

OLFACTORY-ELICITED EMOTIONS ASSESSMENT THROUGH PSYCHO-PHYSIOLOGICAL SIGNALS:

STATISTICAL AND CLASSIFICATION APPROACHES

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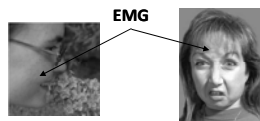


INTRODUCTION

- Emotion corresponds to synchronized changes :
 - In the cognitive system => evaluation processes
 - In the autonomic system => physiological supportive functions
 - In the motivational system => action tendencies, approach or avoidance
 - In the motor system => action, motor expression
 - In the monitor system => subjective feeling
- Odors are good elicitors of emotions with strong facial muscular responses e.g. disgust
- Objectives:
 - Differentiation of pleasantness on the motor expression component using facial electromyography
 - Use of statistical and classification methods

METHODS

Motor expression => Facial electromyography



Reaction to pleasantness should strongly affect the *M. Corrugator supercilii* and *M. Zygomaticus major*, as shown in previous studies (e.g. Soussignan et al., 2005; Bensafi et al., 2002)

M. Frontalis also recorded for other purposes



THE TASK

Presentation of pleasant or unpleasant odors, synchronously with the inspiration phase.

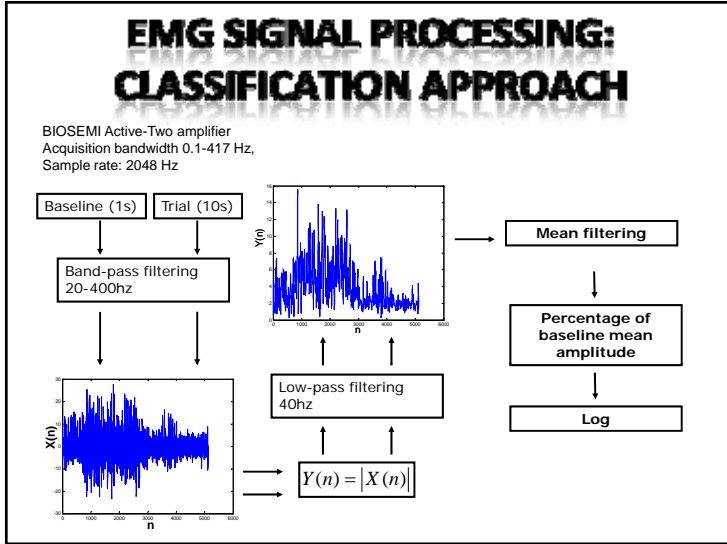
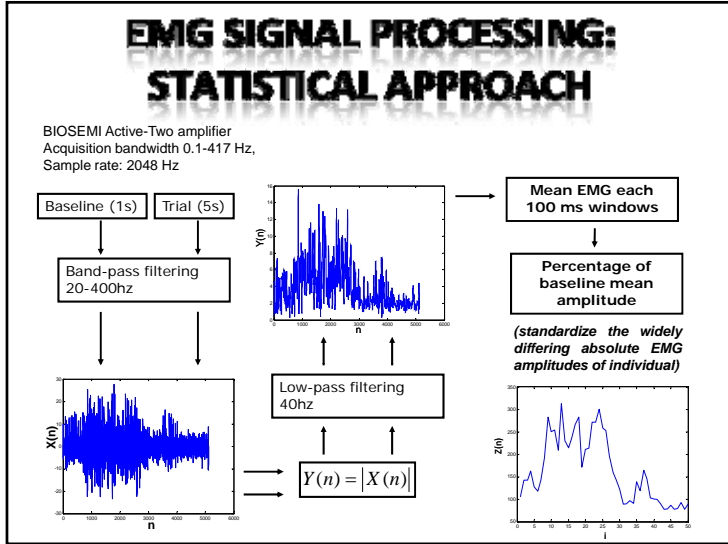


Subjects' task n= 18 (9 female) 27.1 ± 6.2 years old: to report the perceived pleasantness (and other characteristics) of the odor on visual analogue scales

THE ODORS

64 presentations
48 different odors (16 repetitions)

Unpleasant Body odor, cheese, rotten eggs...
Pleasant Lavender, lemon, lilac...



STATISTICAL ANALYSES

Groups definition
A priori selection of unpleasant and pleasant odors and control with subjects' assessments

Analyzed variable
Subjects' mean percentage of muscular activity for unpleasant and pleasant odors

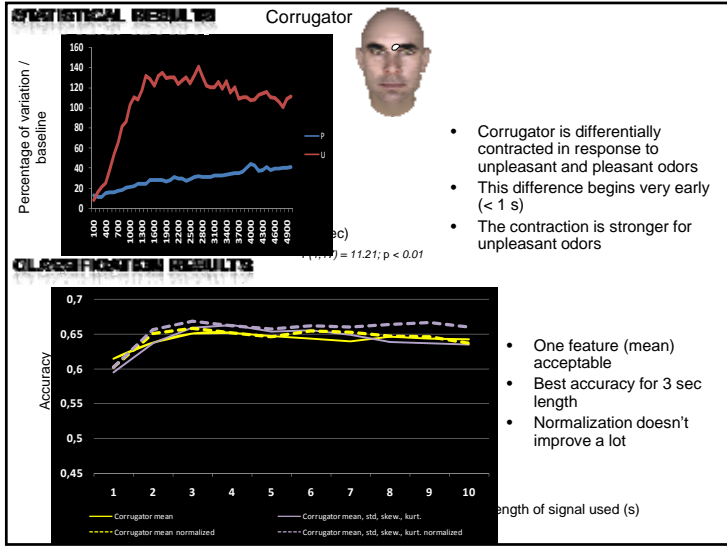
Statistical analyses
Repeated measures multivariate analysis of variance (MANOVA)
Time = multiple dependant variable
Planned comparisons to investigate pleasantness effects as a function of time

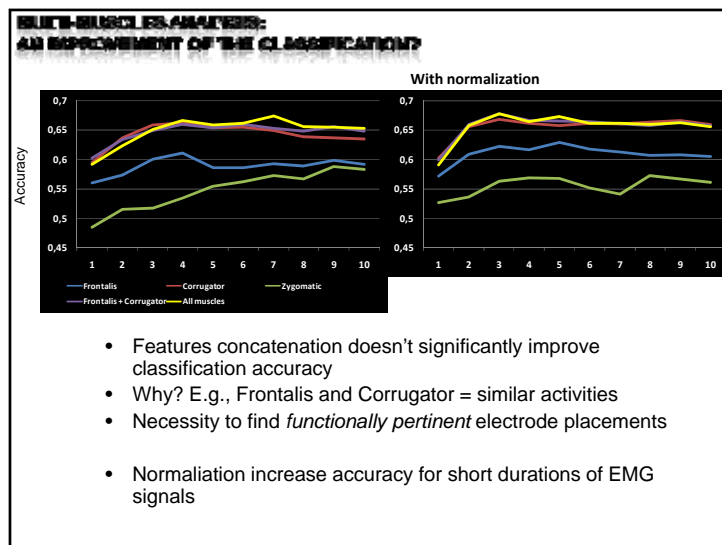
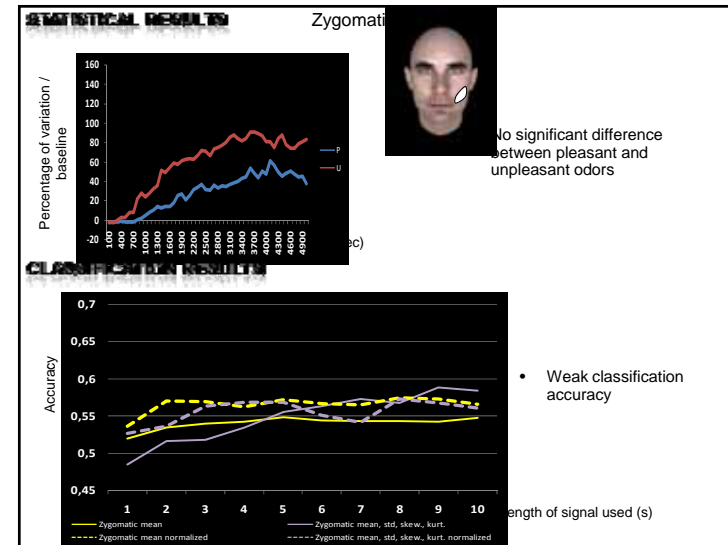
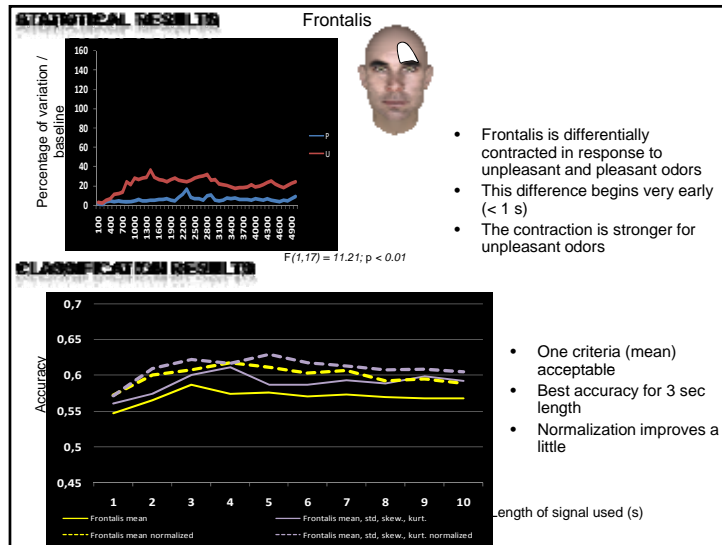
CLASSIFICATION ANALYSES

Classes definition
Based on subject's pleasantness Self-assessment (1008 evaluations)
< 5 : unpleasant
> 5 : pleasant
= 5 or not self-assessed -> sample removed

Features extraction
For each signal (3 muscles): Mean, standard deviation, kurtosis, skewness
Normalization.

Classification
Linear Discriminant Analysis (LDA)
Leave One Out Cross validation





DISCUSSION 1/2

- Results from traditional statistical analyses
 - Corrugator more strongly contracted in response to malodors
 - Interpretation: to close off the senses, attempt to reject the stimulus or to protect the individual from it
 - No result on Zygomatic = effect of respiratory constraints
- Results from classification procedure
 - Weak classification accuracy compared to the state of the art
 - Why so?
 - Real stimuli (emotional induction)
 - Short time periods included for classification
 - But...
 - Best accuracy for 3-4 s time periods

DISCUSSION 2/2

- Including the time to improve accuracy?
 - E.g., accuracy for 10 s slightly weaker than for 3-4 s
- Intra-subject vs. inter-subject variance...
 - Statistical methods: inter subject variance abolished with ANOVA strategies
 - Classification: intra and inter subject variance confounded but reduced by normalization
- Normalization Improvement ? may be when time is considered
 - But what about online classifications????
- Interpretation of the differences?
 - Researchers using statistical approach need to interpret the differences
 - How to extract this information from classifiers?