressions, displays…

Basic Emotion: Categories? Dimensions?

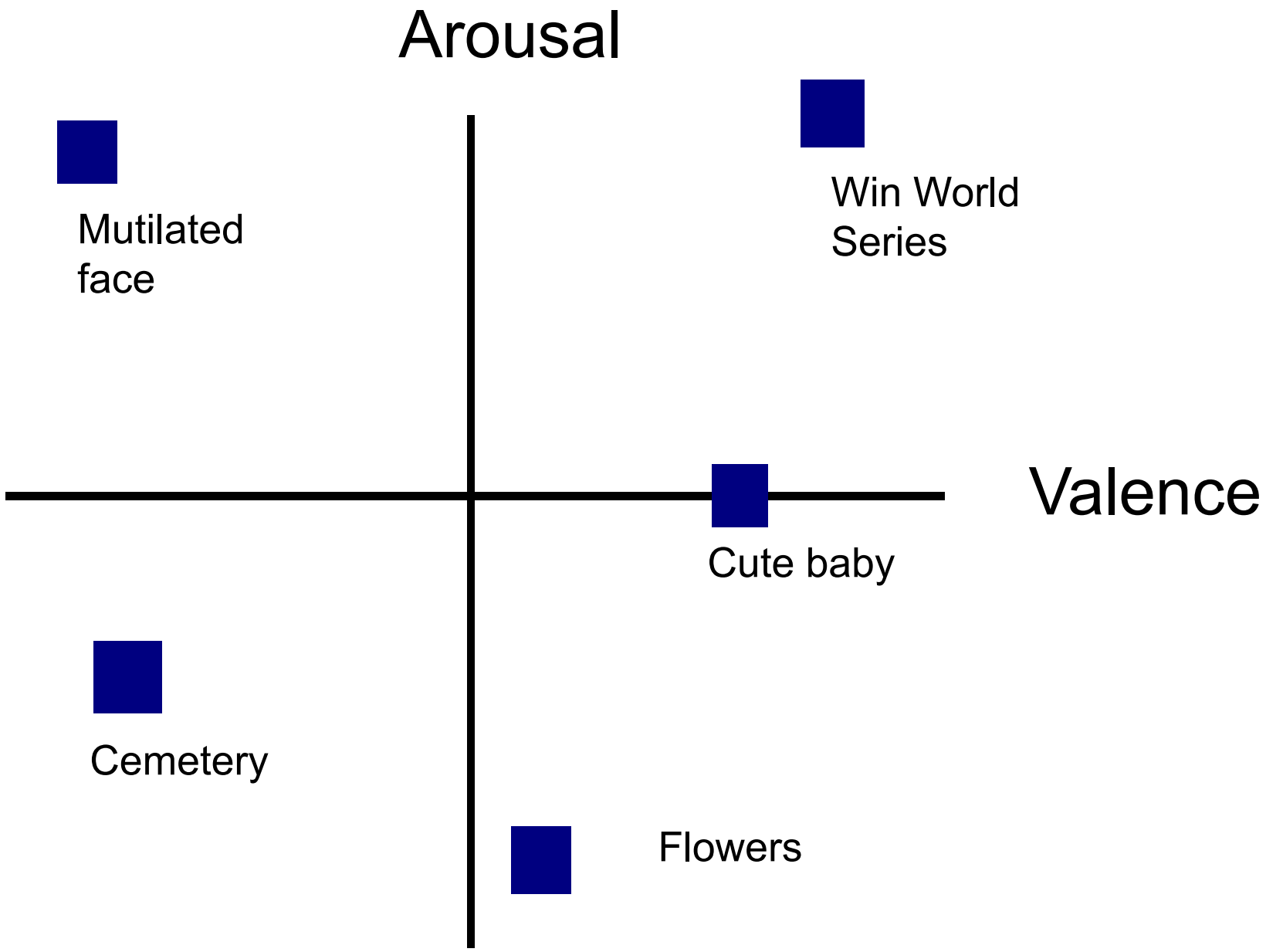
What is emotion? Is it discrete (anger, joy,…) or continuous (aroused-calm, positive-negative, …), or…? *(~100 definitions: Kleinginna & Kleinginna 1981)*

Emotion is like weather. We ALWAYS have emotion.

Continuous: Wind velocity, humidity, temperature, barometric pressure, precipitation

81 ° F / **27** ° C Partly Cloudy Humidity: **79%** Dew Point: **73** ° F / **23** ° C Wind: **6** mph / **9** km/h from the South Pressure: **29.80** in / **1009** hPa Heat Index: **85** ° F / **30** ° C Visibility: **6.2** miles / **10.0** kilometers UV: 0 out of 16 Clouds: **Few 1300** ft / **396** m **6** mph / **9** km/h , Wind Dir: **190°** (South) Ceiling: Unlimited

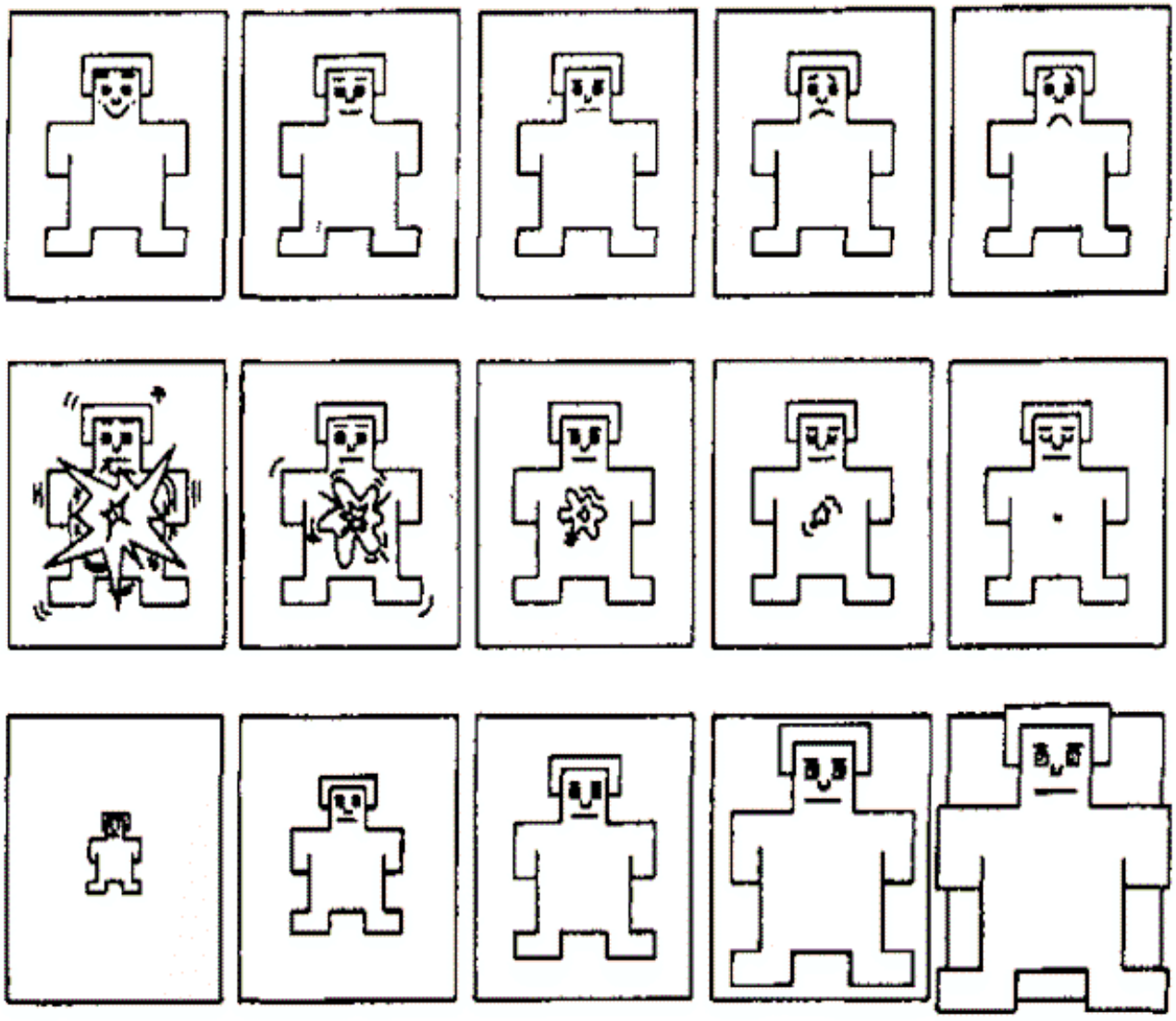
Discrete: Storm, tornado, blizzard, hurricane, typhoon



Skin conductance is a good indicator of arousal, which is a good indicator of memory and attention

FIGURE 1

The Self-Assessment Manikin (SAM)



Which emotion is this person feeling?

Image courtesy of Eduardo Siquier Cortés on flickr. License CC BY-NC-SA.

Happiness

Anger

Surprise

Fear

Sadness

Disgust

Which emotion is this person feeling?

Pride

Anger

Surprise

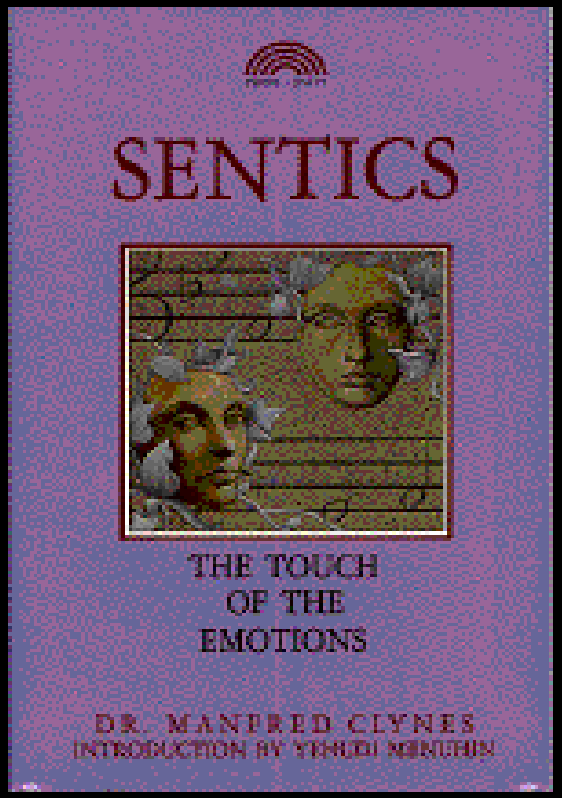
Fear

Sadness

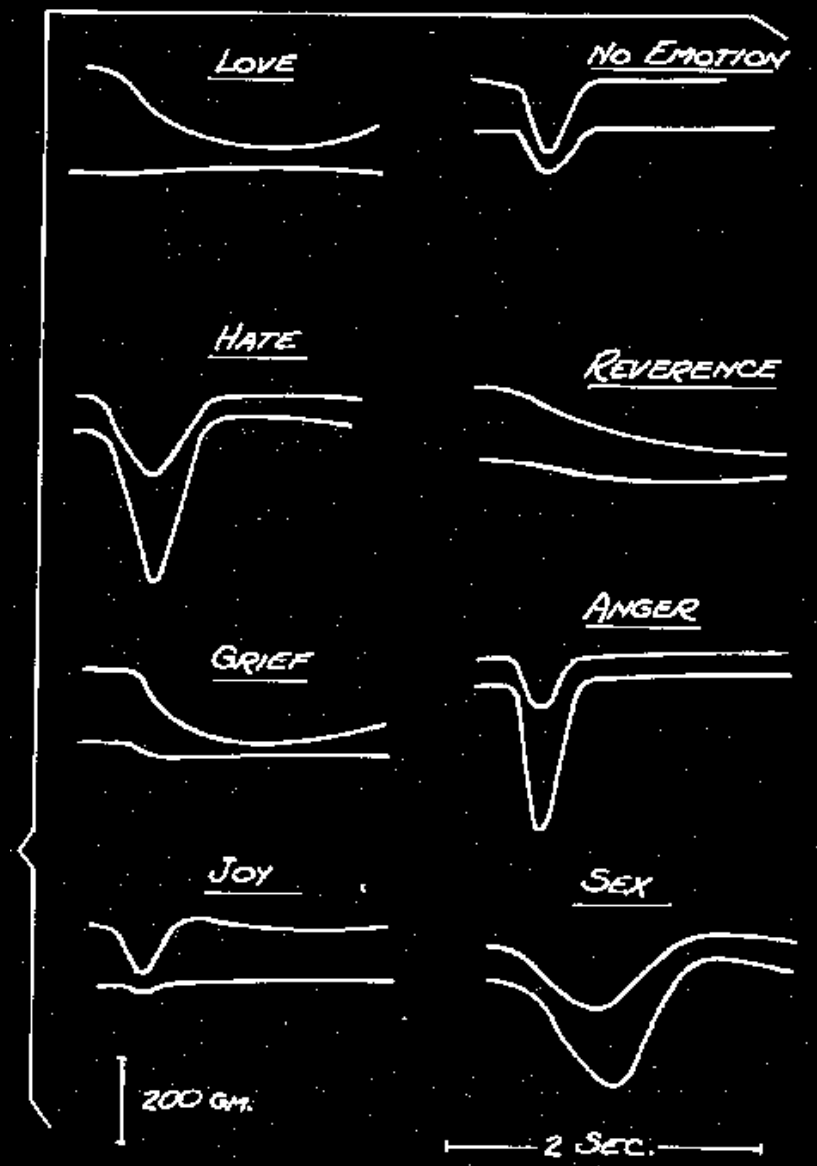
Disgust

(works for any positive term – happy, joy, pride, elated, serenity, etc.)

Emotional touch can be measured



1977, Manfred Clynes (Also coined “cyborg” in Clynes & Klein, 1960)



Essentic Forms (Clynes)

What is affective computing?

Computing that relates to arises from or deliberately influences emotion or other affective phenomena.

Giving technology skills of "emotional intelligence" for interacting with us

Motivation for AC…

This character barges into your office when you're busy. He doesn't apologize, and doesn't notice you are annoyed.

He offers you useless advice.
You express more annoyance. He ignores it.

He continues to be unhelpful. *The clarity of your emotional expression escalates.*

He ignores it.

(this goes on)

Finally you tell him explicitly "Go Away"

He winks, and does a happy little dance before exiting.

…doesn't notice you are annoyed.

[Doesn't recognize your emotion]

You express more annoyance. He ignores it.

[Doesn't respond appropriately to emotion]

He winks, and does a happy little dance before exiting.

[Stupid about expressing emotion.]

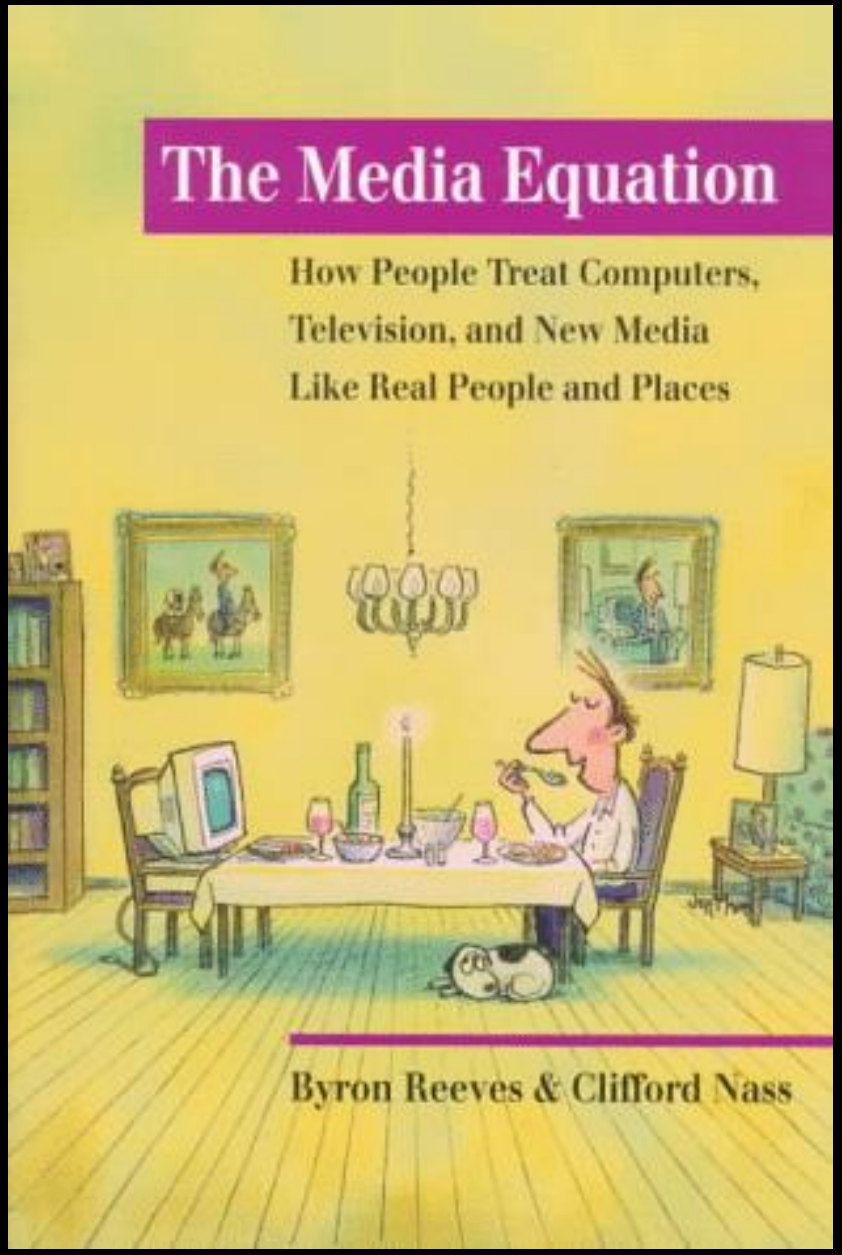
Skills of *Emotional Intelligence:*

- **Expressing emotions**
- **Recognizing emotions**
- **Handling another's emotions**
- **Regulating emotions** \
- **Utilizing emotions** / **if "have emotion"**

(Salovey and Mayer 90, Goleman 95)

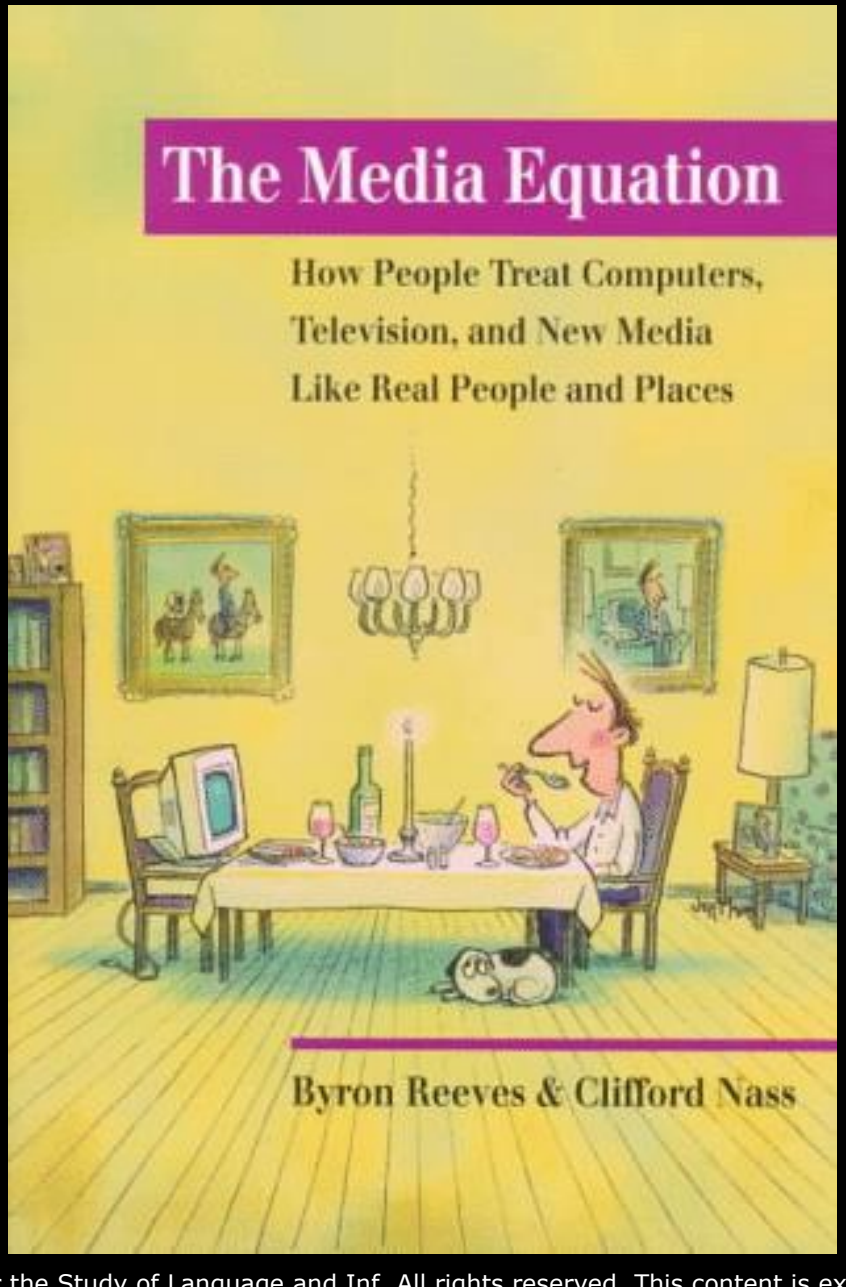
You may already be an expert at this.

Here is why.



Human - computer interaction is natural and social

(Reeves and Nass 1996)



Human- human interaction

Suppose that a person starts to give you help at a bad time.

You try ignoring, then frowning at, then maybe glaring at him or her...

The *smart* person infers you don't like this, ceases the interruption, notes the context, and learns from the feedback.

Human- interaction

Suppose that a starts to give you help at a bad time.

You try ignoring, then frowning at, then maybe glaring at ...

The *smart* infers you don't like this, ceases the interruption, notes the context, and learns from the feedback.

Human-Computer interaction

Suppose that a computer starts to give you help at a bad time.

You try ignoring, then frowning at, then maybe glaring at it...

The *smart* computer infers you don't like this, ceases the interruption, notes the context, and learns from the feedback.

“But the computer wouldn’t frustrate people if it was only more *intelligent*?”

Consider:

“But the person wouldn’t frustrate people if he/she was only more *intelligent*?”

Fact: The most intelligent people are still frustrating (at least sometimes).

People and computers can’t always prevent frustration. Thus, they should be prepared to handle it intelligently.

Emotional intelligence includes:

1. Notice when the person you're interacting with is frustrated (or showing another emotional state).
2. Determine how best to respond.
3. Respond/make it so.
4. Assess how that worked.
5. Learn. Adjust if needed for next time.

Intelligent expression by computers requires first recognizing affective context (and also considering goals & predicting outcome)

Image courtesy of charamelody on flickr. License CC BY-NC.

These should stop looking happy

Image courtesy of Alex Muller on flickr. License CC BY-NC-SA.

"Like one who takes away a garment on a cold day, or like vinegar poured on soda, is one who sings songs to a heavy heart" Proverbs 25:20

Week 2: From your homeworks…

How should a car voice sound, given a driver is either Happy or Upset?

Driver Affect: Car Voice:	Happy Enthused	Happy Subdued	Upset Enthused	Upset Subdued
Number of accidents				
Minutes driver spoke				

Jonsson, I.-M. and Nass, C. (2004) Effects of driver emotion and car voice emotion on actual and perceived driving performance. Stanford CA: Stanford Univ.

Finding: Choosing response appropriate to driver affective state improves driver safety and performance.

Driver Affect: Car Voice:	Happy Enthused	Happy Subdued	Upset Enthused	Upset Subdued
Number of accidents	2	8.3	9.6	6.3
Minutes driver spoke	5.8	4.2	3.9	4.7

Jonsson, I.-M. and Nass, C. (2004) Effects of driver emotion and car voice emotion on actual and perceived driving performance. Stanford CA: Stanford Univ.

How do we measure emotion?

Emotions give rise to changes that can be sensed:

Distance Sensing:	Face, voice
	Posture
	Gestures, movement, behavior
Up-close Sensing:	Temperature
	Respiration
	Pupil dilation
	Skin conductance
	ECG, EEG, Blood pressure
Internal Sensing:	Hormones
	Neurotransmitters
	…

What are the natural affordances of the environment?

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Image courtesy of Daniel Hoherd on flickr.
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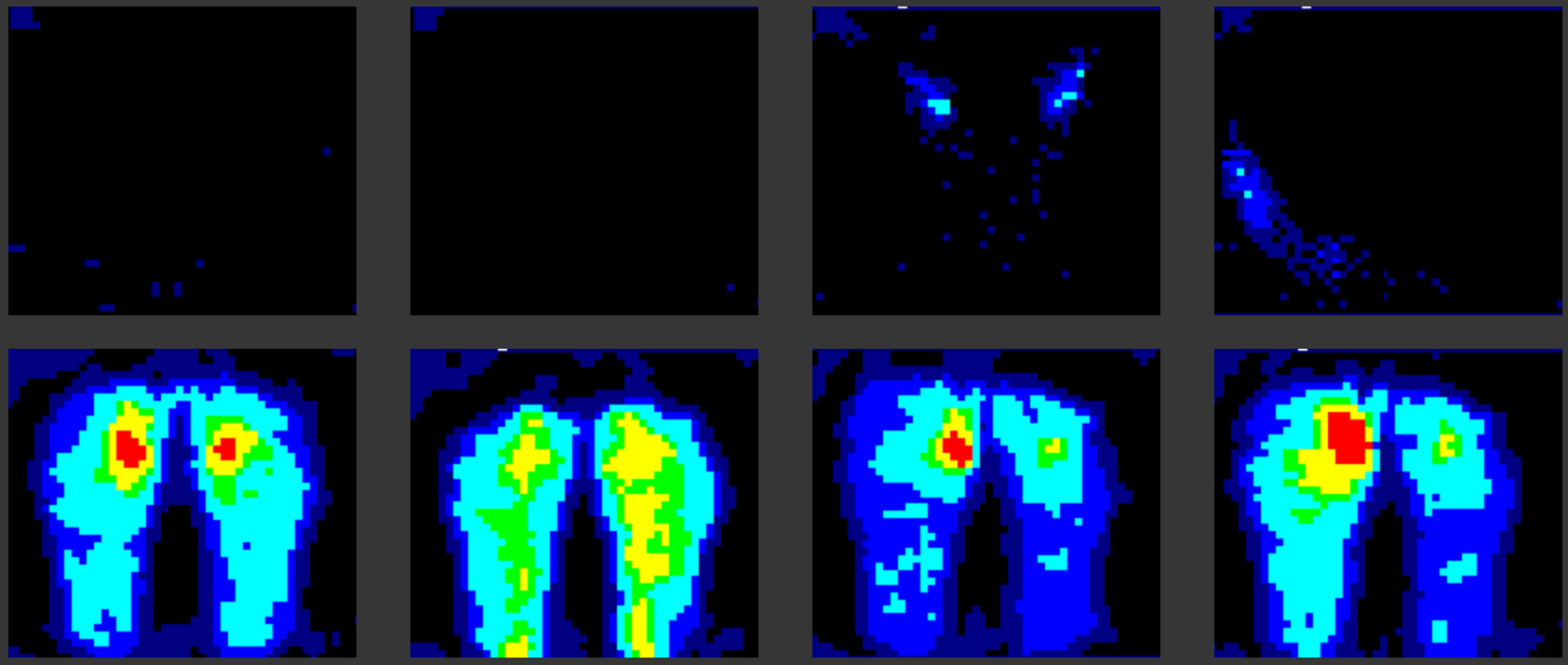
Mouse pressure may increase with frustration, distress

Pressure Sensitive Mouse

(Reynolds)

frustration linked to factors that cause wrist problems
(Dennerlein, et al., International Ergonomics Association ’03)

Can we teach a chair to recognize behaviors indicative of interest and boredom? (Mota & Picard)



Sit upright | Lean Forward | Slump Back | Side Lean

Sensor chair is a significant nonverbal channel for discriminating learner interest…

Results (on children not in training data, Mota and Picard, 2003):
69-83% accuracy recognizing if child is in state of:
High Interest, Low interest, Taking a Break

Emotion recognition & response

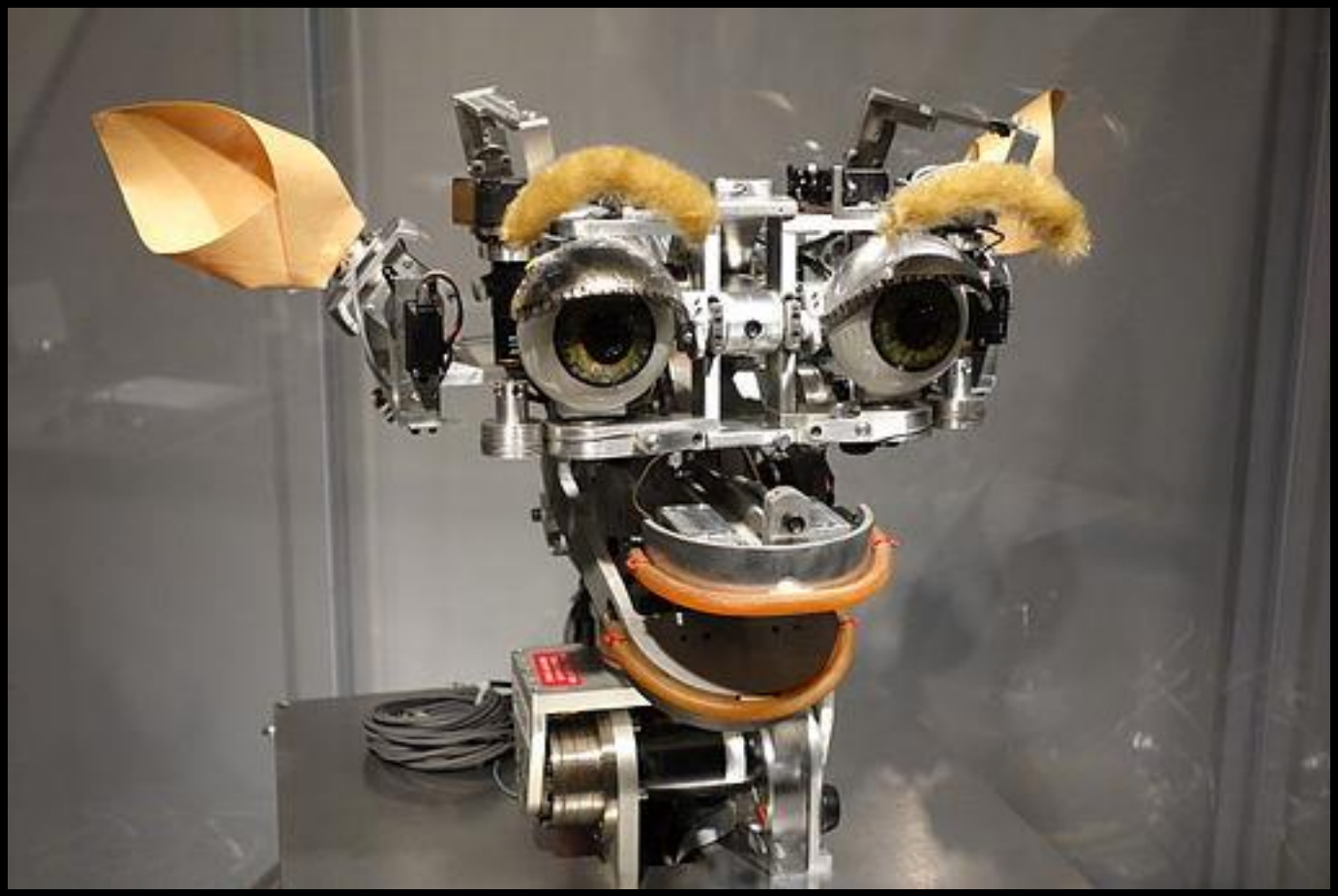


Image is in the public domain.

"Kismet" robot

Emotional arousal and physiology

Subject intentionally expressing 8 emotions:

1. **Neutral**
2. **Anger**
3. **Hate**
4. **Grief**
5. **Platonic Love**
6. **Romantic Love**
7. **Joy**
8. **Reverence**

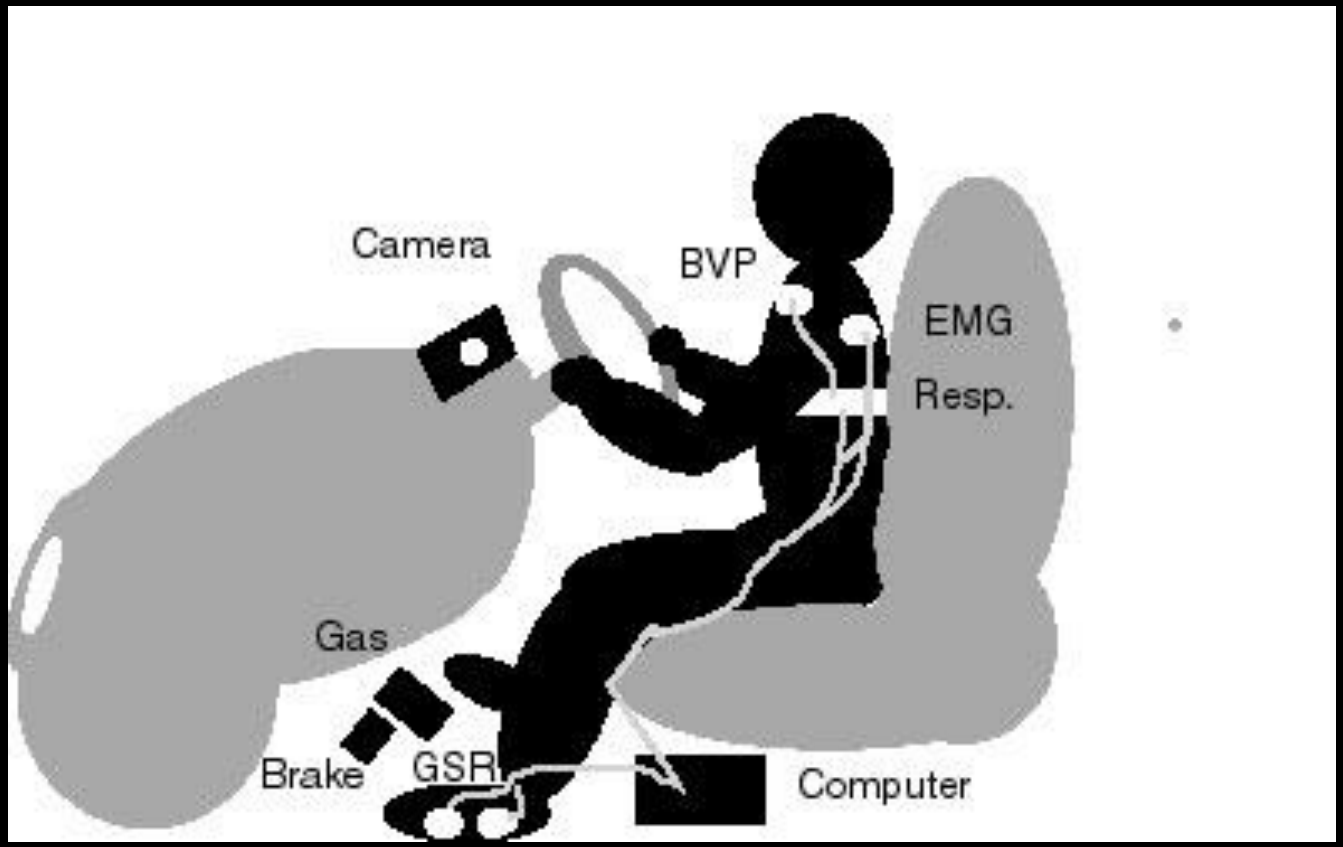
Each emotion collected daily, for > 4 weeks

4 physiological signals:
EMG on jaw, skin conductance, BVP, respiration

Classification Accuracy:

81% on 8 emotions (person dependent)

Picard et al., IEEE Trans. Pattern Analysis Machine Intell.,Oct 2001.



Simultaneously examine physiology and behavior for recognizing level of stress: up to 96% accurate, across 12 drivers.

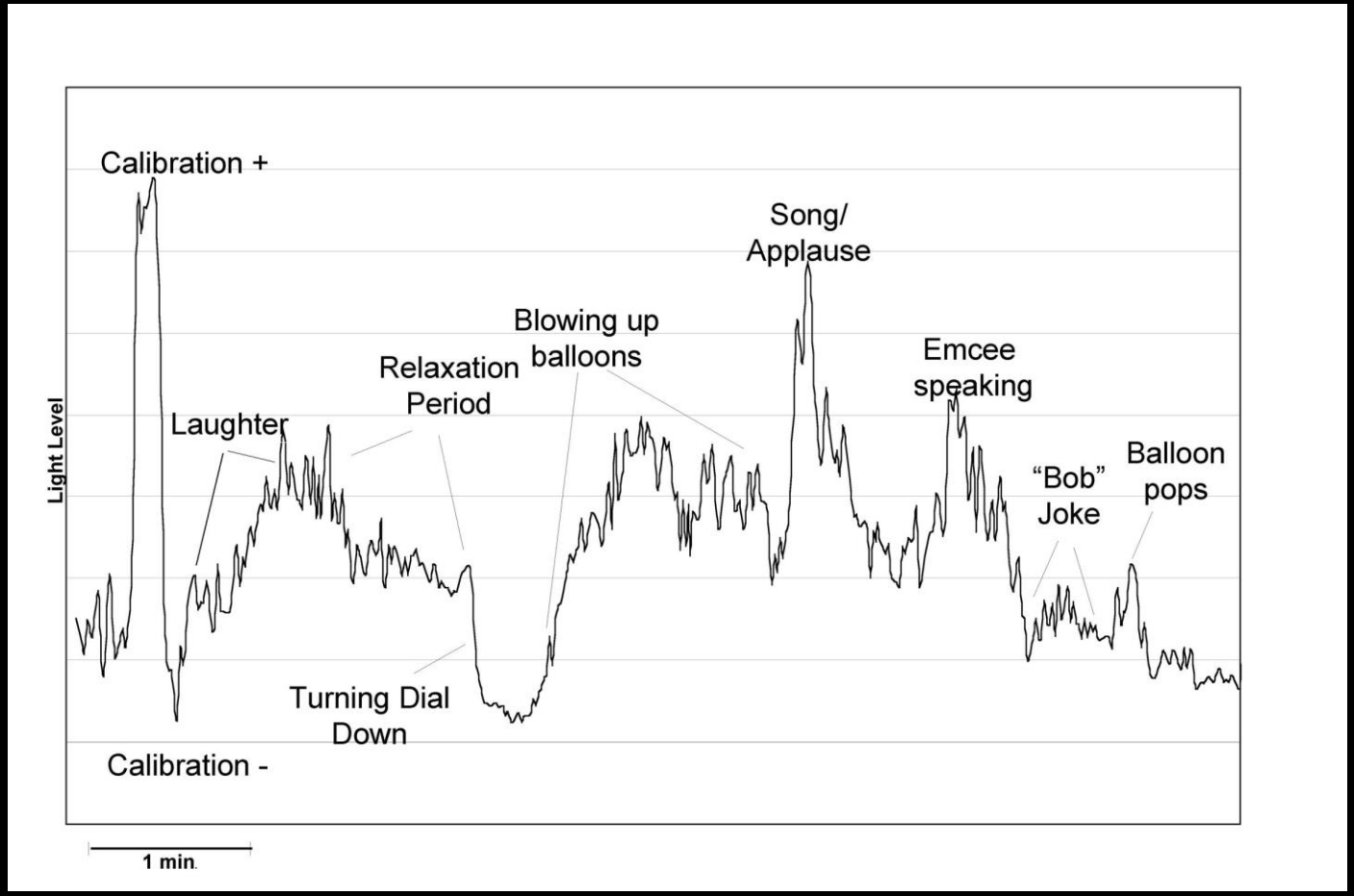
(Healey and Picard, ICPR 2000)

皮膚の伝導性に関する再考

Rethinking skin conductance sensing

(Selene Mota, Hoda Eydgahi, Rich Fletcher)

Audience's "glow" (aggregate skin conductivity) conveys excitement



www.media.mit.edu/galvactivator

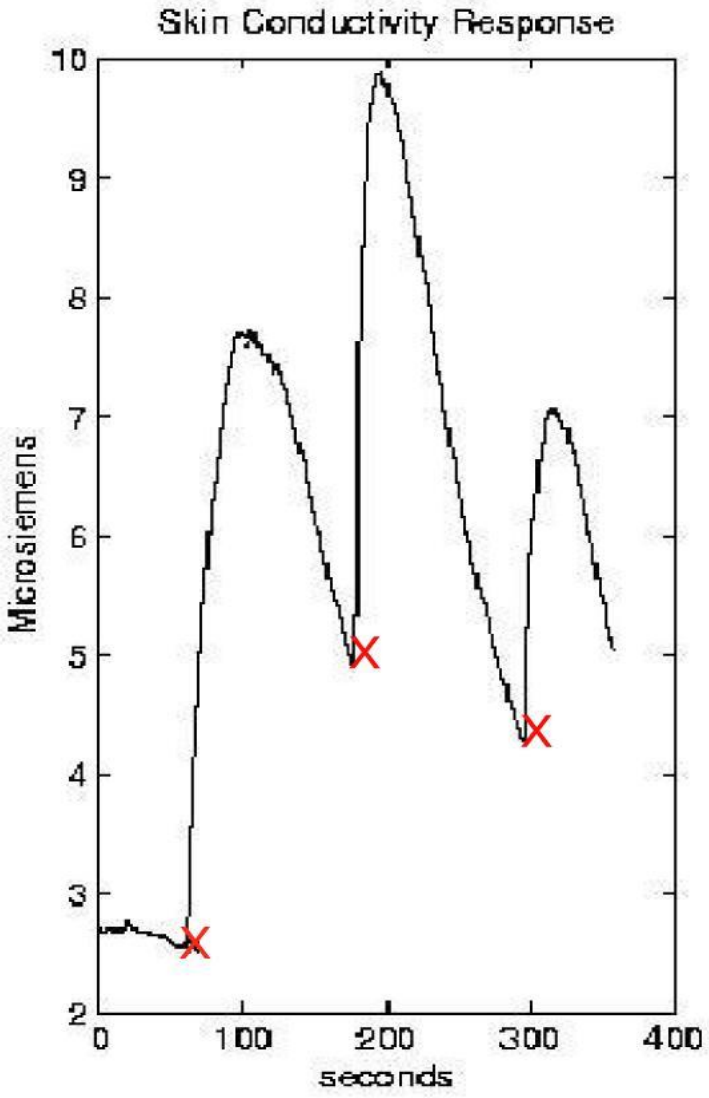
Skin conductance often increases with these:

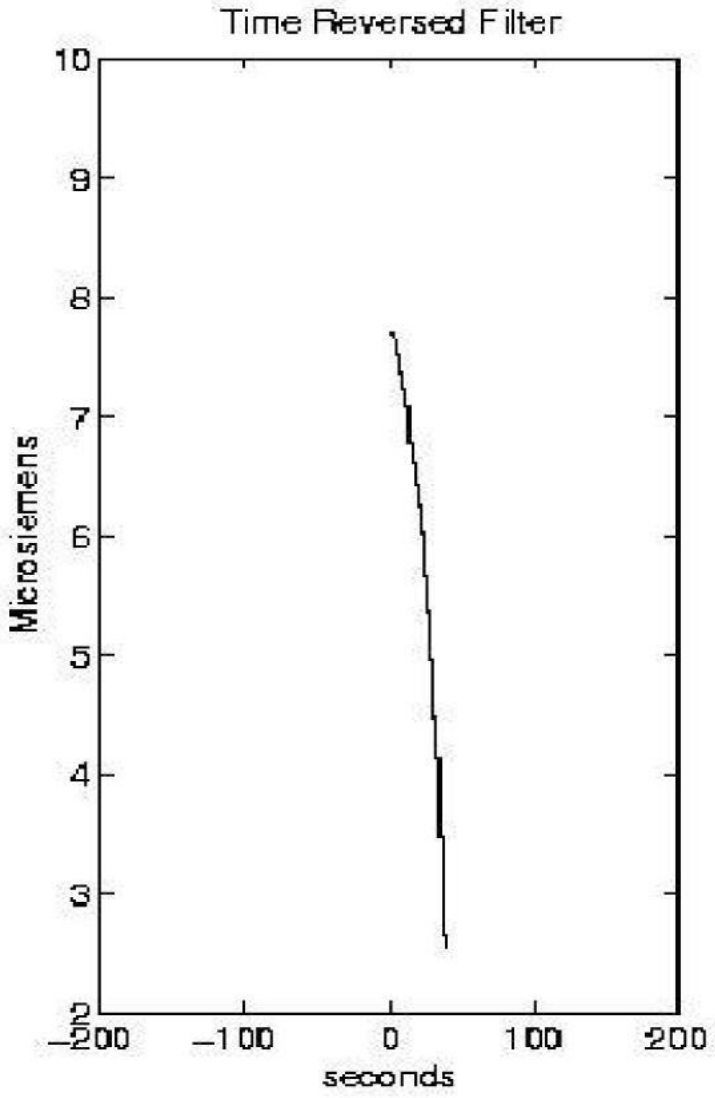
- Significant thoughts
- Exciting events
- Exercise/breathing deeply
- Motion artifacts
- Humidity/moisture increase
- Lying
- Pain

StartleCam:
A Cybernetic Wearable Camera

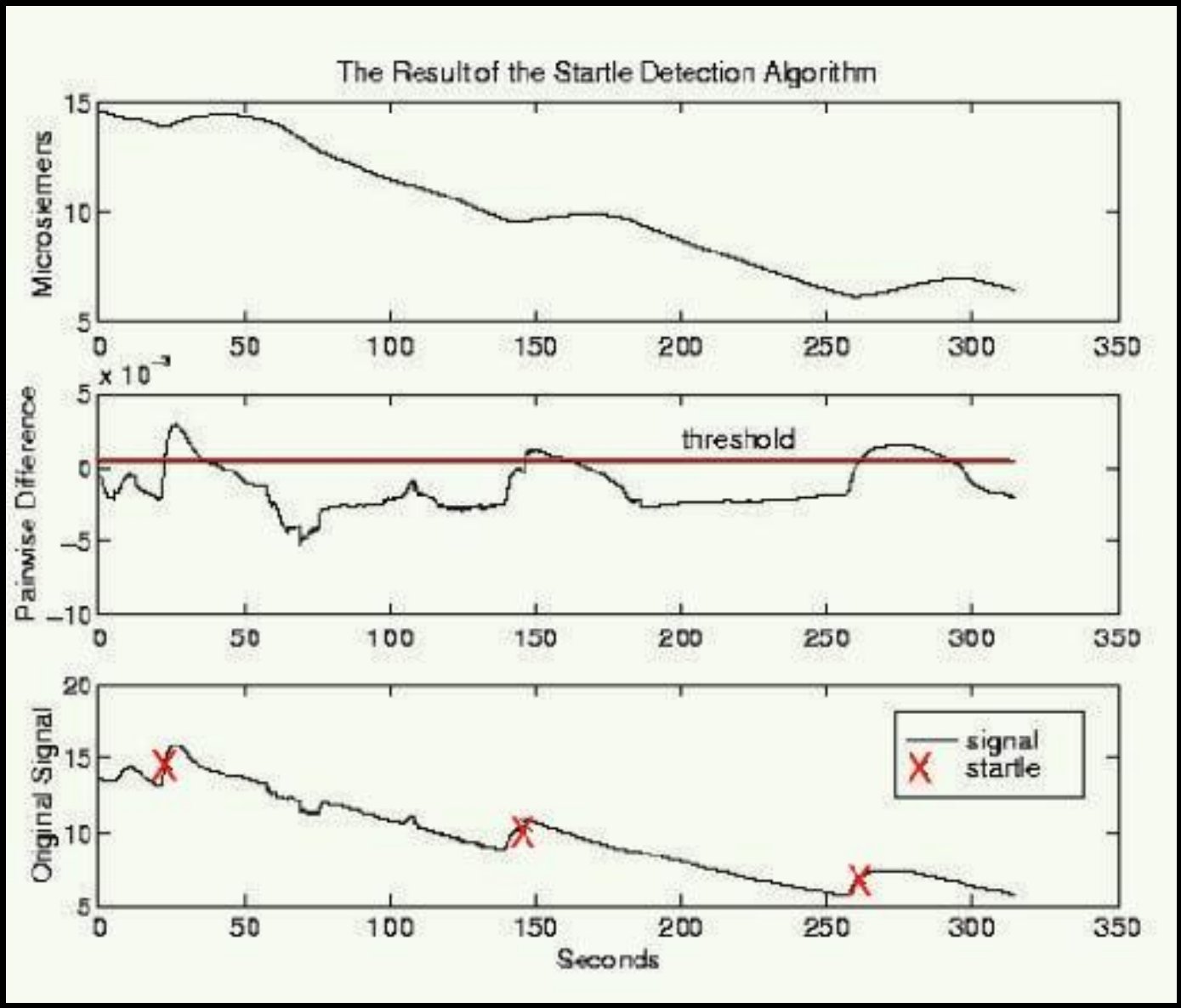
(Healey & Picard, ISWC 98)

StartleCam Filter



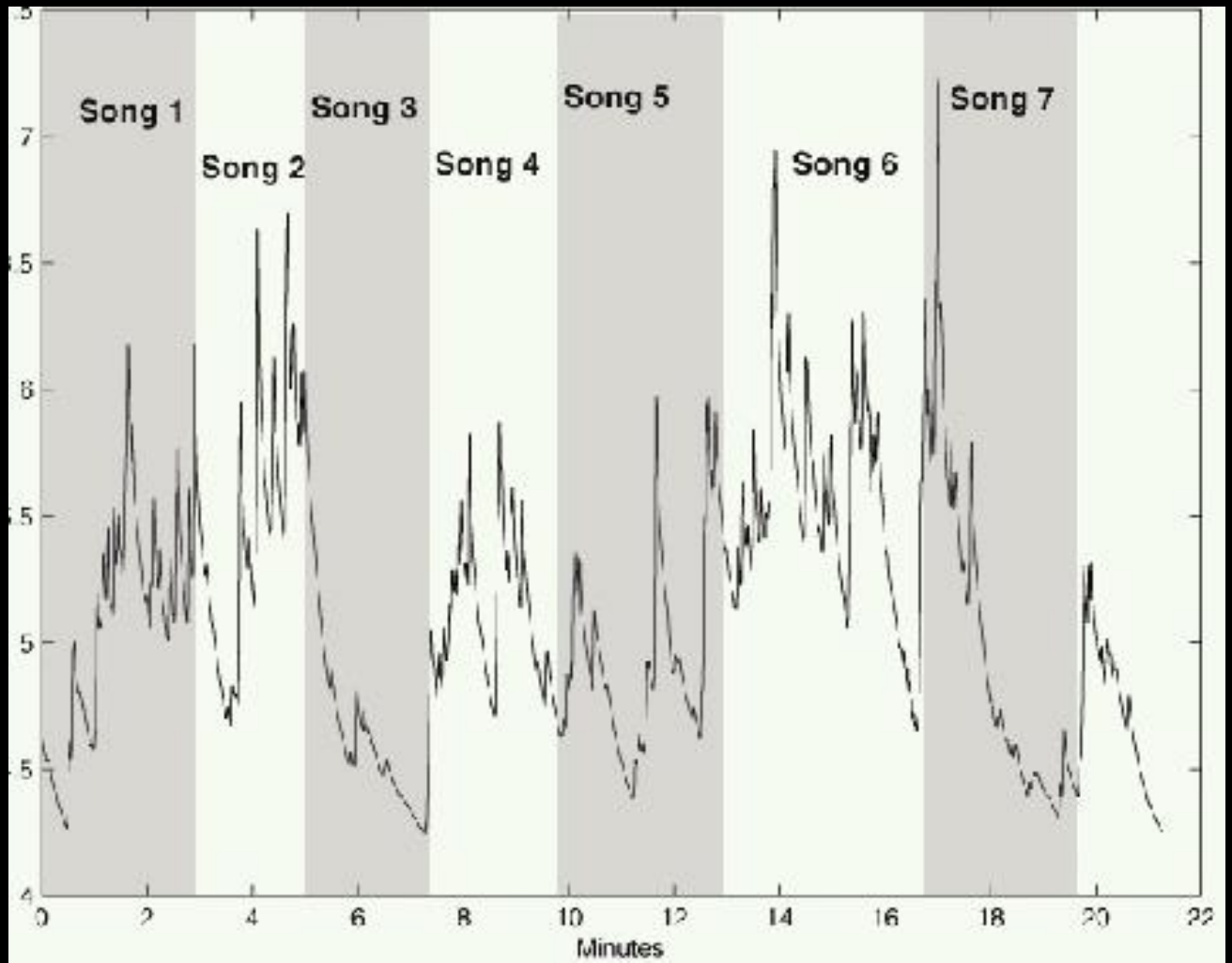


StartleCam Filter Algorithm



Wearable Affective DJ chooses music

from your play-list that helps you attain the level of "activation" you specify or otherwise regulate your feelings/mood (Healey, Dabek, Picard, 1998)



Week 3: From your homeworks…

EDA, GSR etc.

Electrodermal activity (EDA): general phenomenon

Ways to measure: conductance, potential, resistance, etc.

Old terminology (not specific – could refer to any of the above): GSR

Errors

- GSR is traditionally measured on the “non-dominant hand” (Chap 14 says dominant) Note: We now think it’s important to measure both sides in many cases, and the dominant side for more threat/anxiety/grief/sadness

Errors

- HR increases do not imply an increase in Sympathetic Nervous System (SNS) activation. HR increases may also be caused by withdrawal of the vagus nerve, part of the Parasympathetic Nervous System (PNS)

Errors

These are not the same:

- Conductance is (microSiemens).
- Conductivity is conductance per unit of length (microSiemens/cm).

References

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Healey, Jennifer, Rosalind W. Picard, and Frank Dabek. "A New Affect-Perceiving Interface and Its Application to Personalized Music Selection." *Proceedings of the 1998 Workshop on Perceptual User Interfaces* (1998): 4-6.

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