GUESS WHO I AM!

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Introduction

The ability and speed of facial recognition is quite important and has been subject of research for the last years (Bentin et al., 1996; Kanwisher et al., 1997). Here, it was proven that the general way of face processing goes along occipital lobe, OFA, FFA and lastly MTL (Kanwisher et al., 1997; Gauthier et al., 2000; Wixted et al., 2011). In contrast, the neuronal proceeding of the level of familiarity is not yet so well understood (Ramon et al., 2018).

In 2011 Gosling and Eimer proved that N250 is able to differentiate faces between familiarity and unfamiliarity. This effect is maintained across the variations of the same presented stimuli (Andrews et al., 2017).

Based on the article by Wiese et al., 2018 using EEG, they discovered a robust neural index of face familiarity, called 'Sustained Familiarity Effect' (SFE). In fact, the maximum of familiarity effects by SFE has been obtained between 400 ms and 600 ms right after stimuli onset. It is most obvious in occipito-temporal channels, mostly around the electrodes TP9 and TP10. This implied that famous faces should have a more negative peak within this time window in contrast to unfamous faces.

Another experiment has shown that the ability in face recognizing variates between persons. The authors used the „Before they were famous Test“ in which the stimuli variates in angle and age of the celebrities faces. That means they included photos of celebrities as children before they became famous. Those pictures were presented for a few seconds and afterwards they had to assign them to the corresponding person. Some people, the so called „super-recognizer“, could easily identify the younger versions even though they never saw these images before (Russel et al., 2009).

Based on that we wanted to know if there is an **interaction between face-age and familiarity**. This should be manifest in a **smaller familiarity effect for young faces compared to old ones** in the ERPs. The present experiment claims that there is no such difference in the ERPs between the component famous and unfamous faces.

Methods & Design

Participants:

20 (16 female, one left handed, MW = 21.5, SD = 1.92)

- None had neurological disorders
- Post hoc power Analysis (G*POWER 3.1.) showed that enough participants were tested

Stimuli:

Experiment contained stimulus material of another EMPRA-group (“Iconic Brainwaves: Surfing the EEG signals of icon familiarity”) - we only analyzed the data that was recorded with our stimuli (face stimuli)

Pictures of 10 different celebrities, of each 10 pictures (5 young and 5 nowadays)

- 5 famous celebrities
  (Heidi Klum, Katy Perry, Queen Elizabeth II., Jennifer Aniston, Angela Merkel)
- 5 celebrities from different countries - unknown to all participants
  (Valerie Bertinelli (USA), Deborah Kerr (Great Britain), Mindy Cohn (USA), Neetu Signh (India), Cassie –“Thrift Thick“ (USA))

Procedure:

The participants were seated in an electrically shielded room and with their heads resting in a chin rest (80 cm difference to monitor).

- 4 blocks with 220 trials each (circa 1500 ms each)
- blocks started with a fixation cross (1000 ms)
- pictures were show 600 ms (randomized order) with 250 ms fixation cross between (see Fig. 1)

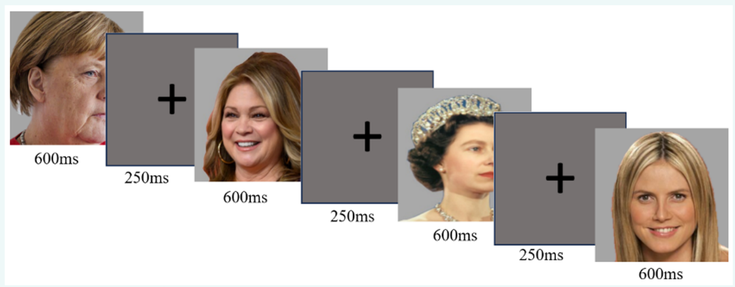

Fig. 1: Illustration of trial structure

Analysis:

- modified 10 - 20 system

EEGLAB:
- sampling rate: 512 Hz
- average reference
- basic filter (0.1 - 40 Hz)

ERPLAB:
- epochs extracted with baseline correction
- text file with trigger codes (familiar vs. unfamiliar)
- arifact rejection (basic only)
- condition averages
- interesting electrodes via ERPLAB viewer:
  - P9, PO9, TP9, Iz, P10, PO10, TP10
- time windows:
  - 100 - 200 ms, 200 - 300 ms, 300 - 500 ms

ANOVA:
- within subject repeated-measured
- 350 ms - 650 ms
- factors:
  - 7 electrodes (P9, PO9, TP9, Iz, P10, PO10, TP10)
  - 2 familiarity (familiar, unfamiliar)
  - 2 age (young, old)

References

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Results

Within Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p	η^2	η^2_p
familiarity	119.714	1	119.714	31.439	< .001	0.297	0.623
Residuals	72.348	19	3.808				
age	99.002	1	99.002	33.908	< .001	0.246	0.641
Residuals	55.475	19	2.920				
familiarity ✻ age	2.321	1	2.321	0.821	0.376	0.006	0.041
Residuals	53.708	19	2.827				

Note. Type I Sum of Squares

Fig. 2: Statistical table of within subject repeated-measures ANOVA

- Main effects of familiarity & age are both significant (Fig. 2)
  ➡ suggests that findings regarding **SFE** (Wiese et al., 2018) could be replicated
- However, the interaction between the two factors is **not** significant
- The **differential ERPs** of the **occipito-temporal** channels show that familiar faces elicit substantially more negative amplitudes than unfamiliar faces (Fig. 3)

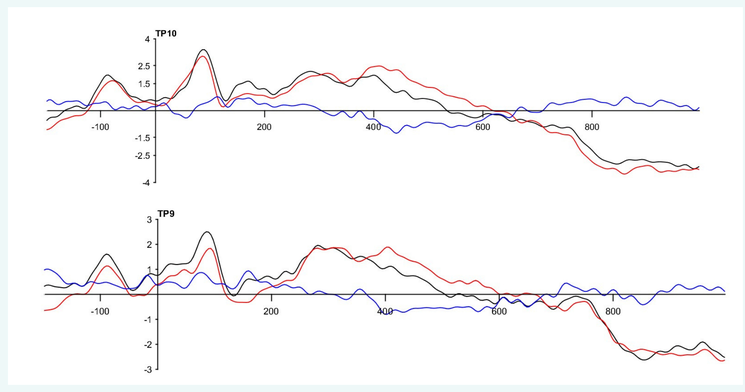

Fig. 3:
Grand average ERPs (N=20) at the left and right occipito-temporal channels TP9 and TP10 for familiar-old (black line) versus unfamiliar-old (red line) faces as well as the differential curve (blue line) of these two conditions.

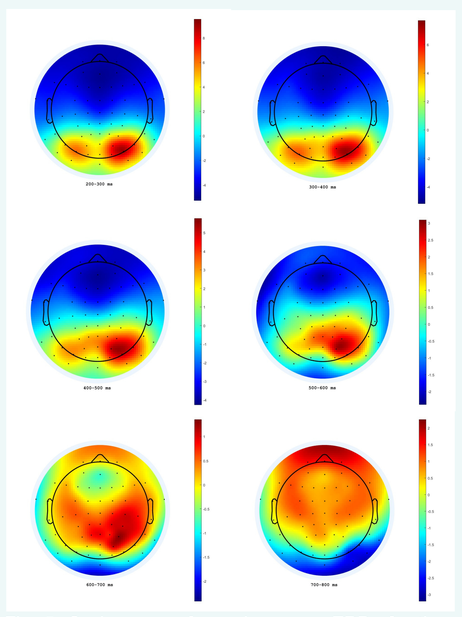

Fig. 5: Scalp maps of grand average ERPs for the familiarity conditions (familiar-old, familiar-young) from 200 to 800 ms after stimulus onset in steps of 100 ms

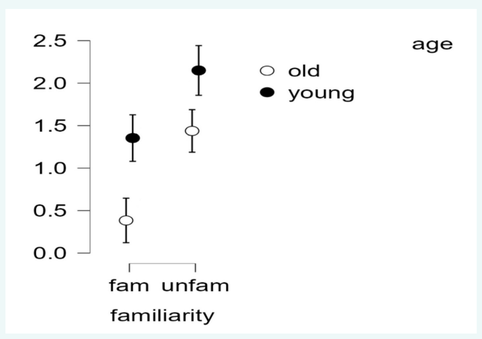

Fig. 4: Descriptive plots (N=20) of the main effects of familiarity & age for the mean amplitudes (350-650 ms) of the electrodes P9, PO9, TP9, Iz, P10, PO10 and TP10 (+/- 95% CI)

- Fig. 5 shows **visibly increased activity** in the **occipito-temporal areas** between 200 to 600 ms after familiar stimuli were presented

Discussion

This study dealt with the processing and recognition of faces depending on familiarity and age. The particular focus was on the difference between famous and unfamous faces, which additionally varied in the age of the presented stimuli.

The examination of the familiarity of famous when compared to unfamous celebrities has shown significant main effects of familiarity and age. Therefore our hypothesis that there is no difference in the ERP’s between the components age and familiarity is refuted. This is confirmed by the results of the post-hoc power analysis, which show that the number of participants is sufficient to produce a significant result for the main effects. However, the sample size is not sufficient to obtain significant results for an interaction effect, one can only detect a tendency.

Nonetheless, there are a few limitations in the data.

Participants.

A more extensive study with more participants should be carried out in order to be able to make a generally valid statement. The participants were exclusively students of psychology in the 4th semester, which leads to a very homogeneous sample. In addition, two participants had to be excluded due to missing behavioral data. Furthermore the participants were not individually screened to determine whether there were super-recognizers among them. Since super-recognizers recognize faces much more easily than non-super-recognizers, this may have had an impact on the results and should be tested in future studies (Russel et al., 2009).

Stimuli.

The stimuli were not individually tested to determine whether the participants were actually familiar with the „famous people“ and unfamiliar with the „unfamous people“.

Despite the given limitations, we were able to replicate the 'Sustained Familiarity Effect' (SFE) and extend the previous results by Wiese et al., 2018 by the variable age.

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