

Introduction

Icons are small pictures or symbols representing a brand and can appear in many different designs and styles. They play an important role in humans' everyday life (Zhou et al., 2022), because they express information in a universal way and therefore improve the efficiency of information transmission (Yang et al., 2021). In some way one could say icons are similar to faces, because both carry more information than the mere image of someone or some brand. While humans' ability to recognise faces has been widely explored, the topic of icon familiarity is still largely uncharted territory. Familiarity refers to the frequency with which people interact with or think about a given entity in everyday life (Souza et al., 2022). Therefore, the aim of this study was to evaluate if the effects of icon familiarity differ from the so-called Sustained Familiarity Effect (SFE), which is often connected to face familiarity. The SFE is a neural familiarity marker, which demonstrates a clear difference in brain potentials between familiar and unfamiliar faces and can be found starting at 200 ms and ending at 600 ms after stimulus onset (Wiese et al., 2018).

In an explorative approach regarding icon familiarity the authors of this study considered the following research questions: **Can the SFE be found for icon recognition? Which effects of icon familiarity can be found?**

Methods & Design

Participants

- (N=22), healthy young adults (5 males, 17 females)
- age: M = 21,45, SD = 1,23

Experimental design

- four blocks with 220 trials each, separated by breaks of individual length
- per block: 100 face images, 5 familiar and 5 unfamiliar icon images with 10 variations each (400*400 pixels)
- images were shown for 600 ms in randomised order

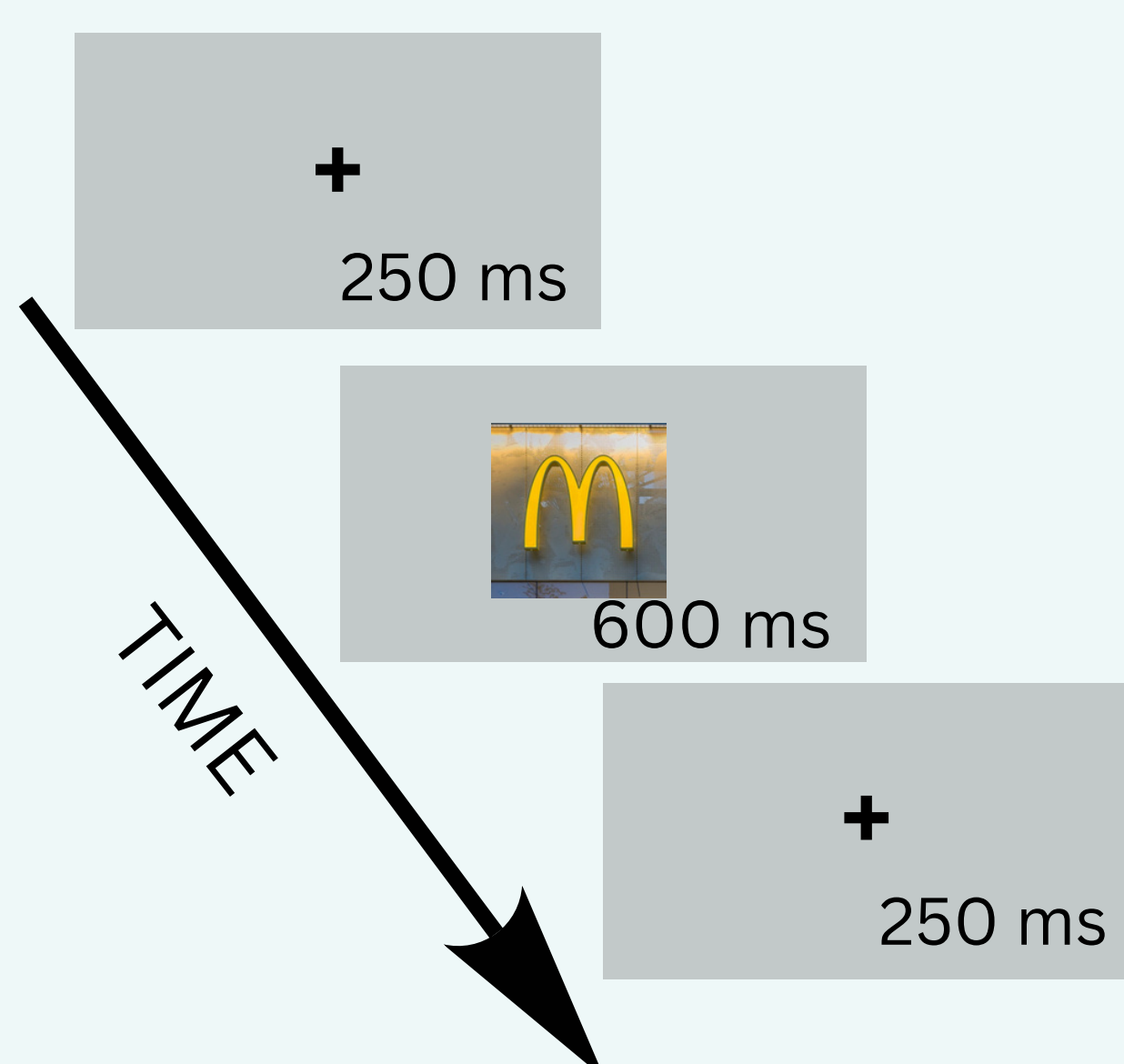


Fig. 1 shows the procedure of one trial, fixation cross (250 ms), icon stimuli (600 ms)

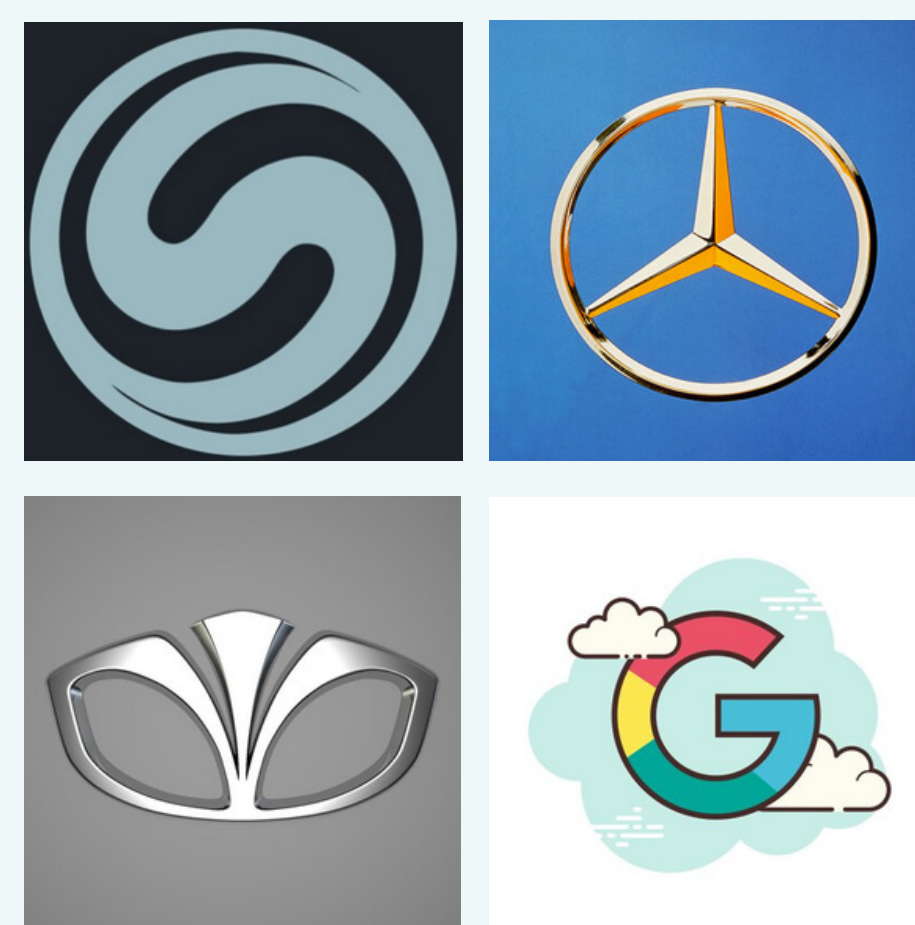


Fig. 2 shows two unfamiliar icons (left) and two familiar icons (right)

EEG recording and data analysis

- only trials with icon stimuli were further analysed (to see trials with face stimuli see study "Guess Who I Am")
- EEG recording was performed using a 64-channel BioSemi Active II system
- recording sites corresponded to an extended 10-20 system
- for preprocessing the EEGLAB toolbox with ERPLAB Plugin was used in MATLAB version R2022b
- average reference was set for preprocessing
 - bandwidth filter (0.1 Hz – 40 Hz) was applied
- data was divided into epochs (with a duration of 1200ms)
- artifact rejection: $\pm 100\mu V$ threshold
- for post-hoc power analyses G*Power version 3.1.9.7 with a significance criterion of $\alpha = 0.05$. was used

Statistical analysis

- for statistical analysis JASP version 0.17.2.1 was used
- 3 within subject repeated measures ANOVAs
 - 1. Confirmatory analysis:** 400-600 ms after stimulus onset: familiarity (familiar, unfamiliar) x electrode (TP9, TP10, PO9, PO10, P9, P10, Iz)
 - 2. Exploratory analysis:** 350-450 ms after stimuli onset: familiarity (familiar, unfamiliar) x electrode (TP9, TP10, PO9, PO10, P9, P10, Iz)
 - 3. Exploratory analysis:** 350-450 ms after stimuli onset: familiarity (familiar, unfamiliar) x electrode (F8, FT8, TP8, T8)

Results

1. Confirmatory analysis

Within Subjects Effects								
Cases	Sphericity Correction	Sum of Squares	df	Mean Square	F	p	η_p^2	CI
Familiarity	None	0.103	1.000	0.103	0.039	0.845	0.002	[0, 0.09]
Residuals	None	55.223	21.000	2.630				
Familiarity * Electrode	Huynh-Feldt	0.707	3.562	0.200	0.545	0.681	0.025	[0, 0.062]
Residuals	Huynh-Feldt	27.225	74.042	0.368				

- suggesting no differences in neural activity between the perception of familiar and unfamiliar icons in the sites and timeframe where the SFE was found to be the biggest
- post-hoc power analysis resulted in a power of $1 - \beta = .06$, given an effect size of $\eta_p^2 = .002$

2. Exploratory analysis (concerning the occipito-parietal recording sites)

Within Subjects Effects								
Cases	Sphericity Correction	Sum of Squares	df	Mean Square	F	p	η_p^2	CI
Familiarity	None	1.138	1.000	1.138	0.370	0.549	0.017	[0, 0.18]
Residuals	None	64.533	21.000	3.073				
Familiarity * Electrode	Huynh-Feldt	0.155	3.592	0.043	0.122	0.966	0.006	[0, .1]
Residuals	Huynh-Feldt	26.734	75.425	0.354				

- repeating the results of the confirmatory analysis for the new, shorter timeframe

3. Exploratory analysis (concerning the frontotemporal recording sites)

Within Subjects Effects								
Cases	Sphericity Correction	Sum of Squares	df	Mean Square	F	p	η_p^2	CI
Familiarity	None	9.553	1.000	9.553	9.590	0.005	0.313	[0.06, 0.51]
Residuals	None	20.919	21.000	0.996				
Familiarity * Electrode	Huynh-Feldt	0.684	2.136	0.320	0.870	0.432	0.040	[0, 0.133]
Residuals	Huynh-Feldt	16.511	44.846	0.368				

- confirming the observations of a more negative signal for unfamiliar than for familiar faces in the frontotemporal electrodes
- post-hoc power analysis resulted in a power of $1 - \beta = .99$, given an effect size of $\eta_p^2 = .313$

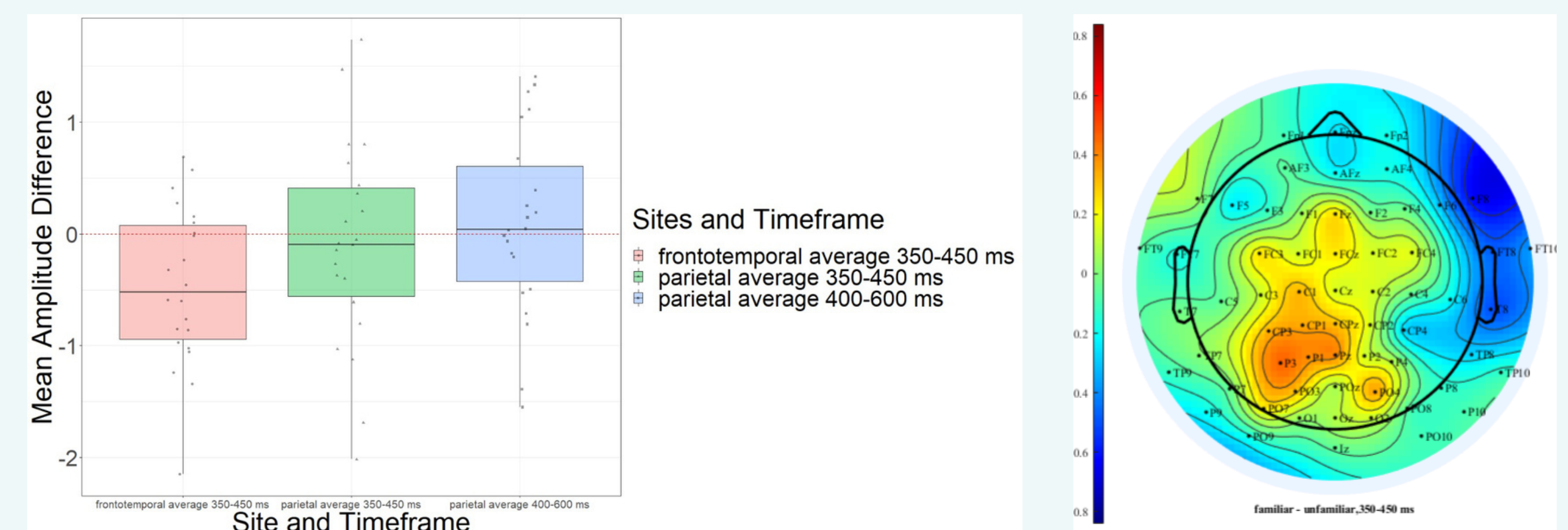


Fig. 3 shows boxplots of the mean amplitude differences between the familiar and unfamiliar icon conditions for different timeframes averaged across recording sites (parietal average: P9, P10, TP9, TP10, PO9, PO10, Iz; frontotemporal average: F8, FT8, T8, TP8)

Fig. 4 shows a topographical map of the mean amplitude of the difference condition between 350 ms and 450 ms after stimulus onset

Discussion

The present study tested the neuronal correlates of icon familiarity whereby the hypothesis, that the SFE can be found for icons, was not confirmed. However, the results showed that familiarity effects for known icon stimuli can also be detected in the neuro-physiological signal but with a different spatio-temporal distribution as compared to faces. Overall, these findings suggest differences in processing of familiarity between icons and faces, supporting the idea of the SFE being specific for faces.

Limitations

- We only used a selected stimuli set. The participants were not asked to what extent they knew the icons, neither was a preliminary study conducted to evaluate the average familiarity of icons in the examined age group.
- The design of the study or rather the long duration of the experiment, may have led to habituation in some or many participants, which could have negatively affected any potential differences between familiar and unfamiliar icons.
- As the post-hoc power analysis shows, the power of the observed effect size was not sufficient to find the SFE.

Overall, this should be taken more into account in further research.

References and more

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