"Neuronal Correlates of Occulometric Parameters in Face Recognition"

Master Thesis

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I herewith declare that I wrote this Master thesis independently under supervision and used no other sources and aids than those indicated.

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Date Signature

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The thesis has to contain a summary in English.

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Chapter 1

Summary

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Chapter 2

Background

Chapter 3

Methods

3.1 Visual Stimuli

3.1.1 Emotional Faces

3.1.2 Scrambled Images

In order to define a baseline for visual recognition we have decided to use trials in which visual input consists of the same pixels as in the emotional trials. To disentangle visual from semantic (emotion) identification we decided to use "scrambled" images - in which pixels from the emotional faces are permuted so as to obfuscate the emotional expressions.

As recognition difficulty of scrambled images should scale proportionally with that of the easy and difficult emotional recognition trials (detailed under section 3.1.1), scrambling has to be progressively complex. Available data ??? suggests that scrambling of smaller image sub-sections (further referred to as "clusters") makes the images progressively difficult to identify and match to other copies. This rationale determined the nature of our scrambling algorithms (detailed below) and was furthermore experimentally validated in preliminary trials (as described in section 4.1).

This was done via a home-brewed Python script written for the purpose of this thesis and openly published on GitHub. The script provides both cluster-based and kernel-based scrambling:

Cluster-Based Scrambling

This scrambling functionality recognises the face region of interest (ROI) by scanning for pixel lines with few unique values, and then divides the face ROI in square clusters of predefined sizes. The clusters then get permuted and rewritten in-place on the image - this is done via the `montage2d` function of the `scikits_image` python package, the function was written and contributed to the package for the benefit of the scientific community as part of this thesis. The image background is then filled with homogeneous values.

Kernel-Based Scrambling

This is done by remapping single pixels via the `geometric_transform` function of the `scipy` Python suite. New positions are computed via a function which adds a random integer in the $[-K; K]$ (K being the kernel integer) interval to both the X and Y coordinates of the said pixel. Effectively, this redistributes each pixel in an area of $[-K; K]$ around its original position with a standard deviation (σ) of K.

3.1.3 Preliminary Experiments

Preliminary experiments have been conducted in order to establish a proper paradigm for the *main* experiments of the project. The rationale of these preliminary experiments is further discussed under section 3.1.2. Their main goal is comparing reaction times between scrambled image and emotional image trials.

For conducting these experiments we have used a home-brewed Python script written for the purpose of this thesis and openly published on GitHub.

Simple Cluster-Based Scrambling

In a first set of trials

Chapter 4

Results

4.1 Preliminary Experiments

In order to establish an experimental paradigm which affords the comparison between emotion recognition and simple visual matching, we need to select stimuli whose matching is correspondingly difficult. For the emotion recognition trials, we decided for faces with emotional "concentrations" ??? of 40% and 100% (as discussed in section 3.1.1).

Chapter 5

Discussion

Chapter 6

Meta