

# Assessing quasi-spontaneous natural emotional facial expressions from the I.Vi.T.E. database



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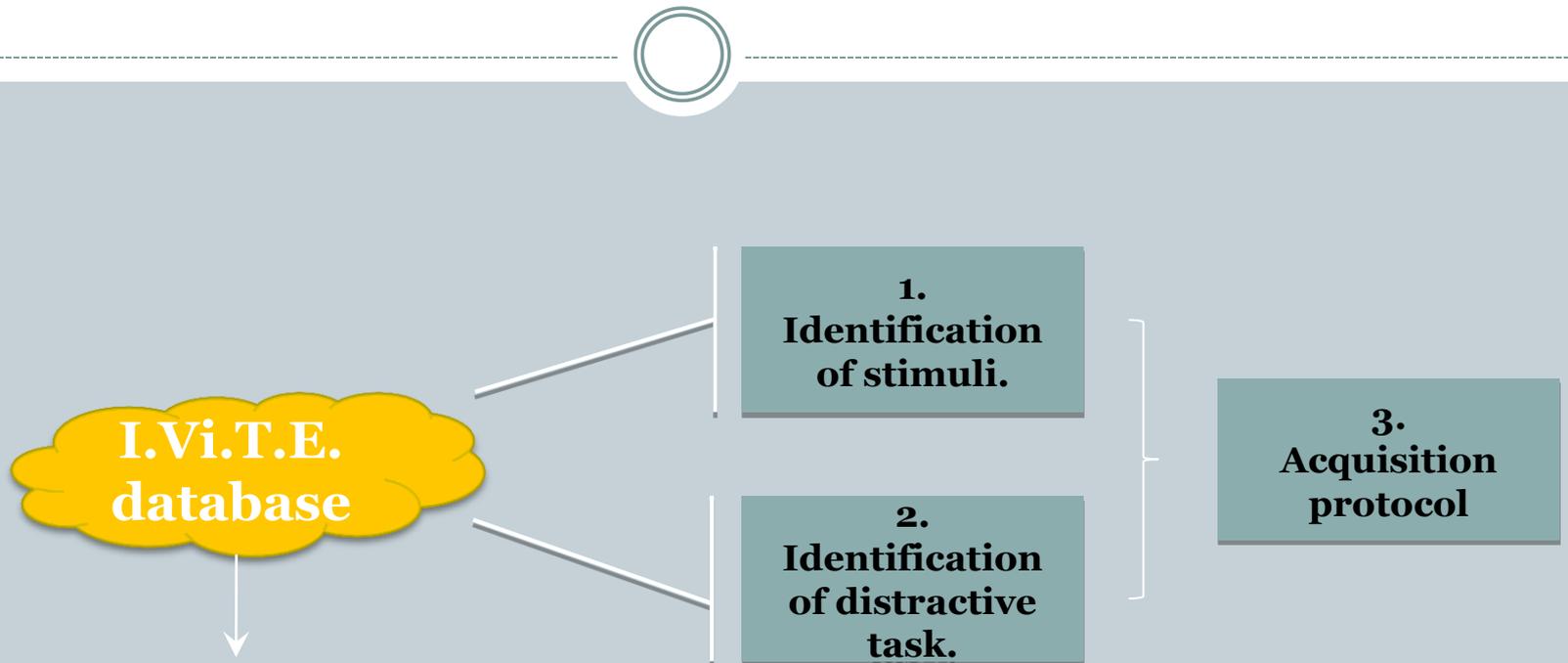
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# I.Vi.T.E. Database Design (Esposito et al. 2012)



## • Induced emotion:

+ **benefits:** higher control over the situation, the possibility to measure natural responses to predefined stimuli

-R. Cowie, et al. (2005)

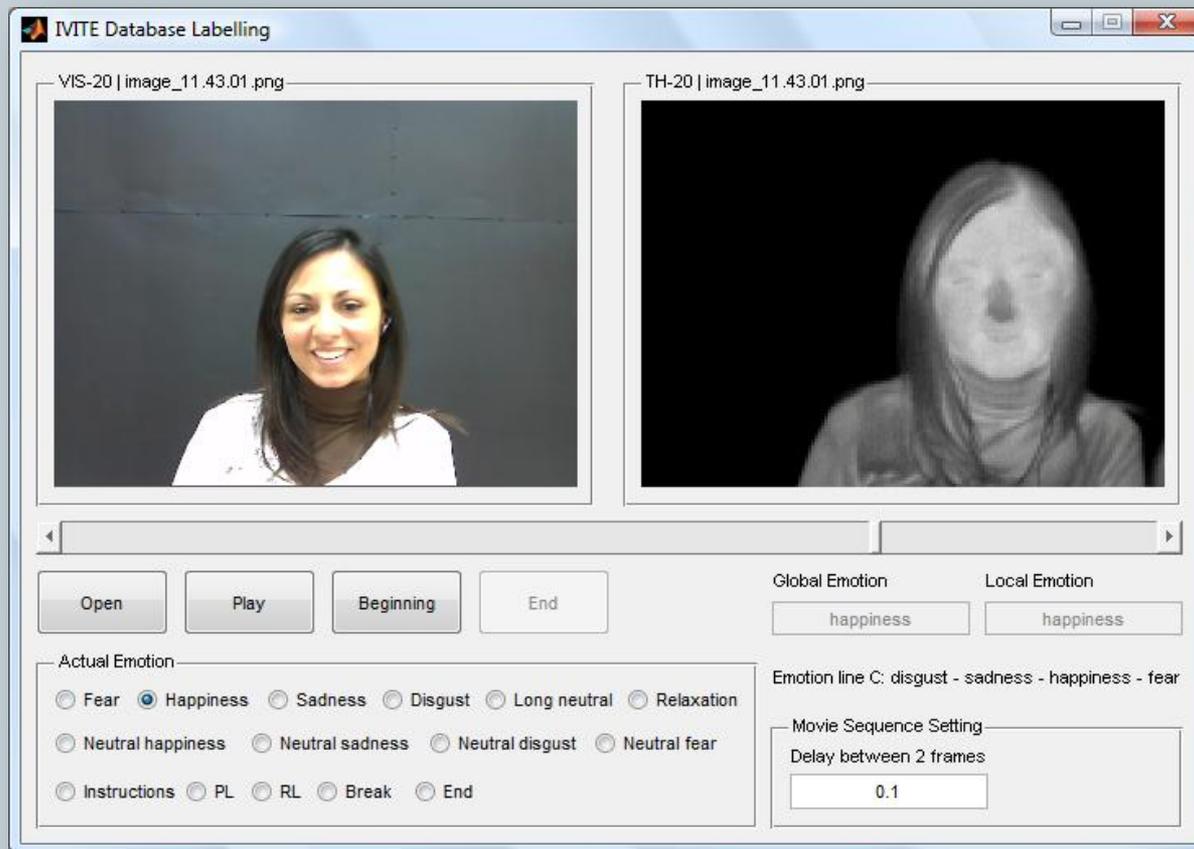
# I.Vi.T.E. database



- **Total number of subjects:** 49 Italian undergraduate students ranging from 22 to 28 years old (Number of subject without any problems: 38), looking at a sequence of selected videos. The audio was listened by headphones.
- **Size of database:** 29.8GB (Thermal: 1.2GB, Visible: 28.6GB). Consists of one image per second in .png format.
- **Selected frame:** 479 thermal image and 479 natural image
- **Acquisition cameras:** thermal (testo 880-3) and webcam (Logitech).
- **Temperature range:** 23-38 °C
- **Image resolution:** thermal 160 × 120 pixels and visible 640 × 480 pixels.

**Figure 1.** *Acquisition laboratory.* On the top, a user looking at the presentation computer and being recorded by the thermal and webcam cameras. On the bottom the presentation computer and the recording laptops (the user is behind the white rack)

# Acquisition procedure: I.Vi.T.E



**Figure 2.** software for manual labelling of I.Vi.T.E.

# Theoretical premise



- *Universality of facial expressions*  
(Ekman, 2003)
- *Universality of the allocation process*  
(Russell, Fernandez-Dols, 1997)
- *Ekman Standard Paradigm*  
(Rosemberg, Ekman, 1995)

# Ekman Standard Paradigm



- Participation of university students as observers and judges
- The use of preselected photographs depicting the six basic emotions (joy, anger, fear, surprise, sadness, disgust)
- A within-subject experimental design

# HOW DO THEY FEEL NOW?



## Goal

Evaluation of the I.Vi.T.E selected frames depicting emotional facial expressions

# Materials



- 479 selected images (disgust=51; fear=89; happiness=89; sadness=109; neutral=141) from I.Vi.T.E. database equally distribute to six conditions ( a, b, c, d, e, f)
- Superlab experimental device used to evaluate pictures: six possible label answers (sadness, happiness, disgust, fear, neutral, others) and 7 intensity level (from 1 very weak to 7 very strong)

# Acquisition procedure

**Subject**  
*n 120 subjects*  
*age 18 - 30 years old*

Male (n 60)  
Female (n 60)

The 479 selected pictures were classified by their emotions (disgust, fear, happiness, sadness and neutral) and distributed to six different conditions (A, B, C, D, E, F).

18 minutes →

TIME	TASK
3 minutes	Explanation of “what to do”
3 minutes	Presentation of the Erq
9 minutes	Execution of recognition Task according one of the 4 conditions as reported before
3 minutes	Relaxation (explanation of donor’ impressions)

**Table 1.** Timing of the acquisition for each user. The total length of the task is about 18’ min.

# The new emotional facial expressions data



- The criterion for the selection of the stimuli is 70% or more of correct recognition.

# An extract of data assessment



	Happy	Sadness	Disgust	Fear	neutral	other	%
VIS_break_16_image_18.27.10_tempr-32.4359	100	0	0	0	0	0	100
VIS_happy_05_image_17.21.11_tempr-30.9413	100	0	0	0	0	0	100
VIS_happy_06_image_10.00.55_tempr-30.6168	100	0	0	0	0	0	100
VIS_happy_06_image_10.01.35_tempr-30.6006	100	0	0	0	0	0	100
VIS_happy_06_image_10.04.35_tempr-30.444	100	0	0	0	0	0	100
VIS_happy_09_image_12.37.52_tempr-32.6271	100	0	0	0	0	0	100
VIS_happy_09_image_12.41.23_tempr-32.621	100	0	0	0	0	0	100
VIS_happy_16_image_18.26.56_tempr-32.1785	100	0	0	0	0	0	100
VIS_happy_16_image_18.24.20_tempr-32.4937	95	0	0	0	5	0	100
VIS_happy_05_image_17.23.45_tempr-30.8556	90	5	0	0	0	5	100
VIS_break_04_image_16.30.27_tempr-30.8358	85	0	0	0	10	5	100

**Table 2.** An extract of confusion matrix of happiness images. Condition E

# An extract of data assessment



	Happy	Sadness	Disgust	Fear	neutral	other	%
VIS_fear_45_image_13.25.17_tempr-30.2512	0	0	100	0	0	0	100
VIS_disgust_42_image_11.40.05_tempr-31.5096	0	5	95	0	0	0	100
VIS_neutral-fear_42_image_11.08.58_tempr-31.4495	0	15	75	0	5	5	100
VIS_neutral-fear_48_image_16.02.10_tempr-30.753	5	20	70	0	0	5	100
VIS_disgust_46_image_15.00.22_tempr-29.7586	0	15	65	0	5	15	100
VIS_fear_39_image_18.22.31_tempr-30.7632	5	20	65	10	0	0	100
VIS_disgust_44_image_13.13.57_tempr-29.5972	0	10	60	0	20	10	100
VIS_neutral-fear_39_image_18.25.42_tempr-30.8169	0	15	55	10	5	15	100
VIS_fear_40_image_09.28.58_tempr-30.413	0	0	50	35	0	15	100
VIS_fear_45_image_13.28.43_tempr-30.2299	0	0	50	10	5	35	100
VIS_fear_45_image_13.25.17_tempr-30.2512	0	0	100	0	0	0	100

**Table 3.** An extract of confusion matrix in percentage of disgust images. Condition D

# Happiness



HAPPY STIMULI	% answer	intensity
VIS_break_16_image_18.27.10_tempr-32.4359	100	6,55
VIS_happy_32_image_12.20.57_tempr-30.6461	100	6
VIS_happy_06_image_10.04.35_tempr-30.444	100	6
VIS_happy_09_image_12.41.23_tempr-32.621	100	5,7

**Table 4.** *An extract of 4 highest happy facial expressions.*

# Happiness



VIS\_break\_16\_image\_18.27.10\_tempr-32.4359



VIS\_happy\_32\_image\_12.20.57\_tempr-30.6461



VIS\_happy\_06\_image\_10.04.35\_tempr-30.444



VIS\_happy\_09\_image\_12.41.23\_tempr-32.621



# Conclusions



- Only 30% of the initial data were correctly assessed according our criterion. 144 images can be considered valid: 42 happiness, 24 sadness, 36 disgust and 42 neutral.
- Among the stimuli, fear was not included because it does not fulfill the choice's criterion.

# HOW DO SHE FEEL NOW?



VIS\_fear\_45\_image\_13.25.17\_tempr-30.2512



**Disgust**

% answer	intensity
100	5,75

# Matching failed ??



VIS\_fear\_45\_image\_  
13.25.17\_tempr-  
30.2512

VIS\_sad\_16\_image\_1  
7.56.28\_tempr-  
32.0756

VIS\_disgust\_05\_image  
\_17.47.51\_tempr-  
30.8904

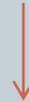
VIS\_fear\_16\_image\_  
18.15.29\_tempr-  
32.6607



**Disgust**



**Neutral**



**Sadness**



**Neutral**

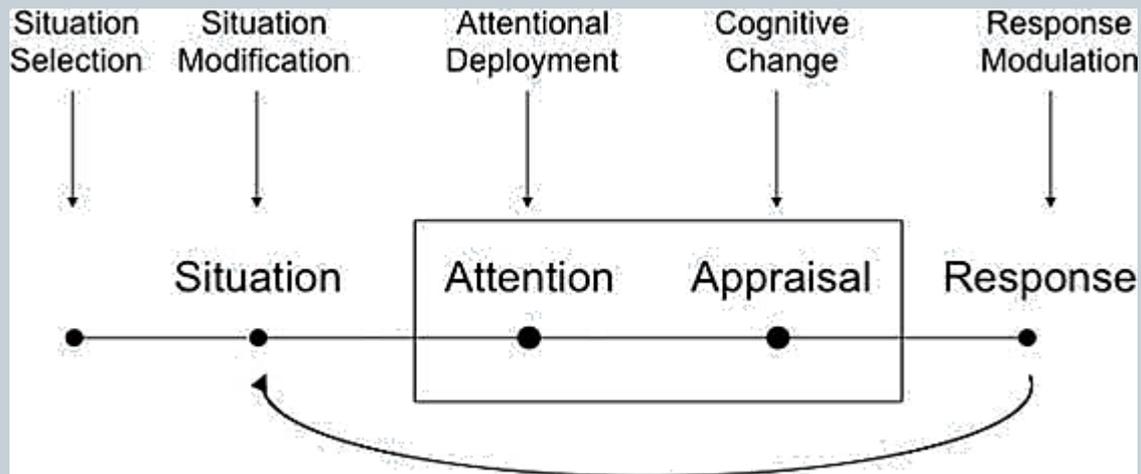


	<b>SADNESS STIMULI</b>	<b>% answer</b>	<b>intensity</b>
<b>Disgust</b>	VIS_fear_45_image_13.25.17_tempr-30.2512	100	3,9
<b>Neutral</b>	VIS_sad_16_image_17.56.28_tempr-32.0756	70	4,9
<b>Sadness</b>	VIS_disgust_05_image_17.47.51_tempr-30.8904	75	4,1
<b>Neutral</b>	VIS_fear_16_image_18.15.29_tempr-32.6607	90	4,3

# How to express and control variability?



1. This variability is hard to control. Our suggestion would be:



**Figure 1.** Figure 2. A process model of emotion regulation that highlights five families of emotion regulation strategies (from Gross & Thompson, 2007).



- **The effects of induced emotional states on emotional experience: a research agenda.**

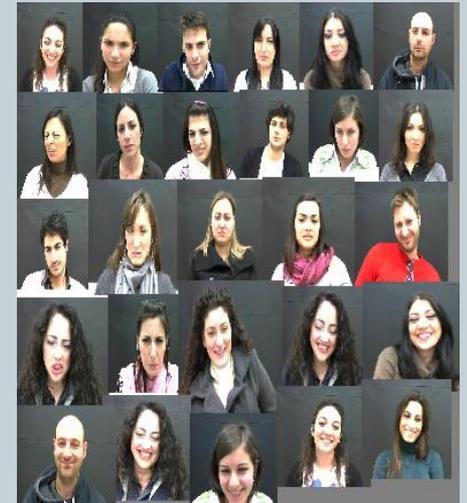
*Vincenzo Capuano<sup>1</sup>, Maria Teresa Riviello<sup>1</sup>, Anna Esposito<sup>1</sup>, Gennaro Cordasco (2012, submitted)*



*The human face ... is a commanding, complicated, and at times confusing source of information.*

*(Ekman, Paul, Wallace V. Friesen, and Phoebe Ellsworth, 1972)*

**THANK YOU FOR YOUR  
ATTENTION**





# Sadness



SADNESS STIMULI	% answer	intensity
VIS_long-neutral_03_image_15.39.32_tempr-30.3505	75	3,9
VIS_sad_42_image_11.27.42_tempr-31.5917	65	4,9
VIS_disgust_05_image_17.47.51_tempr-30.8904	75	4,1
VIS_neutral-disgust_26_image_15.55.53_tempr-31.0067	55	3,2

# Sadness



VIS\_long-  
neutral\_03\_image\_1  
5.39.32\_tempr-  
30.3505



VIS\_sad\_42\_image\_1  
1.27.42\_tempr-  
31.5917



VIS\_disgust\_05\_image  
\_17.47.51\_tempr-  
30.8904



# Disgust



DISGUST STIMULI	% answer	intensity
VIS_fear_45_image_13.25.17_tempr-30.2512	100	5,75
VIS_disgust_42_image_11.40.05_tempr-31.5096	95	5,7
VIS_disgust_20_image_11.17.53_tempr-30.4719	90	6,6
VIS_disgust_06_image_09.44.25_tempr-30.5923	85	5,65

# Disgust



VIS\_fear\_45\_image\_  
13.25.17\_tempr-  
30.2512

VIS\_disgust\_42\_imag  
e\_11.40.05\_tempr-  
31.5096

VIS\_disgust\_05\_image  
\_17.47.51\_tempr-  
30.8904

VIS\_disgust\_06\_image  
\_09.44.25\_tempr-  
30.5923855,65



# Fear



FEAR STIMULI	% answer	intensity
VIS_neutral-fear_01_image_12.42.49_tempr-34.5604	45	4,5
VIS_neutral-sad_06_image_09.29.04_tempr-30.9181	40	4,25
VIS_fear_40_image_09.28.58_tempr-30.413	35	4,4
VIS_fear_20_image_11.52.21_tempr-30.1701	30	4,5

# Fear



VIS\_neutral-  
fear\_01\_image\_12.4  
2.49\_tempr-34.5604

VIS\_disgust\_42\_imag  
e\_11.40.05\_tempr-  
31.5096

VIS\_fear\_40\_image\_0  
9.28.58\_tempr-30.413

VIS\_fear\_20\_image\_1  
1.52.21\_tempr-  
30.1701



# Neutral



NEUTRAL STIMULI	% answer	intensity
VIS_fear_16_image_18.15.29_tempr-32.6607	90	4,27
VIS_pl_11_image_13.39.42_tempr-30.4675	85	4,3
VIS_sad_42_image_11.23.52_tempr-31.3994	85	4,05
VIS_sad_40_image_09.50.00_tempr-30.8672	80	4,7

# Neutral



VIS\_fear\_16\_image\_  
18.15.29\_tempr-  
32.6607

VIS\_pl\_11\_image\_13.  
39.42\_tempr-30.4675

VIS\_fear\_40\_image\_0  
9.28.58\_tempr-30.413

VIS\_sad\_40\_image\_09  
.50.00\_tempr-30.8672



# Other



OTHER STIMULI	% answer	intensity
VIS_sad_38_image_17.56.40_tempr-31.1474	55	4,6
VIS_fear_33_image_13.26.51_tempr-31.2461	50	5,3
VIS_sad_30_image_11.05.06_tempr-31.2102	45	4,9
VIS_pl_01_image_12.59.37_tempr-34.742	45	4,77

# Other



VIS\_sad\_38\_image\_  
17.56.40\_tempr-  
31.1474

VIS\_fear\_33\_image\_1  
3.26.51\_tempr-  
31.2461

VIS\_sad\_30\_image\_11  
.05.06\_tempr-31.2102

VIS\_pl\_01\_image\_12.  
59.37\_tempr-34.742



# Emozioni fondamentali I

## (approccio evuzionistico)



<b>AUTORE</b>	<b>EMOZIONI FONDAMENTALI</b>	<b>CRITERI DI INCLUSIONE</b>
<b>Tomkins (1962)</b>	interesse, gioia, sorpresa, sconforto ( <i>distress</i> ), paura, vergogna, disprezzo, disgusto, rabbia	programma neurale innato, espressione facciale universale
<b>Plutchick (1962)</b>	gioia, tristezza, accettazione, disgusto, paura, rabbia, aspettativa ( <i>anticipation</i> ), sorpresa	significato adattativo nella lotta per la sopravvivenza
<b>Izard (1972)</b>	rabbia, disgusto, paura, senso di colpa, interesse, gioia, vergogna, sorpresa, disprezzo, sconforto ( <i>distress</i> )	programma neurale innato, espressione facciale universale, precocità ontogenetica, qualità esperienziale specifica ( <i>unique feeling state</i> )
<b>Ekman (1973)</b>	sorpresa, rabbia, paura, felicità, tristezza, disgusto	espressione facciale universale, pattern di attivazione fisiologica specifico, condizioni elicитanti specifiche

# EMOZIONI FONDAMENTALI II

<i>Autore</i>	<i>Emozioni fondamentali</i>	<i>Modello teorico</i>	<i>Criteri di inclusione</i>
<b>Panksepp</b> (1982)	paura, ira, panico, aspettativa	<b>neurologico</b>	sistemi neurali esecutivi programmati geneticamente
<b>Kemper</b> (1987)	paura, rabbia, tristezza e soddisfazione	<b>bio-sociologico</b>	significato evolutivistico, precocità ontogenetica, presenza transculturale, risultato di interazioni di potere e di <i>status</i>
<b>Arnold</b> (1960)	rabbia, avversione, coraggio, avvilitamento, desiderio, disperazione, paura, odio, speranza, amore, tristezza	<b>cognitivo</b>	relazione con le tendenze all'azione
<b>Oatley e Johnson-Laird</b> (1987)	paura, tristezza, felicità, rabbia, disgusto	<b>Cognitivo-funzionale</b>	condizioni elicитanti specifiche, carattere non proposizionale, qualità esperienziale specifica
<b>Lewis</b> (1992)	paura, gioia, disgusto, sorpresa, rabbia, tristezza e interesse	<b>fenomenologico-funzionale</b>	assenza di introspezione o autoreferenzialità
<b>Shaver et al.</b> (1987)	paura, rabbia, tristezza, felicità, amore	<b>prototipico</b>	esempi tipici e di uso comune del concetto di emozione

# Critiche al metodo standard



1. Gli stimoli facciali impiegati in queste ricerche non rispecchiano **espressioni facciali** spontanee, ma espressioni deliberate e **posate** che inficiano notevolmente la validità ecologica dei risultati ottenuti da tali ricerche;
2. La **risposta forzata**, che imponeva ai soggetti di dover fornire una risposta scegliendo un'etichetta entro una lista predefinita e limitata di termini; facendo in modo infatti che l'attenzione fosse orientata verso una determinata risposta, il metodo standard ha generato inevitabilmente uniformità e consenso costringendo i soggetti a dare un'etichetta forzata senza fornire delle opzioni neutre o comunque diverse dalle etichette prese in considerazione nelle ricerche.

# 3. Acquisition procedure: I.Vi.T.E



## One image per second

We decided to store a set of images rather than a sequence of video in order to avoid video compression. This is especially relevant for the thermal camera because thermal imagers do not provide as much resolution as webcams. In order to reduce the amount of collected data, we have acquired one image per second.



Facial expressions are generated by contractions of facial muscles, which results in temporally deformed facial features such as eye lids, eye brows, nose, lips and skin texture, often revealed by wrinkles and bulges. Typical changes of muscular activities are brief, lasting for a few seconds. For this reason we consider that one image per second is a good compromise between storage requirement and temporal resolution.

# SUBJECT 48



*Happyness*



*Sadness*



*Disgust*



*Fear*





# I.Vi.T.E – extracted images from database



# Experimental result