The self in face identity processing with fast periodic visual stimulation

Laura Kaltwasser[1], Moritz Köster[2], Marina Palazova[3], Birgit Stürmer[3], & Vittorio Gallese[1,4,5]

laura.kaltwasser@hu-berlin.de

Introduction

Substantial behavioral evidence suggests that self-related processes are different from those of others: Not only do we remember self-related items better [1] but we also respond faster [2] and enhance attention to them [3].

Evidence that self-face recognition is dissociable from general face recognition has important implications for social cognition and face cognition. The former requiring self-other distinction during social interaction such as for example in empathy. The latter suggesting that there are different cognitive modules involved in structural encoding compared to identity or familiarity related processes [4].

We investigate whether one's own face is encoded differently than the one of a familiar other in a paradigm of fast periodic visual stimulation (FPVS) [5], where self and personally familiar other faces are presented repetitively at 4 Hz eliciting a continuous oscillatory brain response, steady-state visual evoked potentials (SSVEP).

Methods

Experimental Design

- Preliminary data of N = 10 healthy young adults
- Controlled photo shooting in three different perspectives (frontal, 45° left and right) of **P**articipant and best friend (same gender)
- **FPVS** paradigm [5] with own and personally familiar other's face during simultaneous ECG and EEG (64 active electrodes) recording
  - **Implicit task:** Detection of pink dot overlain on **S**elf or **F**amiliar other (84 trials)
  - **Explicit task**: Two-alternative forced choice between S and F (72 trials) – response hand counterbalanced within Ps
  - Faces flickering in **4 Hz**

HB1: Reaction time (RT) S < F (in explicit task)
HB2: RT left S < right S (in explicit task)

HN1: SSVEP amplitude S > F (in both tasks)
HN2: SSVEP onset < RT (in explicit task)

1

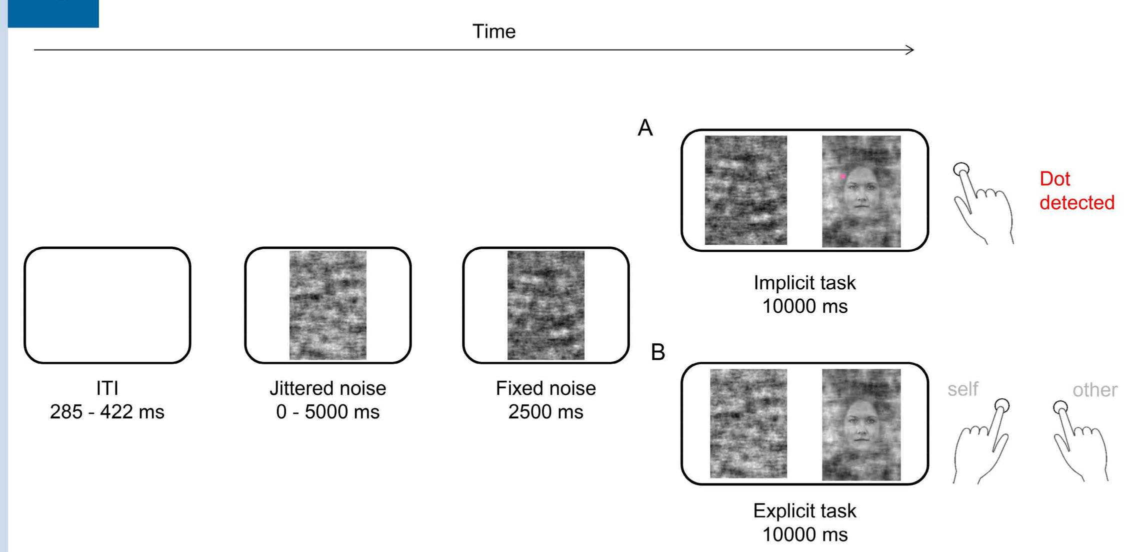


Figure 1: Schematic representation of experimental paradigm. Inter-trial interval during which a fixation cross presented, varied randomly between 285 and 422 ms. Following, noise images were presented in varied length of time, between 0 and 5000 ms, and fixed time of 2500 ms. A: Implicit task in which participants were asked to respond as soon as pink dot appeared on the screen. B: Explicit task in which participants were asked to decide identity of the face image presented. The face stimuli flickered at 4 Hz whereas noise images flickered at 8 Hz. Total length of a trial was approximately 16 seconds

Preliminary Results

2

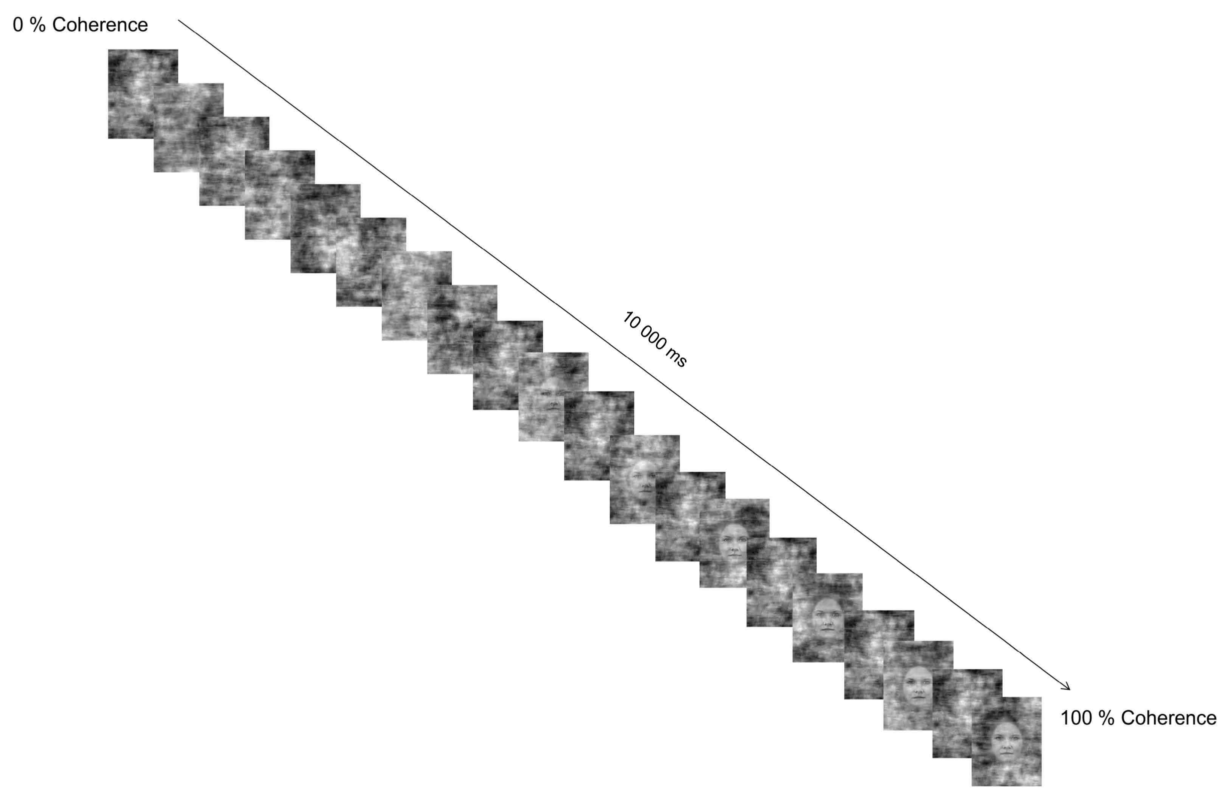


Figure 2: Illustration of face images in decreasing order of phase scrambling. Each image in a sequence of face images alternated with a noise image (i.e. fully scrambled image) with 4 face images per second.

3

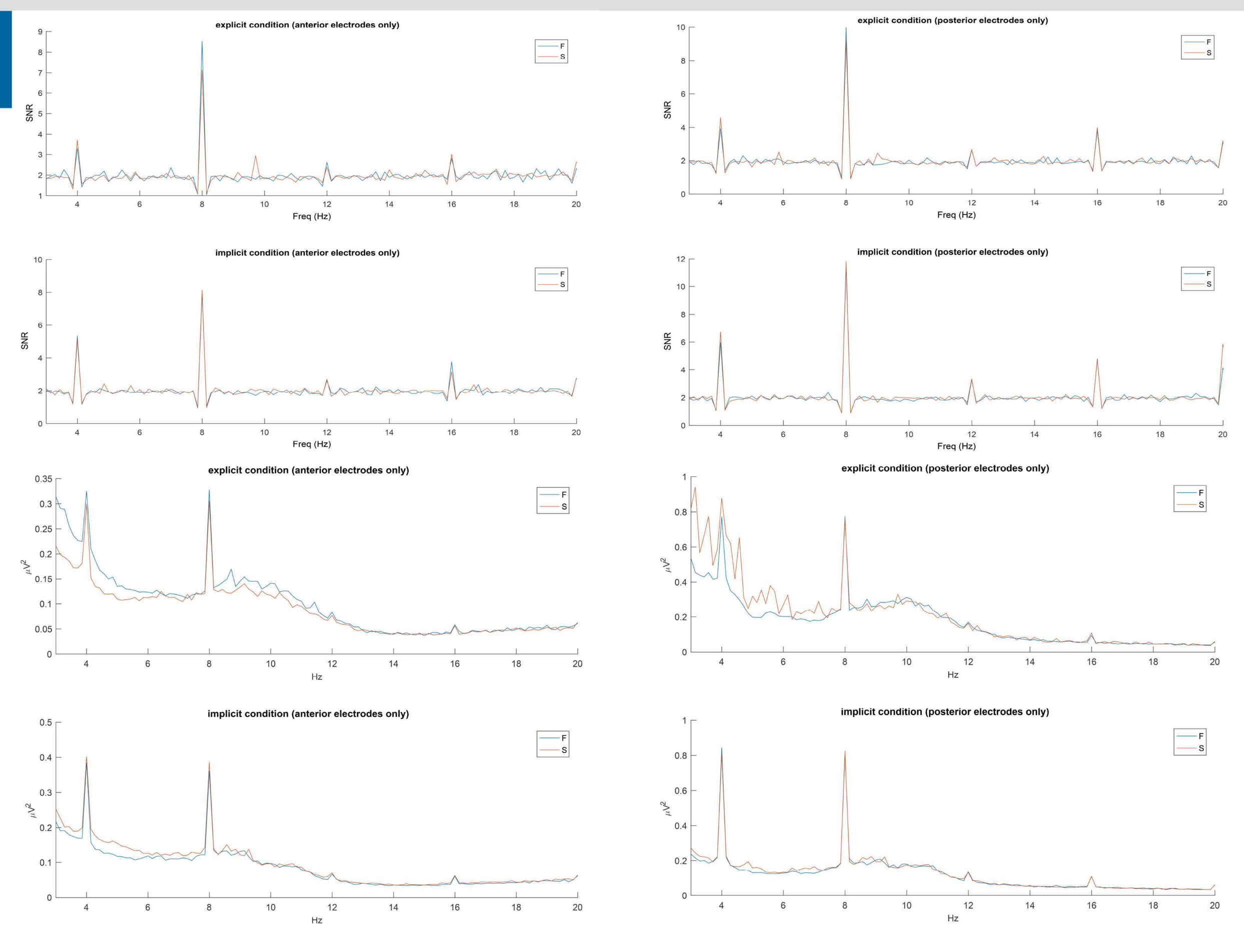


Figure 3: Grand average (N = 10) in signal-to-noise ratio (SNR) and amplitude (Microvolts) for the stimulation depicted in Figure 1 and 2.

4

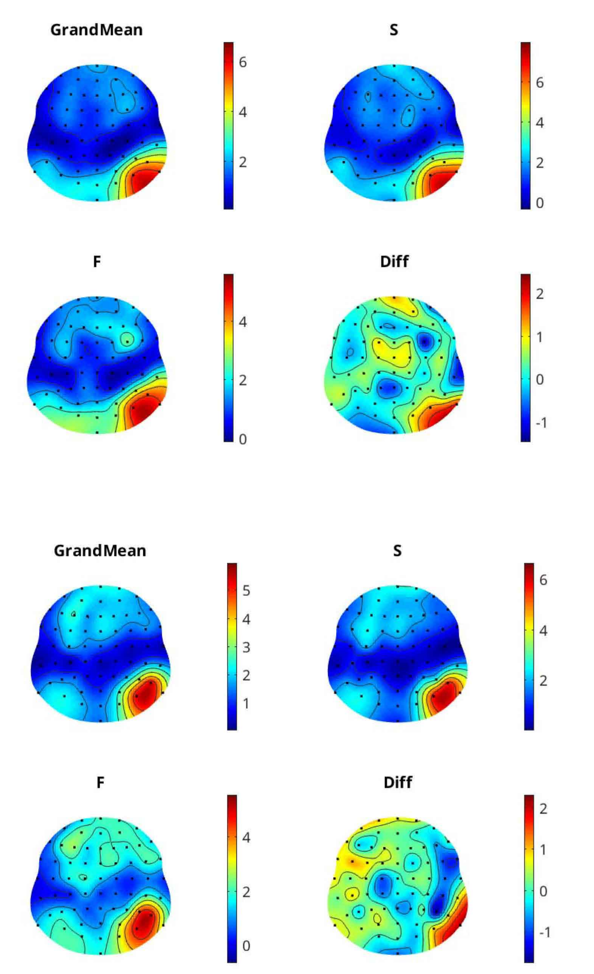


Figure 4: Topoplots of 4 Hz signal for implicit (top) and explicit (bottom) condition 4000 – 5000 ms after onset of face stimulation (40 – 50 % coherence).

5

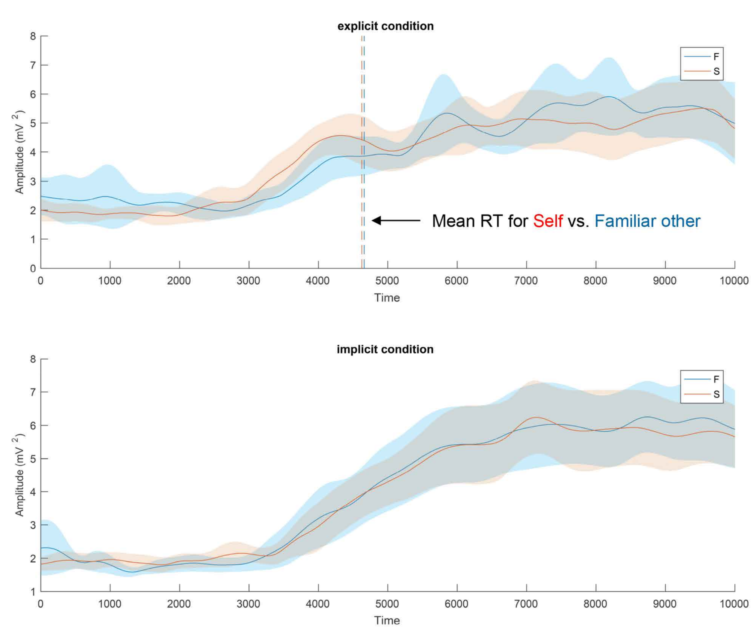


Figure 5: Time series plots at all electrodes. Shaded areas indicate 95 % confidence intervals.

6

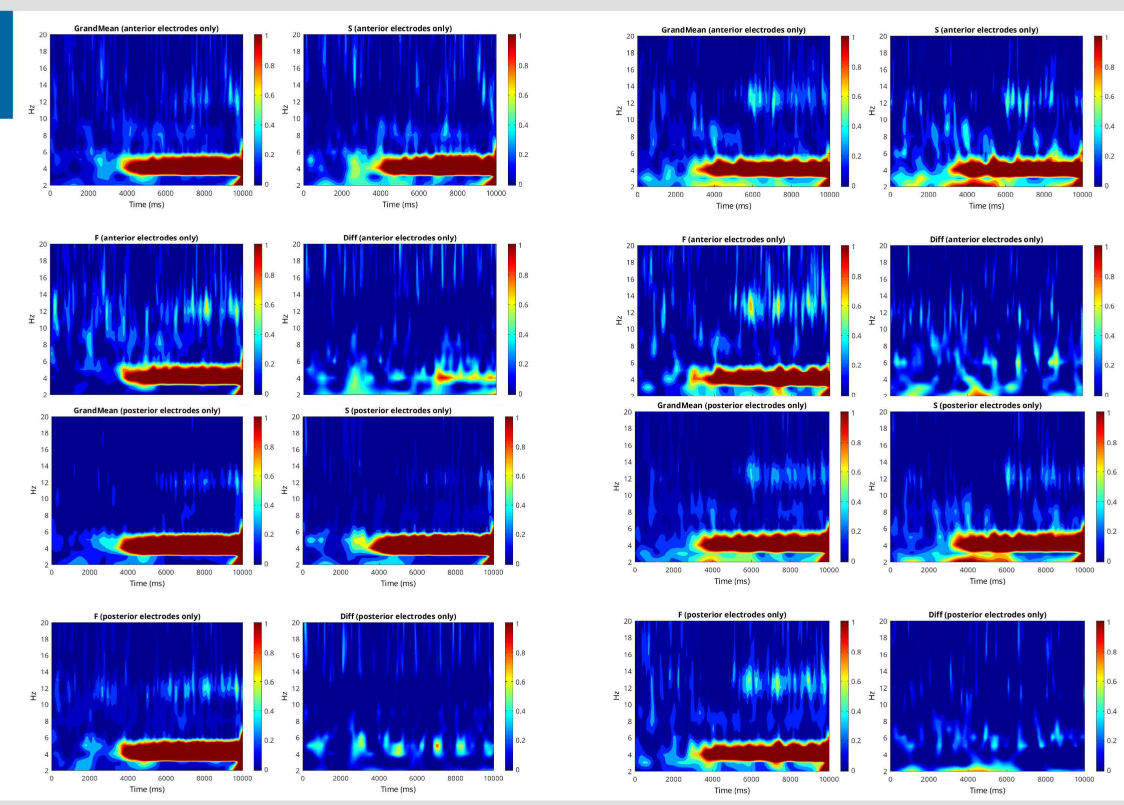
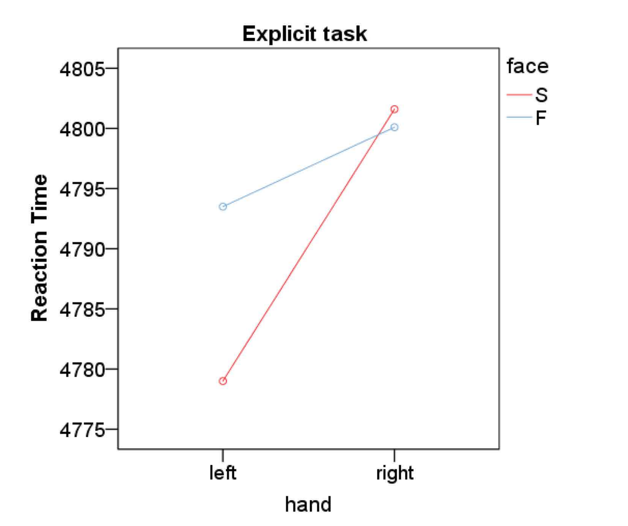


Figure 6: Time frequency plots for implicit (left) and explicit (right) condition at anterior (Fp1, Fpz, Fp2, AF7, AF3, AFz, AF4, AF9, F7 to F8) and posterior electrodes (P7 to P8, PO7, PO3, POz, PO4, PO8, O1, Oz, O2). Amplitude given in Microvolts.

Figure 7: Mean reaction time in the explicit task for self (S) vs. familiar other (F)

7



Discussion

- As expected, performance in the implicit task (dot detection) was not affected by S (M = .98, SD = .02) vs. F (M = .98, SD = .02) [t (9) = -.94, p = .37].
- Numerically HB1 and HB2 were confirmed in that Ps responded faster to S (M = 4789, SD = 498) vs. F (M = 4797, SD = 483) and faster with the left (M = 4779, SD = 460) vs. the right (M = 4801, SD = 563) hand to their own face [2 x 2 ANOVA with ps > .394).
- The FPVS stimulation leads to a reliable response at 4 Hz and its harmonics in the EEG spectrum.
- This response is localized over low level visual areas and shows a right hemispheric dominance.
- Exploratory pairwise t-tests in explicit and implicit task 3000 – 4000 ms after stimulation onset revealed a numerically higher amplitude for Self face (M = 1.2, SD = 1.4) vs. Familiar other (M = .97, SD = 1.3) [t (9) = -.63, p = .54] at posterior electrodes (HN1).
- Visual inspection of Figure 5 delivers support for HN2.
- Preliminary results are in line with behavioral [2] and neuroimaging work, suggesting that self-face recognition activates a frontoparietal „mirror" network in the right hemisphere [6].

References

1: Klein, S. B., Loftus, J., & Burton, H. A. (1989). Two self-reference effects: The importance of distinguishing between self-descriptiveness judgments and autobiographical retrieval in self-referent encoding. *JPSP*, 56(6), 853. | 2: Keenan, J. P., McCutcheon, B., Freund, S., Gallup Jr, G. G., Sanders, G., & Pascual-Leone, A. (1999). Left hand advantage in a self-face recognition task. *Neuropsychologia*, 37(12), 1421-1425 | 3: Brédart, S., Delchambre, M., & Laureys, S. (2006). Short article: one's own face is hard to ignore. *QJEP*, 59(1), 46-52. | 4: Bruce, V., & Young, A. (1986). Understanding face recognition. *Brit J Psychol*, *77*(3), 305-327. | 5: Ales, J. M., Farzin, F., Rossion, B., & Norcia, A. M. (2012). An objective method for measuring face detection thresholds using the sweep steady-state visual evoked response. *J Vision*, *12*(10), 18-18. | 6: Uddin, L. Q., Kaplan, J. T., Molnar-Szakacs, I., Zaidel, E., & Iacoboni, M. (2005). Self-face recognition activates a frontoparietal "mirror" network in the right hemisphere: an event-related fMRI study. *Neuroimage*, 25(3), 926-935.

Affiliations

1 Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Germany;
2 Freie Universität Berlin, Germany;
3 International Psychoanalytic University, Berlin, Germany;
4 Department of Medicine and Surgery, Unit of Neuroscience, University of Parma, Italy;
5 Institute of Philosophy, School of Advanced Study, University of London, UK;

CuttingEEG Paris, 2018