



Universidad Nacional Autónoma de México
Maestría en Ciencias (Neurobiología)
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Correlatos neurales de la percepción emocional por
análisis de patrones en multitud de voxels de datos de
resonancia magnética funcional

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*I, AUTHORMNAME confirm that the work presented in this thesis is my own.
Where information has been derived from other sources, I confirm that this
has been indicated in the thesis.*

Abstract

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Acknowledgements

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Abbreviations

API	Application Programming Interface
JSON	JavaScript Object Notation

Chapter 1

Introduction

¿hacerla como abstract o sección de antecedentes sin citas ni detalle?

1.1 emotion

what

valence, intensity, etc

1.2 evolutionary and social significance

faces as the epitome of ecologically relevant emotional stimuli

1.2.1 OTHER MINDS THEORY (MIND-MIND THEORY)

automatic emotional processing hypothesis: if facial expression is so important a *signal* of inner mental states for a social species like ours, it stands to reason that a cognitive adaptation could have evolved to process it separately of attention.

negative valence bias hypothesis.

Chapter 2

Previous Research

2.1 For automatic emotion identification

The affective priming paradigm(Klauer et al. 2003) is known to produce an effect on reaction times or accuracy for subsequent congruent emotions, thereby reflecting variability in the processes leading to affect recognition.(De Houwer et al. 2009) Many lines of evidence help extrapolate this fact into the notion that affect identification can undergo an automatic or preattentional mode:

- Because affective priming occurs only under short stimulus onset asynchrony (*SOA*) times¹ (300 ms or less), it has been conjectured that its processing must occur before the direction of attention and response strategies take place.(Moors & De Houwer 2006)(Hermans et al. 2001)
- Cognitive load (as produced by the simultaneous presentation of irrelevant tasks) does not seem to impair affective priming.(Hermans et al. 2000)
- The effect is observed even when the prime is presented at unrecognizable subthreshold levels(Draine & Greenwald 1998) and outside the focus of visual attention(Calvo & Nummenmaa 2007).

¹The time lapse between prime and target stimuli presentation.

2.1.1 EMOTION OR VALENCE-DEPENDENT AUTOMATISM

A further refinement proposes that not all emotions were created equally advantageous to recognize. If natural selection produced complementary high-priority neural circuitry for facial expressions, one could naturally ask whether this automaticity also primarily targeted certain life-saving facial expressions. Indeed, a wealth of research has found that the priming effect, as well as others, are biased towards aversive and pejorative emotions, as opposed to happy or neutral ones.(Fox et al. 2002)(Vuilleumier et al. 2001)(Ishai et al. 2004)(Vuilleumier 2005)(Susa et al. 2012)

2.2 Against automatic emotion identification

Contrary to the previous view, Pessoa and colleagues (Pessoa et al. 2002) interpreted the increased activity in relevant structures (fusiform area, amygdala, etc.) during explicit attention to facial features as opposed to inscribed non-expressive details as evidence that facial processing is contingent upon attention. This strand of facial emotion processing research is not without more recent supporters (see (Ochsner & Gross 2005)(Eimer et al. 2003) for instance).

2.3 Perceptual modulation through spare attention: a possible bridging explanation

Seemingly contradictory results stemming from methodologically sound studies cry for a theoretical reformulation to encompass all the facts. Research around the conflict often resorts to some sort of interaction and modulation between systems to explain the data.(Okon-Singer et al. 2007)(Palermo & Rhodes 2007) Sassi and colleagues proposed that even though emotional perception can be turned automatic, unused resources might still be consumed in parallel, should the distracting task not be distracting enough.(Sassi et al. 2014)

Chapter 3

Justification

3.1 General

- Despite the success of neuroscience identifying psychologically-relevant molecular, cellular and anatomical mechanisms;¹ both the methods of “small-to-middle-scale” neuroscience and plain *localizationism* yield against a number of psychological questions. Many known cognitive phenomena² rather emerge (or are thought to do so) from the coordinated physiology of anatomically distributed modules. Evolutionary constraints pose limits on the number of nervous specializations that could univocally correspond to the performance of a function, so that certain behavioral and mental phenomena must correspond to the differential recruitment and modulation of more basic resources at the physiological domain. Moreover, modern views on cognition place emphasis on the consideration of the interactions of organisms with one another and their environment; with some even postulating that such *grounding* and *extension* processes are inseparable from cognition itself.
- Emotions are regarded as some of the most basic wholesale conscious experiences in humans. Understanding their processing contributes to our understanding of subjectivity and intersubjectivity.

¹Which?

²Which?

- As of today, neuroscientists and clinicians are heavily dependent upon verbal reports and other behavioral cues to assess mental states. More work is needed to help bridge the explanatory gap between mechanistic (i.e. physical) facts and subjective (i.e. mental) ones.

3.2 Particular

- Alexithymia patients. More accurate and faster diagnostics. (**Did Federica filter for alexythimic people on her sample?**)
- The ongoing debate surrounding the cognitive mechanisms of facial expression perception will benefit from extra evidence, and more importantly, extra analysis techniques to derive that evidence. (**Is the use of MVPA novel in the facial expression recognition literature? Mention if so.**)
- Multivariate and nonlinear methods have proved successful in the past extending the identification of more complex brain activity interactions which aren't amenable to the traditional regression models.

¿son aportes teóricos, metodológicos, empíricos?

3.3 Methodological justification?

fMRI recording encompasses very wide areas, usually with sufficient spatial resolution. It is suitable for exploratory studies in which relevant brain areas must be first identified so as to lay the groundwork for finer-grained measurement techniques.

Chapter 4

Hypothesis

4.1 Research Question

Are there different modes of facial emotion perception (with or without attention, valence-dependent)?

4.2 Hypotheses

- Working hypothesis (H_1): the putative modes of facial expression processing should be correlated to differential spatio-temporal activity patterns at associated brain areas.
- Null hypothesis (H_0): no significant statistical dependence can be found between perception (i.e., processing) of facial expression under different conditions and activity patterns in the brain.

4.3 Predictions

If the occurrence of “automatic” (i.e. preattentive) or valence-dependent facial emotion processing goes hand-in-hand with a neural activity substrate, a powerful-enough statistical method (such as multivariate classification)

should be able to discriminate said neural activity. This assumes our measurements will be able to capture the relevant signal.

Chapter 5

Goals

- Study the biological basis of emotion perception at the bigger scale of whole-brain functional networks of neuronal ensambles.
- Dissociate the proposed plethora of phenomena that has been traditionally grouped under facial emotion perception. Find and test reliable psychological, imaging and computational methods to achieve that goal.
- As a natural consequence of the newfound descriptive and explanatory power contingent upon the previous point; be able to leverage the resulting methods to predict the occurance of distinct emotion perception workflows from functional imaging data alone.
- Help settle the debate surrounding the existence of more automatic pathways in the processing of emotional imagery, by contributing extra evidence coming from a representative and controlled fMRI study, as well as rigorous analysis and state-of-the-art pattern analysis techniques.

Chapter 6

Sample

(1)

$$f(x) = ax^3 + bx^2 + cx + d$$

For syntax highlighting in code blocks, add three ““” characters before and after a code block:

```
mood = 'happy'  
if mood == 'happy':  
    print("I am a happy robot")
```

Alternatively, you can also use LaTeX to create a code block as shown in the Java example below:

Listing 6.1: Main.java

```
1 /**
2  * Hello, world — example in Java.
3  */
4 public class Main{
5     // says hello to the world
6     public static void main(String[] args) {
7         System.out.println("Hello, world!");
8     }
9 }
```

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blandit quis. Cras ultrices metus tempor laoreet sodales. Nam molestie ipsum ac imperdiet laoreet. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas.

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Column 1	Column 2	Column 3
Row 1	0.1	0.2
Row 2	0.3	0.3
Row 3	0.4	0.4
Row 4	0.5	0.6



Figure 6.1: RV Calypso is a former British Royal Navy minesweeper converted into a research vessel for the oceanographic researcher Jacques-Yves Cousteau. It was equipped with a mobile laboratory for underwater field research.

Chapter 7

Materials and Methods

Chapter 8

Results

Chapter 9

Discussion and Conclusion

9.1 Discussion

9.2 Conclusion

9.2.1 THESIS SUMMARY

In summary, pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Nunc eleifend, ex a luctus porttitor, felis ex suscipit tellus, ut sollicitudin sapien purus in libero. Nulla blandit eget urna vel tempus. Praesent fringilla dui sapien, sit amet egestas leo sollicitudin at.

9.2.2 FUTURE WORK

There are several potential directions for extending this thesis. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aliquam gravida ipsum at tempor tincidunt. Aliquam ligula nisl, blandit et dui eu, eleifend tempus nibh. Nullam eleifend sapien eget ante hendrerit commodo. Pellentesque pharetra erat sit amet dapibus scelerisque.

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varius sem nisi. Nunc tempor magna sapien, euismod blandit elit pharetra sed. In dapibus magna convallis lectus sodales, a consequat sem euismod. Curabitur in interdum purus. Integer ultrices laoreet aliquet. Nulla vel dapibus urna. Nunc efficitur erat ac nisi auctor sodales.

Appendix 1: Some extra stuff

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Appendix 2: Some more extra stuff

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